JOURNAL

OF THE

ROYAL HORTICULTURAL SOCIETY

ESTABLISHED
A.D. 1804

ROYAL CHARTERS
A.D. 1809, 1860 1899

EDITED BY THE

REV. W. WILKS, M.A.

SECRETARY

VOL. XXVII.

1902–1903

LONDON
Printed for the Royal Horticultural Society
BY
SPOTTISWOODE & CO. LTD., NEW-STREET SQUARE, E.C.

Star Primulas. (*Journal of Horticulture.*)

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JOURNAL

OF THE

Royal Horticultural Society.

Vol. XXVII. 1902.

Part I.

PESTS OF THE FLOWER GARDEN.

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[Part I. with three coloured plates.]

Introduction.

Some introductory remarks are necessary as an explanation of the main facts in the life-history of some of the principal parasites to be recorded, and thus prevent their subsequent repetition when each species is under consideration. Thus iteration will be avoided and space economised where there is so little to spare.

One of the most rudimentary lessons to be inculcated is the known fact that parasitic fungi may be arranged under two types, each with a different mode of development, and each requiring a different mode of treatment. It is, at the least, essential to know to which of these types any given pest belongs before effectual steps can be taken against it. We have called these two groups the *epiphytal* and the *endophytal.* The former includes those fungi which establish themselves on the surface of the leaves, stems, or other green parts of living plants, and ultimately cause destruction by a kind of suffocation, and not by affecting, distorting, or absorbing the internal tissues. It is natural to suppose that it is this type of fungus pest which is most amenable to the application of fungicides, the object being to destroy the parasite without injury to the host-plant. We may give as examples the hop mildew and the *oidium* of the vine, both of which are to be kept in check by the application of sulphur. In these cases a white mould is developed in irregular blotches, or broad effused patches, over either or both surfaces of the leaves, the inferior stratum consisting of delicate interwoven threads, forming a mycelium, which attaches itself by means of *haustoria*, or suckers. From this mycelium arise the short fertile threads, which are mostly clavate. The upper portion is soon separated from the lower by a septum, at which it is constricted, and this upper cell, of an elliptical shape, becomes a conidium. Whilst this process is going on another septum is developed at an equal distance below the first, and another conidium is differentiated. This process goes on until a chain of conidia is produced from the original branch, the apical conidium being the oldest, and hence the first to separate itself from its companions, and so the rest fall away in succession until they form a thin stratum of conidia on the surface of the mycelium, in readiness to be transferred by wind or rain to other and healthy leaves (Pl. III. fig. 54*a*). Upon reaching its new location the conidium germinates by the production of a tube near its extremity, and this germ-tube is the initial stage of a new mycelium. This is the asexual reproduction, by conidia, of the *oidium* condition of the Erysiphei, of which the ordinary European vine mildew and the Australian *Erysiphe viticola* are examples. Later in the season the threads of the mycelium produce a more complex form of fruit. A globose receptacle, of a yellowish colour at first, is to be seen here and there upon the white mycelium. It seldom exceeds a small pin's head in size, and ultimately becomes brown or black. The outer membrane, or perithecium, remains attached, and is soon surrounded with more or less distinct radiating flexuous threads or appendages, which vary according to the genera (Pl. III. fig. 54*b*). Internally the perithecium encloses one, two, or more hyaline pear-shaped sacs, or asci, which contain the sporidia. When mature the perithecia split irregularly, and the asci, with their sporidia, are ejected. Each sporidium is elliptical, hyaline, and capable of germination, the germ threads becoming a new mycelium. This is the ascigerous and probably *sexual* reproduction.

The whole career of these *epiphytal* parasites is therefore external and superficial, and, if they can be destroyed by powdering or spraying, the leaves may recover their vigour; but if not, by the destruction of the conidia or sporidia, or by their germination being prevented, the disease is held in check, and its extension to other leaves or other plants rendered impossible. The cultivator who possesses sufficient elementary knowledge of the fungi to determine whether the pests he has to deal with are of this nature is already in possession of the power to treat them effectually. Even the very crude method of picking off the diseased leaves and burning them will limit the area of infection.

More important, and more destructive, are the *endophytal* parasites, which originate within the tissues of the host-plants, and only manifest themselves externally, when it is too late to save the plants. The "rot moulds" are of this kind, such as the Potato mildew, American Vine disease, Tobacco mildew, and many other devastating pests. They are called "rot moulds" because of the rotting of the leaves and stems subsequent to their attacks. Their scientific designation is *Peronosporaceæ*, and they have the habit and appearance of white moulds, but are parasitic on living plants. Here, again, it is of the utmost importance to know something of their life-history, and methods of reproduction, before they can be combated with success. The mature mould, when it appears on the surface of a diseased plant, produces a profusion of spores, or conidia. Each conidium is an elliptical colourless body, having a thin outer coating of membrane with fluid contents. These contents soon become granular, and at length collect at three or four centres, which condense and then become distinctly separated from each other by the growth of a special envelope. Ultimately the membrane of the mother cell is ruptured, and the three or four smaller bodies, which have been differentiated in its interior, escape, each one furnished at one extremity with a pair of delicate movable hairs, by means of which these little bodies, now termed *zoospores*, can swim actively in any thin film of moisture upon which they may fall. Possibly this film may be upon the leaf of a foster plant. In a short time all motion ceases and the zoospores come to rest, the pair of delicate cilia are absorbed, and a germinating thread is produced, the point of which seeks out and enters at one of the stomata of the sustaining plant. Having once obtained an entrance, the thread grows vigorously, and a little mass of threads, called a *mycelium*, is soon developed within the tissues, capable of spreading itself through the plant which it has infected. In the next stage we discover that this mycelium has developed erect branched threads, which pass out through the stomata again into the external air, sometimes singly, sometimes in tufts. These are the fertile threads of the mould, which soon produce a single conidium at the tip of each of the branchlets, just like the original conidium whence the zoospores were developed (Pl. VI. figs. 30, 78). When fully matured each fertile thread produces a score or more of these conidia, which fall away when ripe, and then undergo transformation into zoospores, ready and active, prepared to pass through the same stages again, and indefinitely multiply the pest. This history represents the ordinary conidial fructification of the mould, by means of which it is passed from leaf to leaf, and from plant to plant, until the whole area is affected. How many of the minute conidia may be transported to a considerable distance by a breath of wind it is impossible to say, but it is known that they may be carried to any spot where there is sufficient moisture for the conidia to be differentiated into zoospores, and afterwards come to rest and germinate. This process takes place in summer and autumn, but there is yet another means by which the pest is disseminated in spring.

The mycelium, which flourishes within the substance of the plant infested, is capable of producing larger globose bodies, chiefly within the stems, concealed from external view. These globose bodies secrete a thick envelope, mostly of a brownish colour, and after development they remain in a state of rest within the stems during the winter (Pl. IV. fig. 70*). So that old stems of plants, which are infested with the mould during the autumn, conceal within themselves during the winter a large number of these "resting spores." As the old stems rot and decay, the resting spores are set free in the spring, and then a period of activity commences. The contents of these globose bodies become differentiated into a large number of zoospores, which ultimately escape by a rupture of the thick envelope, armed with vibratile cilia, and in all respects like the zoospores which are developed from the conidia. These active zoospores swarm over the damp soil, and are carried by the spring rains into proximity with the young seedling leaves of the new crop of host-plants ; then the cilia are absorbed, germination commences, the delicate threads of mycelium enter the nearest stomata, and infection results. In this way, in addition to the spread of the infection from conidia in summer and autumn, provision is made for an attack upon seedlings in the spring. It will be inferred that, in order to check the spread of these diseases, the conidia must be destroyed in the autumn to prevent their extension to healthy plants; and the destruction of all rotting *débris* must be carried out during the winter, so as to extirpate all the concealed resting spores, and thus prevent the infection of seedlings in the spring.

From these details it will be evident that plants once attacked by *endophytal* parasites are in themselves hopeless. No external application can destroy organisms which it cannot reach, or, if they could be destroyed, no manipulation can replace the disorganised tissues. Hence, then, all efforts should be directed towards the destruction of the conidia, and resting spores, in order to stamp out the disease at its source and prevent the future infection of healthy plants. The application of spraying to plants apparently without disease would be done as a preventive, in order to destroy at once any germs which might be brought into contact with the foliage; and the destruction of all infected material would limit the local sources of infection. With an intelligent appreciation of the objects which have to be attained, the cultivator may accomplish a great deal in the way of prevention, even though he may be helpless to effect a cure. It will be seen how much of this depends upon an accurate diagnosis of the disease.

There are many other forms of endophytal parasites, and the life-history of some of these is still obscure. In the majority of them only a conidial fructification is yet known, and the internal tissues do not appear to be so absorbed and destroyed as in the case of the "rot moulds;" but in such black moulds as the "Apple and Pear scab" the mycelium appears to be perennial, and produces a fresh crop of conidia each successive year. There is some evidence that this disease is deep-seated and hereditary, and if so it is doubtful whether any amount of external application will result in a perfect cure. The genus *Glœosporium* includes many species which are very destructive, but often they seem to be localised, and the mycelium may not pass internally to other parts. This can only be ascertained by closer investigation. The little pustules on the leaves, and the fruits, are seated beneath the cuticle, where a cushion or stroma of compacted mycelium produces conidia, but without any enclosing membrane or perithecium. When the conidia are matured the cuticle is ruptured, and the spores escape to the surface, in many cases adhering in a somewhat gelatinous mass, which oozes out in the form of tendrils. In such cases it is evident that the application of some fungicide capable of destroying the vitality of the conidia will be of service in preventing the spread of the disease (Pl. 1, fig. 9).

A large and important group of endophytes is that known as the Uredines, of which the common and disastrous "wheat rust" or "wheat mildew" is a familiar example. In the first instance, the host plant produces upon its leaves, in the spring, clusters of little cups, partly embedded in the substance of the leaf, which is usually thickened and discoloured. These little cups constitute the "cluster cups," or æcidium form; the margin is usually white and fringed, and the interior filled with orange subglobose spores, termed æcidiospores, produced in chains, but soon falling apart (Pl. I. fig. 21). The æcidiospores will germinate when mature and produce a thread of mycelium, which is capable also of producing secondary spores (fig. 1). Smaller bodies are also to be found in company, or in proximity, sometimes on the opposite side of the leaf. These have the form of minute embedded cells, containing very small hyaline spore-like bodies called *spermatia*, whilst the cells which contain them are *spermogonia*. What their function may be is as yet only conjectural, but they are nearly always present, and, presumably, not without a purpose. Later on in the summer the same leaves, or others, develop on either or both surfaces small brownish pustules, at first covered by the cuticle, but at length splitting irregularly and exposing a powdery brownish dust-like mass of nearly globose spores, each spore borne at first at the apex of a short hyaline thread, these threads arising from a cushion-like base of mycelium. These powdery spores constitute the "rust," or *uredospores* (Pl. II. fig. 22*b*), and with them ends the second stage of the fungus; but

Fig. 1.—Æcidiospore germinating.

how they are evolved from the first stage, or how they produce the third stage, is a mystery still.

The third is held to be the complete or perfect stage, and the spores produced are *teleutospores*, or final spores. These teleutospores are more or less elongated, divided by a septum across the middle into two cells, and supported upon hyaline sporophores or spore-bearing threads (Pl. II. fig. 22*c*). They are produced in pustules similar to those of the uredospores, but often more compact, and are sometimes mixed with them. A few of the teleutospores will sometimes be found growing within the pustules of the uredospores. When the teleutospores are mature they do not always germinate at once, but a period of rest supervenes, and perhaps they may not germinate until the following spring, becoming, in fact, veritable resting spores. This is an important fact to be borne in mind by the cultivator.

Each cell of the teleutospore is capable of sending out a germ tube through a special pore, and as this germ tube grows, the contents of the cell of the teleutospore passes into the germ tube, known also as the promycelium, and to the extreme end. Ultimately a septum, or division, crosses the tube and prevents retreat. One, two, or more additional divisions of the apical cell take place, and from the side of each of these newly constituted cells buds or processes appear, which gradually enlarge, and in time are converted into secondary spores, or promycelial spores, into which some of the contents of the old spore pass, and these smaller bodies are eligible for the production of mycelium, which is prepared to find an entrance into the leaf of some young and new host plant, and producing infection commence the cycle over again (fig. 2). Thus, then, we have in order of succession spermogonia, æcidiospores, uredospores, and teleutospores, each of the three latter capable of producing secondary spores, but the last of all producing the promycelial spores which are the medium of reinfection, from the complete and perfect condition of the Puccinia.

It may be mentioned, in passing, that the life-history in the genus *Uromyces*, where the teleutospores are only one-celled, is precisely similar.

But all these stages are not always to be found associated together. The chain is not always perfect. In some cases the *Æcidium* only is

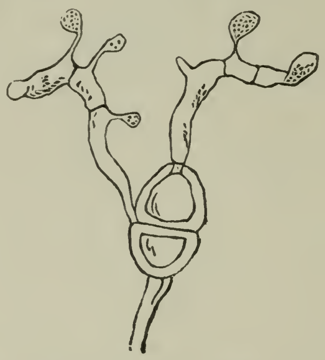

FIG. 2.—TELEUTOSPORE GERMINATING.

known, with or without spermogonia; or in other cases only the uredospores are known; or in certain cases only the teleutospores. In each of these instances the fungi are regarded as imperfect, or, at least, as imperfectly known Uredines.

Besides these cases, in which æcidiospores, uredospores, and teleutospores are produced on the same species of host-plant, there is another group which those who have implicit faith in heterœcism contend produce the æcidiospores with spermogonia on one species of plant, and the uredospores and teleutospores on another and quite different species of host-plant. Let each be persuaded in his own mind, as it will serve no good purpose to enter upon discussion here.

There is another group in which only the spermogonia, uredospores, and teleutospores are known, and these all occur on the same host-plant. Here the æcidiospores are absent.

In a fourth group only the æcidiospores and teleutospores are known, and these occur upon the same species of host-plant. The uredospores are wanting or do not produce pustules of their own.

In the fifth group teleutospores only are known, so that both æcidiospores and uredospores are absent, and the teleutospores only germinate after a period of rest. In another subsection only teleutospores are found, but they germinate at once on arriving at maturity, without an intervening period of rest. Thus much it seemed necessary to explain, as it has some connection with the dispersion of the Uredines, and the steps to be taken in contending with them. It will be evident at once that the destruction of these clusters of teleutospores will minimise the spring infections, and hence that they should be well looked after and destroyed, either by effective fungicides, or by burning up all the dead leaves and stems of the foster plants known to have been affected. In this case, again, we must suggest the importance of acquiring some practical knowledge of the history and mystery of such plant parasites, if they are to be encountered and vanquished in their career of destruction.

In this connection we cannot omit alluding to the evidence, which is gradually accumulating, of the connection between those minute organisms the microbes, or *Schizomycetes*, and plant diseases. There are certain diseases which attack cultivated plants, and produce disastrous results which have long been a mystery, since, although the host-plants appeared to be suffering from the attacks of some insidious fungus disease, none of the usual external appearances could be detected. In several cases of this kind it has been affirmed, although not yet completely confirmed, that the disease is caused by the presence of a minute *bacterium* or *bacillus* in immense numbers. There is no reason analogically why this should not be the case, and all the evidence seems to strengthen the probability; but the suggestion is so recent and the investigation so difficult that it would be imprudent to hazard any very decided opinion. Researches into a Vine disease in California, a Melon disease in some parts of the United States, and the very prevalent "Peach yellows" almost establish the fact that microbes are present in large numbers, and are hypothetically the cause of the disease. In reference to the disease of Cucumbers and Melons it has been claimed that the disease is accompanied profusely by bacteria; that the juice of diseased plants swarming with these organisms, when transferred to healthy plants, will inoculate them with the disease, which will make its appearance in three or four days; that seed watered with the juice of diseased fruits did not germinate, or only 25 per cent. germinated at all, and these soon decayed; that the diseased juice when introduced into healthy stems and fruits of Tomato rapidly produced decay; that young Tomato plants in proximity with diseased Cucumbers were all destroyed. Hence it is concluded that the disease in question is caused by bacteria, and may be transmitted to other plants by inoculation. If all this should be confirmed, then we shall have to deal with another class of plant diseases, of fungoid origin, which will require a different mode of treatment, and doubtless offer a stubborn resistance.

From the foregoing observations it will be manifest that there are such broad distinctions between different groups of pestiferous fungi that they should not all be subjected to the same mode of treatment, and that the remedies which might be successful in cases of one kind would be powerless in another. Hence, then, modes of treatment must have a relation to the known character of the parasite. It follows from this that a certain amount of knowledge of the life-history and affinities of the parasite must precede any definite effort to counteract or destroy it, as in animal diseases an accurate diagnosis must precede treatment. Such being the case, it is important to consider what means can be employed to diffuse the necessary information amongst cultivators, so as to enable them to determine the general character of the disease. This does not imply the specific identification of the fungus, which would be the work of an expert, but the general characteristics only, and especially whether the disease is caused by an endophyte or an epiphyte; after this, presuming it to be an endophyte, whether it is related to the rot-moulds, the forms of anthracnose, as represented by species of *Glœosporium*, or to the "rusts" or Uredines. The cultivator in possession of the power to determine thus much for himself might easily learn what remedies have been most successful in similar cases, and apply them systematically with some hopes of success.

Another important question cannot summarily be dismissed without consideration, and that is whether, and to what extent, heredity has to do with the dissemination of plant diseases. It is admitted that in the animal world certain diseases are hereditary. Can it be possible also that amongst plants there is any evidence to be found of the transmission of disease through the seeds to a succeeding generation? On this point we have a few authenticated facts to submit, and then we have done.

The first instance is a record of 1885 by W. G. Smith, where he states, as the result of his examination of Oat grains, that not only the mycelium but the resting spores of Corn mildew sometimes do exist within the grains of Corn when the Corn is planted; that the fungus spores germinate at the same time as the grain; and that the disease can be and potentially is hereditary.*

There can be no doubt that some of these diseases are hereditary and can be transmitted through the seeds. A writer † says: "We had about 1,000 very fine plants (Sweet Williams) for blossoming next year, all raised from seed last summer, and in the autumn we noticed a few patches of the fungus (*Puccinia Dianthi*) and used Gishurst's compound and sulphur mixed with it as a solution, applying it with a syringe. We thought we had destroyed it, but find that all the plants that are not dead are dying piecemeal, and there is not one that has escaped. We cannot grow one of these seeds from Japan; immediately they are up in the seed-pans, under glass, they are attacked and destroyed." This view is also confirmed by a subsequent writer.‡

Upwards of thirty years ago a friend sent us specimens of infected Celery leaves, asking for the name of the pest, which was *Puccinia Apii*; at the same time he stated that he had two separate stocks of Celery plants, and although both were in the same garden, only one stock was attacked by the parasite. The seed which produced the infected plants was given to him by a person who had informed him since that all his plants were similarly affected. The seed from which

* *Gard. Chron.*, Aug. 22, 1885.

† *Gard. Chron.*, Jan. 12, 1884, p. 57. ‡ *Gard. Chron.*, Jan. 26, 1884, p. 120.

the other plants were raised had been derived from another source, and not a pustule of the brand could be detected on the leaves; and yet they had been transplanted and were growing in rows side by side. The conclusion is that the germs of the parasite were present in the seed which produced infected plants; and if not, why did not all the plants suffer alike?*

The Rev. M. J. Berkeley records an instance in which plants of *Pyracantha* raised from seeds imported from Russia were all killed by a species of *Fusicladium*, whilst old plants of *Pyracantha* growing at the same place remained perfectly free from disease.†

At the time when the Hollyhock disease was at its height a quantity of seedlings were found showing the disease in their seed-leaves: some of the seeds, or carpels, which had not been used were examined, and pustules of the disease were found developed on the outside, whilst similar traces of disease were found in seeds of Wild Mallows.‡

Cases need not be multiplied, since we contend that the above are sufficient to establish the fact that inheritance of fungoid disease must be taken into account in connection with the dissemination and perpetuation of these diseases.

It only remains for us to intimate that in the following pages our first object has been to interest and instruct the cultivator in the simplest and most practical manner, which we believe would be best attained by grouping the pests together according to the nature of their hosts, rather than by following any purely scientific and systematic classification, which would assume considerable previous knowledge, and would be better left in charge of the expert.

The grouping which has suggested itself is as follows:—

Pests of the flower-garden;
,, ,, vegetable-garden;
,, ,, fruit garden and orchard;
,, ,, vinery and conservatory.

PESTS OF RANUNCULACEOUS PLANTS.

Although we have included descriptions of all the ordinary diseases of Ranunculaceous plants which are under cultivation, it must be remembered that there are also a large number of fungoid pests which infest wild and uncultivated plants of this order, some of which may at any time invade the flower garden and commence their ravages upon their cultivated kindred. Some limit being indispensable, we have been compelled to exclude the parasites of wild plants, except in those cases where they have been known to invade the garden.

Black Hellebore Leaf-spot.

Phyllosticta helleborella (Sacc.), Pl. I. fig. 1.

The leaves of Hellebores are apt to become very much disfigured by parasitic fungi, of which many species are recorded, and amongst them the above-named, which made its first appearance in Italy.

* *Country Life*, Sept. 19, 1867, p. 88.
† *Gard. Chron.*, Oct. 28, 1848, p. 716. ‡ *Gard. Chron.*, July 1, 1882, p. 23.

In the form which is found in Britain the foliage is disfigured by large blotches, or spots, on the upper surface, which are sometimes very irregular and angular in shape, without any distinct border or marginal line. At first they are blackish, but soon become paler and bleached in the centre, leaving the blackness around the edge. The spots are sprinkled with little black dots, like pin-points, which are the conceptacles, or perithecia, of the fungus, and contain the spores.

Under the microscope these perithecia are blackish, minute, rounded, flattened bodies, with a pore or orifice at the apex, through which the spores escape, and are more or less immersed in the substance of the leaf. The sporules are oblong and colourless, minute ($7 \times 3 \mu$), with two nuclei, and are produced on short stalks within the receptacles.

In Italy this species is found growing in company with another fungus of a higher development, but resembling it in external appearance. In that case the spores are produced within delicate cylindrical cells, or asci, to the number of eight in each ascus, and the species is called *Sphærella Hermione*, of which the above-named *Phyllosticta* is an imperfect condition. Hitherto there is no record of the perfect condition, or *Sphærella*, having been found in this country.

At present, as far as we are aware, this parasite is confined to Italy and to isolated spots in Great Britain.

If taken in the early stage of its appearance, and all the diseased leaves are removed, so long as the plants are otherwise in a healthy condition, they may recover. Failing this, the application of one of the copper solutions should be made.

It may occur either on the leaves of *Helleborus niger*, *viridis*, or *fœtidus*.

Sacc. Syll. iii. 201 ; *Grevillea*, xiv. p. 73, No. 403.

Another and allied species, *Phyllosticta atrozonata* (Voss.), occurs on the leaves of *H. viridis* in Carniola. The leaf-spots are characterised by concentric zones, and the sporules are smaller.

In France another species, *Phyllosticta Helleboriana* (Brun.), occurs on the leaves of *H. fœtidus*, in which the spots are smaller, rounded, and margined by a brown line, whilst the sporules are smaller still.

In Italy the leaves of *H. viridis* are attacked by the angular, dry, palled spots of *Phyllosticta Helleboricola* (Mass.), with very minute sporules. So that altogether four species of the same genus of parasite have occurred on the leaves of Hellebore in Europe.

Hellebore Leaf-spot.

Septoria Hellebori (Thum.), Pl. I. fig. 2.

This little-known parasite has on one or two occasions been found on the foliage of *Helleborus niger* in Britain, although first discovered in Austria.

The spots on the leaves are rather large and irregular, without any determinate margin, and of a brown colour. The spots are sprinkled with the minute black dots, as in *Phyllosticta*.

The principal difference, as revealed by the microscope, lies in the form and dimensions of the sporules, which, in the present instance, are long and thread-like (40–50 μ long).

It has been found on *H. niger* and *H. fœtidus* in Austria, and in France, as well as in Britain.

Fortunately it is so rare that experiments have not been made with remedies, but probably spraying would be useful.

Sacc. Syll. iii. 2840 ; *Grevillea*, xiv. p. 102, No. 507.

A similar parasite occurs in Italy on the leaves of *H. viridis*, in which the spots are whitish and angular, circumscribed by a blackish line, and is called *Ascochyta Hellebori* (Sacc.).

The species in this genus resemble externally those of *Phyllosticta* and *Septoria*, but the sporules are different, since they are divided by a cross-partition into two cells. In this instance they are about $8 \times 2\ \mu$.

Hellebore Blotch.

Coniothyrium Hellebori (Cooke and Mass.), Pl. I. fig. 3.

The leaves of the black Hellebore have been attacked in this country by a new parasite, which at present seems to be unknown abroad, and, fortunately, very little at home.

The leaves are occupied by two or three dingy brown spots, somewhat circular in form, but without any determinate margin. The minute dots of the perithecia are chiefly central, and more or less in concentric rings.

Microscopically it differs principally in the sporules, which are oval ($4–5 \times 2–3\ \mu$) and of a pale brown colour, whereas in the other leaf-spots enumerated here the sporules are colourless.

It is unnecessary to suggest remedies.

Grevillea, xv. p. 108 ; *Sacc. Syll.* x. 5748.

Hellebore Smut.

Urocystis pompholygodes (Schl.).
Urocystis Anemones (Pers.).

This smut, which attacks Hellebore leaves, is also common on those of Anemone, Hepaticæ, Ranunculus, Pulsatilla, Eranthis, &c., and is hereafter described as "Anemone smut." (See Pl. I. fig. 7.)

Hellebore Leaf-mould.

Ramularia Hellebori (Fckl.), Pl. I. fig. 4.

This delicate mould occurs in whitish patches on living, or fading, leaves of Hellebore in this country, and on the Continent, occupying either surface of the leaf.

The spots are rather small and of a circular form, becoming white, with a blackened or purplish margin. The mould appears to the naked eye only as a delicate frosting on the spots.

Under the microscope small tufts of slender short threads arise from the mycelium, which pervades the spots (scarcely 20 μ long), and the conidia are produced singly on the tips of these threads. They are somewhat fusiform or spindle-shaped, divided by a septum in the centre into two cells, and are a little longer than the threads which support them ($24–30 \times 4–5\ \mu$), wholly colourless, but rather granular within, soon falling away when mature.

Spraying is generally effective in this class of parasites.

The present species has been recognised in Italy, Switzerland, and Germany, as well as in Great Britain.

Sacc. Fung. Ital. pl. 1013; *Sacc. Syll.* iv. 970; *Grevillea,* xiii. p. 51.

Hellebore Rot-mould.

Peronospora ficariæ (Tul.), Pl. VI. fig. 5.

Many Ranunculaceous plants are liable to attack from a destructive mould of a similar kind to that of the Potato disease, and amongst them are the Hellebores. The foliage is attacked by the parasite, which soon takes possession of the entire plant.

The external patches of the mould are effused, and of a dirty white colour, looking like mealy blotches to the naked eye.

When magnified the tufts of mould are seen to consist of erect fertile threads, which are from five to six times forked in the upper portion, the final branches, and those immediately preceding them, being curved and bent downwards, leaving obtuse angles. The conidia are borne singly on the tips of the threads, and are broadly elliptical, with a slight tinge of violet.

Resting spores are produced, for the winter, upon the internal mycelium, the thick external coating being of a pale yellowish-brown. These resting spores are set free in the spring, by the rotting of the foster plant, and active zoospores, which are formed in the interior, then escape from their temporary prison and infect the young host-plants and perpetuate the disease.

This disease is widely spread in Europe, being known in Britain, France, Germany, Belgium, Finland, and Italy, as well as in Bosnia and Lapland, and in the United States of America.

Being such a complete endophyte, it is almost hopeless to attempt to save plants when once they are attacked; external applications are of little avail.

Saccardo Syll. vii. 835; *Cooke M. F.*, p. 235; *Gard. Chron.* July 7, 1888, fig. 2; *Mass. B. F.*, p. 119.

German Hellebore Rot-mould.

Peronospora pulveracea (Fckl.).

This disease, which attacks the foliage of Hellebores in Germany, has not yet been discovered in Britain. Externally it much resembles the British species, but the microscopical characters are somewhat different.

The size of the conidia are represented as $25–30 \times 18–22\ \mu$.

Saccardo Syll. vii. 875; *Berlese Icones*, t. 52.

Globe Flower Leaf-spot.

Phyllosticta Trollii (Trail).

This parasite has only recently been found on the leaves of *Trollius europæus* in Scotland.

It forms irregular brown spots on the leaves, which are usually limited by the veins, and the receptacles, or perithecia, are scattered over the spots, on the under surface.

The sporules, which are produced within the perithecia, are very minute ($4 \times 1\ \mu$), obtuse at each end and colourless.

Should it ever become aggressive, it would be well to try spraying with a copper solution.

Trail, Trans. Crypt. Soc. Scot. 1889, p. 43 ; *Sacc. Syll.* x. 5003.

The Globe Flower Brand (*Puccinia Trollii*, K.) has only been recorded in Italy, Switzerland, and Lapland.

Two other leaf-spots are known to occur on the leaves of *Trollius*, namely, *Ascochyta Trollii*, with two-celled sporules, only known in Siberia, and *Septoria Trollii*, with long thread-like sporules, near Lake Lucerne in Switzerland.

Aconite Diseases.

Hitherto none of the special diseases which attack the Aconites have been recorded for this country. *Septoria napelli* (Speg.) has occurred in Italy, and also *Septoria lycoctoni* (Speg.).

Æcidium Aconiti-napelli (DC.) and *Uromyces Aconiti-lycoctoni* (DC.), the former in France, Germany, and Switzerland, the latter in Italy, Switzerland, France, Germany, Hungary, and Siberia, are not British, whilst *Æcidium circinans* is confined to Scandinavia.

An Aconite white mould *Ramularia monticola* (Speg.) is also recorded for Italy.

Larkspur Diseases.

At present we have been spared the infliction of these diseases, of which *Septoria Delphinella* (Sacc.) is found in France. The mould called *Cercospora Delphinii* (Thum.) is still Siberian, whilst *Puccinia Delphinii* (Diel) is Californian.

Anemone Rot-mould.

Plasmopara pygmæa (Unger), Pl. VI. fig. 6.

This "rot-mould" is similar in character to that already described as occurring on Hellebore, and is found on the leaves of Anemone as well as sometimes on Aconite.

The threads are often in bundles of two to six together, and are either simple or branched above, the branches are either simple or once or twice forked, the tips surmounted by from two to four short conical branchlets supporting the conidia. The latter are elliptical, of variable size (18–25 × 15–20 μ), with the apex broadly and obtusely teat-like.

In the interior of the plant the resting spores are produced from the mycelium. These are globose (45–55 μ diam.) with a yellow-brown coating, or epispore, which is either smooth or minutely rugulose.

The history and development of these rot-moulds are rather complicated, and may be found more in detail in the Introduction, p. 3.

The distribution of this pest includes not only Great Britain, but France, Germany, Italy, Belgium, and North America.

The remark on remedies under "Hellebore Rot-mould" applies with equal force to this species.

Sacc. Syll. vii. 807; *Cooke, M. F.* 234, t. xv., f. 267; *Berlese Icones*, t. 10; *Cooke Hdbk.* No. 1776; *Mass. B. F.* p. 112.

Anemone-smut.

Urocystis Anemones (Pers.), Pl. I. fig. 7.

This smut attacks the leaves and petioles of various allied plants, such as Anemone, Hepatica, Aconite, Hellebore, Ranunculus, Pulsatilla, and Eranthis, swelling and deforming them.

To the naked eye its presence is very evident, as the leaves are blistered, and the petioles swollen, becoming paler in colour, until the distended cuticle bursts, and shows the mass of sooty spores, which are produced in profusion, and scattered over the plant as soon as they are mature, producing a most unsightly appearance.

Under the microscope these spores are seen to be of a compound character, forming glomerules, or clusters, more or less globose. The central spores are dark brown, spherical, and compressed (18–16 μ); the peripherical or outer cells, to the number of about ten or more, are colourless and compressed at the sides (each glomerule about 26 μ long). The tissues of the host-plant are traversed by mycelium.

This pest is to be found in most European countries, in Asiatic Siberia, and in North America.

It is always desirable to pick off and burn all infected leaves as soon as the parasite makes its appearance, and thus it will probably be kept in check. Generally only one or two leaves are at first attacked; but although the pest may appear year after year, it is possible to keep it under control if taken in time.

Sacc. Syll. vii. 1901; *Cooke M. F.* 91, 232, t. ix., f. 183, 184; *Gard. Chron.* Sept. 30, 1876, fig.; *Plowr. Br. Ur.* 288; *Cooke Hdbk.* No. 1541; *Mass. B. F.* p. 188.

Anemone Cluster Cups.

Æcidium punctatum (Pers.), Pl. I. fig. 8.

The leaves of the garden Anemone are liable to attack from this species of cluster cup which is generally believed to be a distinct species from the *Æcidium Anemones* (Pers.), which attacks the foliage of the Wood Anemone, and has colourless æcidiospores.

The cups are scattered over the leaves, somewhat uniformly, whilst the leaves are much thickened by the mycelium. The cups are flattened, and semi-immersed, with a torn, rather yellowish margin. The lobes are larger than in the common wild species, and are often not more than four to each cup. The æcidiospores are almost globose (16–23 μ) and of a brownish-yellow colour. The foliage is very much distorted when attacked by this parasite, which has a facility for spreading rapidly.

Hitherto it has not been demonstrated that there are associated with this species, as with many others, a Uredo form and a Puccinia form, but it appears to be complete in itself.

It has been found, besides Great Britain, also in France, Italy, Germany, and Belgium.

Pick off affected leaves and spray with copper solution to destroy scattered spores.

Sacc. Syll. vii. 2705; *Cooke M. F.* ii. 194; *Cooke Hdbk.* No. 1604; *Plowr. Br. Ur.* p. 268.

Another cluster cup (*Æcid. leucospermum*) with whitish æcidiospores and the accompanying rust (*Puccinia fusca*) is found on Wild Anemone.

Anemone Peziza.

Sclerotinia tuberosa (Hedw.).

It has long been known that certain long-shaped bodies, resembling Anemone roots, are to be found amongst the roots of the Wood Anemone, and are called sclerotia, which represent a kind of compact fungus

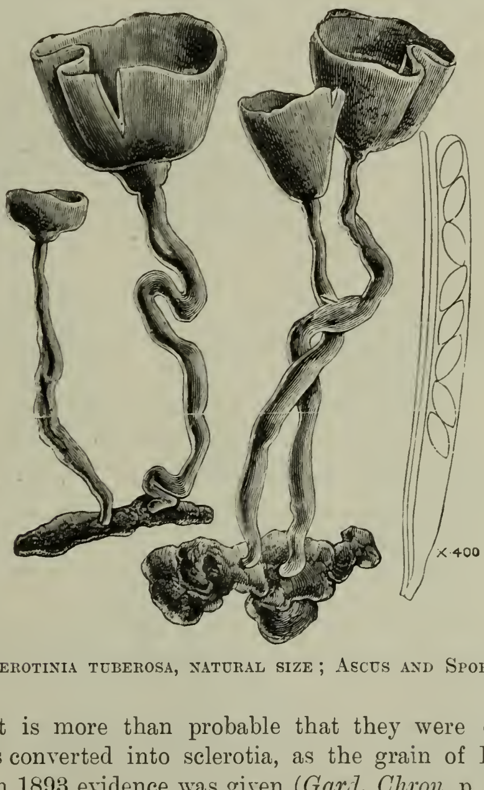

Fig. 3.—Sclerotinia tuberosa, natural size; Ascus and Sporidia × 400.

mycelium. It is more than probable that they were originally true Anemone roots converted into sclerotia, as the grain of Rye is changed into ergot. In 1893 evidence was given (*Gard. Chron.* p. 75) that these sclerotia have appeared also amongst garden Anemones.

In form and size they resemble the rhizomes of Anemone, but are harder and more compact, and of a different internal structure and composition.

Ultimately, and in autumn, these sclerotia send up one or more fleshy stems to the surface of the soil, where the apex at length expands into a cup-shaped form, half an inch or more in diameter, and of a brownish colour, with a fleshy substance, easily broken up with the fingers. These cups are such as were formerly called *Peziza*, but now *Sclerotinia*, because developed from a sclerotium (fig. 3).

The interior of these cups is fertile, and a thin section shows, under the microscope, that it is composed of long cylindrical cells called asci, placed side by side. Each of these asci contains eight spores, or sporidia, uncoloured, and elliptical in form ($15–17 \times 6–7\ \mu$): when mature these spores are ejected like a cloud of fine dust.

Collect the Peziza form in the spring to prevent diffusion.

Sacc. Syll. viii. 797; *Gard. Chron.* May 28, 1887, p. 712, fig. 137; *ib.* July 15, 1893, p. 75; *Massee Pl. Dis.* p. 157.

Anemone Leaf-spot.

Septoria Anemones (Desm.).

We have no record of this leaf-spot hitherto on any but uncultivated Wood Anemone, and upon this it is common.

Hepatica Diseases.

At least two diseases of Hepatica are known on the Continent, but at present have not made their appearance in Britain. These are the cluster cups, *Æcidium hepaticæ* (Beck), and the leaf-spot, *Septoria hepaticæ* (Desm.).

Sacc. Syll. vii. 2706; *Sacc. Syll.* iii. 2830.

The May Apple leaf-spot (*Phyllosticta podophylli*) has occurred in gardens on the leaves of *Podophyllum peltatum*, although of little importance (*Grev.* xiv. 74).

Columbine Anthracnose.

Glæosporum Aquilegiæ (Thum.), Pl. I. fig. 9.

The leaves of living Columbines are subject to the attacks of a minute fungus of a destructive kind, but hitherto little known in this country. In this case the little dots make their appearance on both surfaces, clustered together on discoloured spots.

The spots are rather large, irregular, and of an ochraceous colour, with a broad brown margin, caused by the internal mycelium which destroys the vitality of the leaf. The dots represent cavities in the substance of the plant, which contain the numerous conidia, or spores; these are at first borne on short stalks, but soon liberate themselves, and are expelled in a kind of tendril from the orifice in the cuticle.

In this species the conidia are elliptical, without any division ($12–15 \times 5\ \mu$) and colourless.

PESTS—FLOWER GARDEN.

The species was first discovered in Siberia, but has recently been found in gardens in this country, although hitherto there has been no record of its appearance in Continental Europe.

There is no accounting for the manner in which some of these parasites diffuse themselves, so as to suddenly appear, and perhaps as suddenly disappear, in localities far remote from each other.

Another species, *Glæosporium Martianoffianum*, with the conidia twice as large, has also been found in Siberia on the same host-plant.

Diluted Bordeaux mixture checks the disease.

Sacc. Syll. iii. 3660 ; *Grevillea*, xiv. 123.

Columbine Leaf-spot.

Ascochyta Aquilegiæ (Roum.), Pl. I. fig. 10.

One kind of leaf-spot has been found in this country on Columbine leaves, and has probably migrated from France, where it was first discovered.

The spots on the leaves are somewhat rounded and nearly white ($\frac{1}{2}$–1 m. diam.), with a dusky margin, dotted towards the centre of the spots with the minute perithecia.

The conidia are narrowly elliptical, with a brownish tint, and are divided by a septum across the centre into two cells.

If troublesome, try spraying with one of the fungicides.

Sacc. Syll. iii. 2191.

Another leaf-spot has been found in France on Columbines, *Phyllosticta Aquilegicola* (Br.), with brownish spots and small continuous conidia ($8 \times 2\ \mu$).

Another occurs in Italy, in which the spots are whitish, with a broad brown margin, but the conidia are long and threadlike. This is called *Septoria Penzigii*. The purple spot parasite has also been found in Italy. *Septoria Aquilegiæ* has rather longer threadlike conidia. The North American leaf-spot is perhaps different.

A tufted mould, seated on purple-brown spots, is known in the United States as *Cercospora Aquilegiæ*, of which the conidia are very long ($140\text{–}300 \times 5\text{–}6\ \mu$).

Columbine Cluster Cups.

Æcidium Aquilegiæ (Pers.).

These cluster cups have often been regarded as a variety of the Ranunculus cluster cups, but there are other writers who contend that they constitute a distinct species, without any indication of either uredospores or teleutospores being affiliated thereto. They occur collected in clusters upon round or irregular yellow spots, with a violet-brown margin, on leaves of Columbine.

The cups are shortly cylindrical, on the under surface, seated upon a thickened cushionlike base. The æcidiospores are compressed and angular ($16\text{–}30 \times 14\text{–}20\ \mu$), orange in colour, and distinctly warted.

They have been known for many years as occasional occurrences in

Britain, and their geographical distribution includes France, Switzerland, Germany, Finland, and Siberia.

Never likely to cause sufficient trouble to call in the aid of fungicides, better to pick off the diseased leaves if the cups appear.

Sacc. Syll. vii. 2710; *Pers. Ic. Pict.* iv. t. 23, f. 4; *Cooke Hdbk.* No. 1615*a*; *Plowr. Br. Ur.* 263.

Pæony Leaf-spot.

Phyllosticta Pæoniæ (S. & Sp.), Pl. I. fig. 11.

Pæony leaves are subject to several kinds of leaf-spot in different countries, but only the above has at present been recorded for Britain. This scarcely deserves to be called a "leaf-spot," since the spots are obsolete, and the rather large perithecia are scattered, like little black dots, over the leaves.

The conidia are elliptical, with two nuclei ($10 \times 5\ \mu$), and have a slight tinge of olive.

The greatest harm that the majority of these leaf-spots do to the plants is to disfigure the foliage. In general they may be kept in check by spraying and picking off the infested leaves.

Sacc. Syll. iii. 200.

Three other species of *Phyllosticta* are recorded as producing leaf-spots on Pæony. These are *Phyllosticta Moutan* and *Phyllosticta Haldensis* in Italy, and *Phyllosticta Commonsii* in North America.

Other leaf-spots are produced by species of Septoria, with long thread-like conidia, such as *Septoria Pæoniæ* in N.-W. Europe, and *Septoria macrospora* in Italy. *Septoria Martianoffiana* is only known in Asiatic Siberia.

Pæony Rust.

Cronartium Pæoniæ (Cast.), Pl. I. fig. 12.

A peculiar kind of rust, not very common but occasionally appearing in gardens, on Pæony leaves, chiefly on the under surface, is the above, which has been known for very many years.

The pustules are small, and collected together on paler spots, but with none of the bright yellow or rusty colour peculiar to most of the plant rusts.

The uredospores are enclosed in a kind of peridium, or volva, and are either ovate, or elliptical, and spiny ($20-30 \times 15-30\ \mu$). From the centre of the spore mass arises a compact column composed of the brown teleutospores, or final spores, many of which commence to germinate while still attached to the foster plant. The long flexuous columns (2 m. long) give a peculiar appearance to this parasite, making it look rather like a colony of worms or larvæ upon the leaf, commonly extending over a considerable surface. It has very little of the general appearance of a Uredine, and would rather puzzle the inexperienced.

It is found throughout the greater part of Europe and in Asiatic Siberia.

No successful experiments recorded, and the presumable æcidiospores are unknown.

Sacc. Syll. vii. 2139; *Mass. Pl. Dis.* p. 235; *Cooke M. F.*, 215; *Plowr. Br. Ur.* 254.

Pæony Brown Mould.

Cladosporium Pæoniæ (Pass.), Pl. I. fig. 13.

This mould was first found in Italy by Professor Passerini in 1876, and has since made its appearance in this country.

It forms broad chestnut-brown spots on the foliage, which ultimately turn black.

The threads are short and unbranched, nearly straight, and erect, divided transversely into joints, and springing from an abundant creeping mycelium. The threads bear at their tips the very variable conidia or spores, which are commonly one- or two-septate, and sometimes two or more are attached in a short chain ($15–22 \times 6\ \mu$).

Although found upon still living, but faded, leaves, it is rather uncertain whether it should be regarded as a destructive pest. Many species of *Cladosporium* are very common on decaying plants, and for the most part are simply saprophytes. The Tomato mould (*Cladosporium*) is nevertheless a destructive parasite, and possibly others may become so.

Spray with dilute potassium sulphide solution.

Sacc. Syll. iv. 1729.

Another brown mould, of a different character, *Cercospora variicolor*, with long slender conidia ($35–50 \times 3\frac{1}{2}\ \mu$), has been found on Pæony leaves in the United States. This is a true parasite.

Drooping Pæony Disease.

Botrytis Pæoniæ (Oud.), Pl. VI. fig. 14.

This white mould appear rather suddenly upon what appears to be healthy-looking plants, causing them before the time of flowering to become limp, the stem droops, and at length the plant dies.

The mould may be detected on the stem of a diseased plant like a delicate white mould on the blackened and shrivelled surface.

The threads terminate in somewhat globose heads, which bear a profusion of colourless elliptical conidia, or spores ($16–18 \times 7\ \mu$).

Later on small black *sclerotia*, which are compact masses of hibernating mycelium, will be found in the tissues, both above and below the ground.

It is presumed that these sclerotia remain in the soil until the succeeding spring, when they may start into new life, as some of these sclerotia do, under the form of a minute Peziza.

This threatens to be a troublesome disease, and should be encountered at once should it appear. All infected parts should be destroyed, so as to prevent hibernation of the sclerotia.

Mass. Pl. Dis. 157; *Gard. Chron.* Aug. 13, 1898, fig. 32.

Clematis Diseases.

The cultivated species of Clematis have hitherto been remarkably free from fungoid pests, whilst our common hedgerow species has two or three enemies. One or more of these may at any time make their appearance in the garden, especially those in which *Clematis Vitalba* may have secured a place. Hence we enumerate, incidentally, the diseases to which the Clematis is liable.

The common Clematis cluster cup (*Æcidium Clematidis*) occurs over the greater part of Europe, on the leaves of *C. Vitalba*, *C. recta*, and *C. Flammula*.

Another cluster cup (*Æcidium Englerianum*) has been found on Clematis leaves in Abyssinia.

In India another species (*Æcidium orbiculare*) has been found on *C. grata*, *C. orientalis*, and *C. puberula*, whilst *Æcidium Otagense* is confined to New Zealand.

Leaf-spot is also common, with *Phyllosticta Vitalba* (Cooke), formerly included by error under *Septoria Clematidis*, on our indigenous species. *Phyllosticta Clematidis* in Canada; *Phyllosticta corrodens* upon *Clematis Vitalba* in Italy, in company with *Phyllosticta bacteriosperma*.

One form of leaf-spot, with bicellular conidia, is *Ascochyta Vitalba*, found in France.

Of leaf-spots having long threadlike conidia *Septoria Clematidis* is British, as well as proper to some other parts of Europe. *Septoria clematis—Flammulæ* on *C. Flammula* in France; *Septoria clematis-rectæ* on *C. recta* in Italy, as well as *Septoria Flammulæ* on *C. Flammula*, and *Septoria Viticellæ* on *C. Viticella*. To these may be added *Septoria Jenissensis* on *C. glauca* in Siberia, and *Septoria Jackmanni* on *C. Jackmanni* in New York.

Crucifer Rot-mould.

Peronospora parasitica (Pers.), Pl. VI. fig. 30.

There are but few parasites on garden Crucifers, but this is sufficiently destructive to the foliage of Wallflowers, Stock, and some other garden flowers to make up for the deficiency.

It occurs in whitish mouldy patches on the leaves and inflorescence.

The mycelium is profuse, thick, and very much branched, from which arise the erect threads, which are also rather thick, soft, and flexile, from five to eight times branched, in a forked or trifurcate manner, the ultimate branches awl-shaped and curved, bearing the broadly ellipsoid conidia ($20–22 \times 16–20\ \mu$).

The resting spores, which are seated upon the mycelium in the stems and branches of the host, are globose ($26–40\ \mu$ diam.), either smooth or rugged, and of a yellowish or tawny colour.

For details of life history and development of the rot-moulds see Introduction, p. 2.

Diseased parts should be burnt to destroy resting spores.

Sacc. Syll. vii. 830; *Cooke M. F.* t. 14, f. 265; *Hdbk.* No. 1778; *Mass. Pl. Dis.* 79, 355; *Mass. B. F.* 119, f. 45, 46, 129.

Poppy Rot-mould.

Peronospora arborescens (Berk.), Pl. VI. fig. 15.

This is the principal pest of the Poppy family, and occurs on the leaves of the Opium Poppy, as well as on those of some uncultivated species. It was first described by Berkeley in the JOURNAL R.H.S. forty years ago.

It appears as a white mould, in patches, on the under surface of the leaves.

The fertile threads are erect, slender, and divided from seven to ten times, in the upper portion, in a furcate manner. The branches are more or less flexuous and spreading, gradually attenuated, so that the final branches are very thin, somewhat curved, and pointed. The conidia are almost globose ($15–22 \times 13–18\ \mu$), with a tinge of violet. In the autumn resting spores are produced upon the mycelium, within the tissues of the host-plant, and these are globose, with a striate brown envelope or coating.

The production of active zoospores, and their aid in the perpetuation of the species, follow the type of the other species of rot-moulds. See Introduction, p. 2.

This species has been found in France, Belgium, Germany, and Italy.

Spraying as a remedy can be of little use in so deep-seated an endophyte, but all parts of diseased plants should be burnt so as to destroy the resting spores.

Cooke Hdbk. No. 1785; *Journ. Roy. Hort. Soc.* i. p. 31, t. 4, f. 24; *Sacc. Syll.* vii. 836; *Cooke M. F.* p. 217; *Berlese Icones*, t. xliii.; *Mass. B. F.* 120.

A black mould, *Heterosporium Eschscholtziæ*, is found on Eschscholtzia leaves in California.

Mignonette Disease.

Cercospora resedæ (Fckl.), Pl. I. fig. 16.

This fungus is rather common on the wild species of Reseda, and sometimes proves destructive to the cultivated Mignonette, causing dusky brownish patches upon the foliage.

To the naked eye the blotches on the leaves seem to be minutely velvety from the threads of the mould, and without definite margin, but it spreads rapidly from plant to plant.

The threads are short ($50\ \mu$ long) and densely crowded together, septate, and brownish in colour. The conidia are produced at the apex of the threads singly, and are very long and flexuous ($100–140 \times 3\ \mu$), attenuated gradually upwards, and divided by numerous (four to five or more) transverse partitions, or septa; they are also slightly coloured.

It has been observed in Britain, Germany, Italy, the United States, and Australia.

Spraying with dilute Bordeaux mixture has been recommended.

Sacc. Syll. iv. 2092; *Mass. Pl. Dis.* p. 319; *U.S.A. Depart. Agric. Rep.* 1889, with plate; *Grevillea*, iii. 182.

A rot-mould, *Peronospora crispula*, has been found on leaves of *Reseda luteola* in the Rhine Provinces, and may at any time attack the Mignonette, should it appear on our uncultivated species of *Reseda*.

PESTS OF VIOLET AND PANSY.

Considerable anxiety is manifested by those who grow these plants extensively as to the prospects of the future, with the increasing number of Violet diseases which we are about to enumerate. Nevertheless it must still be remembered that quite a number of fungoid pests are known as affecting this family which have not yet made their appearance in the garden, but are common on uncultivated representatives. To be forewarned is to be forearmed, and all prospect of contagion from infested wild plants should always be held in consideration. For this purpose we have thought it prudent to give incidental notices of the diseases to which uncultivated plants are liable, as well as some affecting cultivated species, which have not as yet invaded our shores.

Violet Leaf-spot.

Phyllosticta Violæ (Desm.), Plate I. fig. 17.

This spot has occurred on the leaves of *Viola odorata* and *Viola tricolor* in various parts of Europe. It disfigures the foliage, but seems to have but little influence on the flowering.

White rounded spots are formed on both surfaces of the leaves, several spots occurring on the same leaf, and then occasionally coalescing and forming irregular blotches, but with a definite margin. The receptacles, or perithecia, are very minute, resembling little black dots just visible to the naked eye, scattered over and immersed in the bleached spots.

The sporules, or conidia, are produced within these receptacles, escaping when mature by a pore at the apex. In this instance they are cylindrical and straight (10 μ long), rounded at the ends and colourless, oozing from the mouth of the receptacle in the form of a whitish tendril.

The variety on the Pansy has rather smaller sporules ($7 \times 3\,\mu$).

This pest is known in France, Belgium, Italy, and Great Britain, as well as in Australia.

If troublesome in gardens fungicides should be resorted to in order to prevent spreading.

Sacc. Syll. iii. 203; *Cooke Hdbk.* No. 1352; *Grevillea,* xiv. 73, No. 404.

Another species, *Phyllosticta Libertæ* (Sacc.), with blackish leaf-spots and very minute sporules, occurs on Sweet Violet leaves in France and Belgium.

Dog Violet Leaf-spot.

Septoria Violæ (West.), Pl. I. fig. 18.

This minute endophyte has occurred upon the leaves of several species of Viola, and especially on the Dog Violet, *V. canina* and *V. sylvestris,* probably also on the Sweet Violet.

Pale bleached spots are formed on the leaves, circumscribed by a reddish-brown line. Upon the upper surface of these rounded bleached spots, but immersed in their substance, are numerous minute dotlike brown receptacles, or perithecia, so small as to appear like pin-points to the naked eye.

The sporules, contained within these receptacles, are long and thread-like, sometimes straight and sometimes flexuous, and colourless, escaping when mature by a pore at the apex.

It may be remarked here that the ordinary leaf-spots are produced by fungi of three genera, all very much alike in external appearance, but differing in the form of the sporules. In *Phyllosticta* they are very small, about twice as long as broad, more or less, and undivided. In *Ascochyta* the sporules may be similar, or larger, divided across the centre into two cells. In *Septoria* the sporules are generally very long, and threadlike, sometimes with a row of nuclei, or several transverse divisions.

The above-named species is found in Britain, Belgium, and Italy.

If troublesome, spraying may be useful to check it.

Sacc. Syll. iii. 2811 ; *Grevillea*, x. 48.

Septoria violicola is found on leaves of *V. biflora* in Switzerland and Germany, and *Septoria hyalina* on two or three species of *Viola* in North America.

Violet Anthracnose.

Glœosporium Violæ (B. and Br.).

Some years ago the Rev. M. J. Berkeley received some leaves of *Viola odorata* from Scotland, with a parasite which he briefly described under the above name.

The leaves were disfigured by one or two pallid spots, which concealed minute cavities scattered over the surface. In these cavities were produced minute sporules, or conidia, which were expelled through ruptures of the cuticle when moist, oozing out in little orange gelatinous masses, and spreading themselves over the surface of the leaf.

Thus far goes the description, and we have since seen the only specimens which passed through Berkeley's hands, but fail to find any trace of conidia or sporules on the discoloured spots ; and as the parasite has never been found since, it must remain uncertain or doubtful.

Grevillea, vi. 126 ; *Sacc. Syll.* iii. 3668.

Another species of Anthracnose, which might possibly be the same, has been found on Violet leaves in Italy, and called *Marsonia Violæ* (Pass.), the difference being that the spots are of a chestnut colour, and the sporules, which are narrowly elliptical ($15–18 \times 5\ \mu$), are divided across the centre into two cells, the only distinction between *Glœosporium* and *Marsonia* being that in the latter the sporules are bicellular.

Sacc. Syll. iii. 4036.

Violet Smut.

Urocystis Violæ (Fischer), Pl. I. fig. 17.

In some gardens, for the past century, the Violet smut has been more or less of a nuisance, disfiguring the foliage and weakening the plants.

The leaves are blistered and distorted, chiefly along the midrib, and the petioles become swollen and gouty, usually twisted and pallid. Later on these pustules split irregularly down the centre, and expose a mass of blackish spores, like soot, which are scattered over the leaves.

These spores are complex, like those of the smut on Hellebore and Anemone, and consist of irregular rounded balls ($32–50 \times 20–45$ μ) compounded of a number of smaller cells, the central ones being dark brown (10×17 μ diam.) and from one or two to six, angular by compression, while the outer ones, or those of the circumference, are colourless and somewhat hemispherical, but they do not germinate ($6–10$ μ diam.).

When the coloured spores germinate they give origin to a short thick thread (promycelium) into which the coloured contents of the spore pass. From the end of this thread five or six fusiform secondary spores are produced. Sometimes the secondary spores will germinate and produce tertiary spores.

This parasite is so deeply seated that fungicides are of little avail. All that can be done is to pick off all the diseased leaves, as soon as they appear, and burn them, so as to prevent the germination of the spores and the spreading of the disease.

It is certainly well known in France, Germany, and Italy.

Sacc. Syll. vii. 1905 ; *Cooke M. F.* 92, 232, t. ix., f. 185, 186 ; *Mass. B. F.* 189 ; *Plowr. Br. Ur.* 288 ; *Cooke Hdbk.* No. 1538 ; *Tubeuf. Dis.* 317, fig. 174 ; *Gard. Chron.* Sept. 30, 1876.

Violet Rust.

Puccinia Violæ (Schum.), Pl. I. fig. 20.

The Violet rust is so widely diffused, and so general on wild plants, that it is fortunate it is not found oftener in the garden than it is. Like many others of its kindred it is developed under three forms or stages, the earliest being the cluster cups, and afterwards the Uredo and the Puccinia. For practical purposes it is better to treat them as distinct diseases, without reference to their genetic connection, or, at least in so far as the cluster cups are concerned, their entirely different appearance to the ordinary observer. The pustules of the Uredo, and afterwards of the Puccinia, are scattered over the surface of the leaves, the former of a rusty brown colour, and the latter dark brown, nearly black, breaking through the epidermis.

The Uredo spores are powdery, and are produced in little pustules on either surface of the leaves. Individually they are nearly globose, and rough with short spines ($21–26 \times 17–23$ μ).

The teleutospores, or final spores, are darker in colour, and are produced in similar pustules, often mixed with those of the Uredo. They have the usual Puccinia form, with a central partition dividing them into two cells ($20–35 \times 15–20$ μ).

When mature these teleutospores are capable of germinating from each cell, the threads so produced developing towards their apex two or three secondary spores, which are simple and much smaller than the primary spore. The life-history and development are very similar in all the species of *Puccinia*. See Introduction, p. 5.

The present is a widely diffused species, and is known, not only in

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Britain, but also in France, Belgium, Germany, Switzerland, Italy, Austria, Finland, Asiatic Siberia, North America, and Patagonia.

It is doubtful whether fungicides are of much service with such deeply seated endophytes as *Puccinia*, although it was affirmed, during the greatest prevalence of the Hollyhock Puccinia, that spraying with Condy's fluid was decidedly advantageous.

Sacc. Syll. vii. 2163 ; *Cooke M. F.* 102, 210 ; *Plowr. Br. Ur.* 152 ; *Cooke Hdbk.* No. 1502.

It should be mentioned here that another species of rust has been found, in Britain and Germany, on the leaves of *Viola palustris*, and named *Puccinia Fergussonii*, in which the pustules are clustered together in large rounded patches. The teleutospores are smooth and rather deformed (20–30 × 13–20 μ) ; no uredo spores have at present been found (*Grevillea*, iii. p. 179).

Yet another species (*Puccinia hastata*) occurs on the leaves of *Viola hastata* in the United States, with much larger teleutospores (35–40 × 20–25 μ) and smooth globose uredospores.

A third species (*Puccinia alpina*) is found on leaves of *Viola biflora* in Germany, Switzerland, Italy, and Lapland. The teleutospores are longer than in any other of the species (30–52 × 17–23 μ), with the surface finely granulated.

Violet Cluster Cups.

Æcidium Violæ (Schum.), Pl. I. fig. 21).

In these modern days the above cluster cups are treated as a stage in the development of *Puccinia violæ*, but their general appearance is so distinct that for general purposes we prefer to treat them as a separate disease.

All the green parts of the Violet plants are liable to be invaded by this parasite. The cups are disposed in groups or clusters, seated on the leaves upon yellowish spots. The margin of the cup is white and torn into irregular teeth, exposing the bright orange æcidiospores (16–24 × 10–18 μ), which, as usual, are produced in chains, being separated and dispersed when mature.

The area of distribution corresponds with that of the Violet rust.

It is not sufficiently common to have originated any experiments with fungicides.

Scattered Cluster Cups.

Puccinia ægra (Grove), Pl. II. fig. 22.

Another species of cluster cups was discovered in 1876, principally on the stems, but also on the foliage of *Viola cornuta*. The cups are few and scattered (*Æcidium depauperans*) and the æcidiospores are also orange. In 1883 the corresponding Uredo and Puccinia were found, which were described under the name of *Puccinia ægra*. They have hitherto only been found in Britain (*Grevillea*, v. p. 57).

A species of cluster cups has also been found on wild Violets in the United States.

Sacc. Syll. vii. 2174 ; *Cooke Hdbk.* No. 1626 ; *Gard. Chron.* 1876,

p. 175, 361 fig. 72 ; *Cooke M. F.* 198 ; *Grove Jour. Bot.* 1883, p. 274 ; *Plowr. Br. Ur.* 158.

Violet Rot-mould.

Peronospora Violæ (D. Bary), Pl. VI. fig. 24.

Amid all the vicissitudes of the Violet crop it has hitherto suffered little serious injury from the rot mould, which is of close kindred to the Potato disease mould. It has appeared, and is not uncommon, on wild plants, and has recently invaded the Violet and Pansy under cultivation.

The tufts of the mould are effused on the foliage, and although white are not particularly conspicuous, the threads are collected in little bundles, growing erect, and are many times divided in the upper portion into forked branches, with the final branchlets awl-shaped and bent backwards.

The conidia are elliptical, growing singly at ($22–27 \times 15–19\,\mu$) the tips of the branchlets, but with a slight tinge of violet in their colour.

It is assumed that resting spores are produced, as in other rot moulds, but they have not yet been detected. (See Introduction, p. 3.)

Plenty of air, and not too much water, retard the spread of the disease.

Another rot-mould (*Peronospora megasperma*) has been found on *Viola tricolor* in the United States.

Sacc. Syll. vii. 838 ; *Berlese Icones,* t. xlii. ; *Mass. Pl. Dis.* 80 ; *Cooke M. F.* 235 ; *Grevillea,* iv. 109 ; *Mass. B. F.* p. 121.

Violet White Mould.

Ramularia lactea (Desm.), Pl. I. fig. 23.

This common little white mould on Violet and Pansy leaves does not much trouble the cultivator, since it has preference for the wild plants.

White orbicular spots appear on the leaves, circumscribed by a brown line, three or four spots being usually present on one leaf. The mould gives a mealy appearance to the spots, as if they had been powdered with flour, and principally on the under surface.

The mould itself is a very simple structure, consisting of rather twisted short threads ($30–60\,\mu$ long), without branches, bearing at their tips the oblong or spindle-shaped conidia ($8–10 \times 2–3\,\mu$). Occasionally two or three of the conidia will be met with attached to each other, end to end, so as to form a short chain.

It has been suspected that many of the species of this genus of moulds are only the naked conidia of some higher form of fungus, as has been proved in a few cases.

The present mould is known, not only in Britain, but also in France, Germany, Bohemia, Austria, and Italy.

It seems to be amenable to fungicides if taken in time.

Sacc. Syll. iv. 979 ; *Journ. Roy. Agr. Soc.* lxi. (1900), p. 735 (sub *Ovularia lactea*) ; *Journ. R.H.S.* xxvi. (1901), p. 198 ; *Grevillea,* iv. p. 109.

Another species, *Ramularia agrestis,* with larger and sometimes septate conidia, has occurred on Violet and Pansy leaves in Italy.

American Spot Disease.

Alternaria Violæ (Gall.), Pl. II. fig. 25.

There is very little doubt that this disease has made its appearance in this country, and is capable of doing considerable damage. It occurs principally on the leaves, commencing with small yellowish spots, surrounded by a narrow rim; sometimes they spread till they occupy the whole leaf. Most of the spots are free from fungus spores, with scarcely any indications of mycelium. Spores are developed in a saturated atmosphere after twenty-four hours.

The spores are borne in chains, or darkish-brown threads, which rise from the diseased surface. They separate easily, and can be transported freely to other and healthy leaves. These spores, or conidia, are club-shaped, or flask-shaped, divided by transverse as well as vertical septa, so as to be muriform ($40-60 \times 10-17\mu$), somewhat olive in colour.

Hitherto known only in the United States and in Britain, it is undoubtedly a dangerous pest.

At present no effective remedy has been discovered. Fungicides have produced little or no effect. Suggestions are made as to prevention, rather than cure, by giving careful attention to the production of vigorous, healthy plants.

Healthy plants inoculated with the fungus spores soon produced the disease.

U.S.A. Dep. Agric. Bull. 23, 1900; *Journ. Roy. Hort. Soc.* xxvi. December 1901, p. 246, pp. 491–3; xxvi. 1902, p. ccxxii.

Italian Violet Black Mould.

Macrosporium Violæ.

A black mould, under the above name, of which we have no description up to now, is reported to be destructive to Violets in Italy.

At the time of going to press we have seen Violets with the leaves in a bad condition, but there is no evidence that such condition has been caused by a parasite. The tissue was entirely bleached and dead over a large portion of the surface, commencing at the margin, and extending inwards, and not interfoliary. Cultivators are of opinion that it is due to external circumstances, which is most probable.

All the dead spots seen by us become occupied by tufts of black mould, which are not present when the fading commences, but occur only on the dead tissue, and hence it is probably a saprophyte.

The moulds are of two kinds, growing in company, forming small dark olive tufts, and not becoming confluent. The earliest form is a *Cladosporium*, with slender unbranched septate threads of a pale olive and rather long. The conidia at first continuous, then uniseptate, at length bi- or tri-septate ($18-30 \times 7\ \mu$).

The other mould, which appears mixed with the former, is a *Macrosporium* resembling *M. sarcinula*, with delicate deciduous threads and somewhat cubical conidia ($30-35 \times 25-30\ \mu$). Truncate at the ends and but slightly constricted. The septa, longitudinal and transverse, divide the conidia into quadrangular cells, mostly in three irregular rows, and of a darker olive brown than the *Cladosporium*.

Further investigation is advisable, but it certainly is not the Italian species.

Gard. Chron. 1902, April 12, p. 265.

Violet Black Moulds.

Cercospora Violæ (Sacc.), Pl. II. fig. 26.

This destructive genus of black moulds has no fewer than six representatives, which attack members of the Violet family. They form spots on the leaves, and develop tufts of short erect threads upon the spots. These threads are each surmounted by a long slender spore, which in most cases is septate, or divided by transverse partitions, and is gradually attenuated upwards almost to a point.

The British species (*Cercospora Violæ*) has five or six rounded white spots on each leaf, upon which the mould is developed.

The threads are very short, but the spores are very long (150–200 $\times$ $3\frac{1}{2}$ μ), attenuated upwards, divided by numerous transverse partitions, threads and spores having a smoky tinge.

It occurs also in Italy, Austria, and the United States.

It is recommended to spray with dilute Bordeaux mixture.

Sacc. Syll. iv. 2087 ; *Sacc. F. Ital.* t. 651 ; *Mass. Pl. Dis.* 319.

Another species (*C. Violæ-tricoloris*), with longer olive threads, occurs in Italy.

A species (*C. Violæ-sylvatica*), with shorter spores (45–70 μ), is found on *Viola sylvatica* in the Netherlands.

A British species (*Cercospora Ii*) has been found in Scotland on *Viola palustris*, with short spores (20–60 μ).

In the United States *Cercospora murina*, with spores (25–35 $\times$ 4–5 μ), has occurred on *Viola cucullata*, and *Cercospora granuliformis*, with variable spores on the same host.

In Saxony *C. lilacina* has curved or sickle-shaped conidia (50–75 μ long).

DISEASES OF CARYOPHYLLACEÆ.

A synopsis of the diseases of the Carnation family has already been published, which did not attempt to include the parasites of uncultivated plants, and yet extended to a considerable length. It will be necessary here to give more explicit details of the several diseases, so that they may be recognised by the ordinary observer.

Journ. R.H.S. xxvi. 1902, p. 649, Pl. I. II.

Dianthus Leaf-spot.

Phyllosticta Dianthi (West.), Pl. II. fig. 27.

This leaf-spot occurs on the foliage of *Dianthus barbatus* in gardens. It is not a destructive fungus, except to the foliage, which it discolours and distorts to a considerable extent.

The spots are whitish, and sometimes two or three are run together into one irregular blotch. The receptacles are quite minute, but visible to the naked eye, scattered over the upper surface, but more clustered towards the centre of the spots, with the circumference almost bare.

The sporules are elliptical and colourless, without any division, but usually with two or three small guttules (about $8 \times 3\ \mu$). At one time it was the custom to call these small sporules by the name of spermatia, which led to the inference that they were fertilising, and not direct reproductive bodies. This name and supposed function were abandoned, with the discovery that they were capable of germination under favourable circumstances.

The present species has also been found in Belgium, where it was first discovered by Westendorp.

If troublesome, spray with one of the copper solutions; otherwise picking the diseased leaves may be sufficient to prevent recurrence.

Sacc. Syll. iii. 237; *Journ. R.H.S.* 1902, Pl. I., f. 1.

Phyllosticta tenerrima is a Canadian species on leaves of *Saponaria.*

Carnation Leaf-spot.

Ascochyta Dianthi (Alb. and Schw.), Pl. II. fig. 28.

The leaves of Pinks, Carnations, &c. are liable to be infested with another small parasite, which causes spots on the living leaves. The pale spots are somewhat rounded or elongated, without distinct margin, and are dotted with the minute receptacles, which are accumulated in patches, at first covered by the cuticle.

The sporules are elongated, rather broader at one end than the other, but sometimes nearly equal, divided by a transverse septum in the centre into two cells; each extremity is furnished with an obtuse nipple or apiculus ($14\text{–}16 \times 3\frac{1}{2}\ \mu$).

In this and similar cases, where the sporule or spore is divided into two or more cells, it may be taken for granted that each cell is capable of germination, and for all practical purposes acting as if each cell were an individual sporule.

The little receptacles in which the sporules are produced are like little flattened round flasks, with a short neck, pierced at the apex, through which the matured sporules may escape. The base of these receptacles is attached to the delicate mycelium, upon which they are seated, and which pervades the spots.

This species is found also in Germany and the Netherlands.

Sacc. Syll. iii. 2203; *Journ. R.H.S.* 1902, p. 649, Pl. I., f. 2; *Cooke Hdbk.* No. 1357.

Lychnis Brown Spot.

Septoria Lychnidis (Desm.), Pl. II. fig. 27.

This parasite occurs on irregular red brown, or pallid rufous, spots on the leaves of *Lychnis dioica* and other species. The spots have no definite margin, and are sprinkled with the scattered receptacles, which are as minute as usual, and but just visible to the naked eye.

The sporules are long and threadlike, often curved or flexuous, and divided by from five to seven transverse septa ($50\text{–}70 \times 2\frac{1}{2}\text{–}3\ \mu$).

It has been recorded in France, where it was first discovered, and afterwards in Italy and Great Britain.

Sacc. Syll. iii. 2804; x. 6318.

Another species, with round pale spots, margined by a narrow bright brown ring (*Septoria noctifloræ*), occurs on *Silene noctiflora* in America.

One species without any definite spots (*Septoria dianthicola*) attacks the leaves of Sweet Williams and Pinks in Italy and Portugal.

Another affects the leaves of Saponaria (*Septoria Saponariæ*) in France, Italy, and Germany, in which the spots are pallid and rounded or irregular, the sporules being more robust than usual.

The leaf-spot most prevalent in Europe, S. Africa, and Australia (*Septoria Dianthi*) is not recorded for Britain. (See Journal R.H.S. 1902, Pl. I., f. 3).

Large Dianthus Spot.

Septoria sinarum (Speg.), Pl. II. fig. 31.

This leaf-spot seems hitherto to have been confined to the leaves of *Dianthus sinensis*, which are blotched with large and somewhat rounded whitish spots, often occupying the greater part of the leaf, and without any definite margin. The receptacles are scattered over the upper surface of the spots.

The sporules are of the threadlike type, but very short for fungi of this kind ($20–25 \times 2–2\frac{1}{2} \mu$).

The species was first found in Italy, but has since migrated to Britain.

Sacc. Syll. iii. 2802.

We may just mention *Septoria dianthophila* which affects the stems of *Dianthus caryophyllus* in Brazil.

Two species are recorded as selecting specially the calyces of *Dianthus* for their host. One of these is named *Septoria Carthusianorum*, and occurs in Belgium; whilst the other is called *Septoria calycina*, and is given as Belgian also; but except in the names we fail to detect any difference between them, and suspect that it is the same parasite described independently by two different persons.

Carnation Anthracnose.

Glæosporium Dianthi (Cooke).

During the spring of 1902 Carnations in several localities were attacked by this pest before it could be found in fructification and described, as it would appear to be an entirely new pest.

The leaves are at first spotted with small purple roundish spots. These gradually enlarge and become confluent and indeterminate, and at length brownish in the centre. Meanwhile the leaves become sickly, and commence to die off at the tips. The pustules are not to be distinguished by the naked eye, and scarcely by the aid of a lens. Cells beneath the cuticle supply the place of definite receptacles, and in them a large number of elliptical hyaline sporules ($10–12 \times 5 \mu$) are produced, which escape through the fissured cuticle. At length the cuticle about the orifice turns pallid, and appears as a pale dot on the purple spots.

No remedies have been tried, but it would be advisable to apply diluted Bordeaux mixture, so as to destroy the extruded sporules, and to pick off as many of the diseased leaves as possible.

Observed since the plates were in press, and hence too late for illustration here.

Septate-Carnation Anthracnose.

Marsonia Delastrei (De Laer.), Pl. II. fig. 32.

We venture to include here references and descriptions of another of those destructive forms of disease which is called in America "Anthracnose," although there was no record of a British species until the immediately preceding species was discovered as this description was going to press. They form spots on leaves and stems, but there are no definite receptacles, only cells or cavities in the substance, which are covered by the cuticle. The sporules are formed in these cavities, and are liberated by the rupture of the cuticle.

The spots on the leaves of *Lychnis* are tawny and without definite margin. The sunken cells are scattered over these spots. The sporules are narrowly club-shaped, rounded at the apex, and attenuated towards the base. They are colourless, and at first without division, but at length are divided by a septum in the centre into two cells ($20–25 \times 6–7\,\mu$), and are at first attached to long slender threads. Because of the divided spores it is called *Marsonia.* If the spores were undivided it would be *Glœosporium.*

Evidently this is only a mature form of another described parasite called *Glœosporium Lychnidis*, with which it agrees in every respect except in the septation of the sporules, both occurring upon the same host.

The distribution of this species is France, Belgium, Netherlands, Germany, Austria, Italy, and Siberia.

Diseased parts should be collected and burnt.

Sacc. Syll. iii. 3700; iv. 4035; *Journ. R.H.S.* 1902, p. 650, Pl. I., f. 4.

A similar parasite (*Cylindrosporium Saponariæ*) is found on the leaves of Soapwort in France. The sporules are straight and cylindrical ($10–40 \times 3\frac{1}{2}\,\mu$), Journ. R.H.S. 1902, p. 650, Pl. II., f. 17.

Soapwort Smut.

Sorosporium saponariæ (Rud.), Pl. II. fig. 34.

This smut occurs chiefly on the Continent upon the inflorescence of the Soapwort, on which it has been known for half a century. Only recently has it made its appearance in gardens in this country on *Dianthus deltoides.* It attacks and destroys the reproductive organs of the flowers, converting them into glomerules of spores.

The spore masses, or glomerules ($40–100\,\mu$ diam.), are rounded and composed of a great number of loosely connected cells, or teleutospores, which are yellowish-brown and angular from mutual pressure. The outer surface is rough with little tubercles and ridges (12-18 × 10-14 μ). The spores have been induced to germinate artificially, but not to proceed to the formation of secondary spores.

In the majority of species of the "smuts" the spores and glomerules are very dark brown, or almost black, and hence the name; but in a few species—and this amongst the number—the colour is pale.

Undoubtedly the smuts may be disseminated by means of the spores, but, at the same time, there is strong evidence in support of a perennial mycelium in perennial plants.

The present species is known in France, Germany, Austria, Italy, and Algeria as well as Britain.

Difficult to combat, but seldom occurs in this country. Better to burn infected plants.

Sacc. Syll. vii. 1872; *Plowr. Br. Ur.* p. 296; *Mass. B. F.* p. 202, figs. 59, 59A; *Journ. R.H.S.* 1902, p. 650, Pl. II., f. 9.

Anther Smut.

Ustilago violacea (Pers.), Pl. II. fig. 33.

This smut habitually attacks the flowers of many species of Caryophyllaceæ, chiefly appropriating the anthers, and converting them into a mass of blackish powdery spores, which are diffused and scattered over the petals. In older books it is known as *Ustilago antherarum* from its habit of growth.

The spores are subglobose and lilac under the microscope, covered with a network of ridges (6-9 μ diam.), the meshes being about $\frac{1}{2}$ μ apart. On germination a fusiform promycelium is formed, which is commonly three-septate, each joint giving origin to a secondary spore, or sporidiole, of an ovate form.

This species is known also in France, Belgium, Germany, Switzerland, Austria, Bohemia, Transylvania, Italy, and North America.

Naturally there can be no remedy, as the presence of the parasite is unknown until it makes its appearance in the flowers, and then it is too late. All that can be done is to destroy all infected plants, so as to prevent the spread of the disease.

Sacc. Syll. vii. 1781; *Cooke M. F.*, figs. 102–104; *Plowr. Br. Ur.* p. 280; *Mass. B. F.* p. 179; *Cooke Hdbk.* No. 1534; *Journ. R.H.S.* 1902, p. 651, Pl. II., f. 11; *Tubeuf. Dis.* p. 297.

Sweet William Brand.

Puccinia Dianthi (DC.), Pl. II. fig. 35.

One of the most common and best known pests of Sweet Williams and other allied plants, attacking the living foliage and rendering them most unsightly. There are usually large pale spots upon the leaves, which are somewhat rounded, or one or two other spots are joined to make them irregular, or to occupy nearly the whole of the surface of the leaf.

The pustules are rounded and cushionlike, either disposed in circles on the spots, or running together and forming an irregular crust, which is at first pale brown, then dark brown, covered with the pale cuticle, which splits irregularly, leaving the ragged margins like a frill round the pustules.

The teleutospores are fusoid or clavate, rounded at the apex, or conical, with the epispore thickened, divided at the middle into two cells, the lower one attenuated downwards into the hyaline pedicel (30–50 × 10–20 μ), pale in colour, and ochrey brown.

No cluster-cups, or uredo, known to be associated with this species, which is reported over the greater part of Europe, Asiatic Siberia, and North America.

In some books it is called *Puccinia Arenariæ*, and in others *Puccinia lychnidearum.* There are authors to whom names are pretty playthings, to be tossed about as they please.

Doubtless infection is transmitted of this disease through imported seeds.

Sacc. Syll. vii. 2361; *Mass. Pl. Dis.* 253; *Cooke Hdbk.* No. 1503; *Cooke, M. F.* p. 210; *Plowr. Br. Ur.* p. 210; *Gard. Chron.* Jan. 12, 1884, p. 57; Jan. 26, 1884, p. 120; *Journ. R.H.S.* p. 652, Pl. I., f. 5.

Campion Brand.

Puccinia Silenes (Schrot.), Pl. II., fig. 36.

We are not prepared to affirm to what extent this pest has worked in gardens, but it is common on wild plants, and we fear sometimes on cultivated ones also. It occurs on the living leaves of almost any species of *Silene* and *Melandryum* throughout Europe.

The first stage, or cluster-cup (*Æcidium behenis*), appears in the spring on the Bladder Campion, in small rounded clusters of the usual appearance, with white fringed margins and orange spores. The æcidiospores are angular and granulated (17–26 × 14–20 μ).

The pustules of the uredo form come later, and are rather small, either scattered, or at times confluent, and the uredospores are elliptical or ovoid, externally rough (19–26 × 17–22 μ), pale brown.

The teleutospores are contained in darker pustules, of a similar form and scattered, but not collected upon bleached spots. They are elliptical, or ovate, quite different in general outline from those of the Sweet William brand, rounded at both ends, and divided in the middle into two equal cells (25–40 × 16–25 μ), externally smooth, and of a chestnut-brown colour, with a short and uncoloured pedicel.

The area of distribution includes France, Belgium, Germany, Switzerland, Italy, and Siberia, as well as Britain.

Dilute Bordeaux mixture has been recommended as having proved effective.

Sacc. Syll. vii. 2154; *Journ. R.H.S.* 1902, p. 652, Pl. 2, f. 15; *Cooke M. F.* p. 211; *Plowr. Br. Ur.* 147.

Puccinia fastidiosa on *Dianthus sinensis* has larger teleutospores, and seems to be peculiar to Siberia (*Journ. R.H.S.* 1902, Pl. II., f. 16).

Carnation Brand.

Uromyces Dianthi (Niessl.), Pl. II., fig. 37.

The teleutospores in this parasite are one-celled, in which it differs from *Puccinia*, although the habit is the same. We met with it in 1891 on Carnations imported from Switzerland, and its visits may be repeated.

At first there are pale spots on the leaves, caused by the innate mycelium; then scattered minute elevated blisters follow, which are for a long time covered by the cuticle. Finally these pustules crack at the apex and disclose the brown powdery spores.

The uredospores are spheroid or elliptical, and rather large (40×17–$28\ \mu$), externally rough, and pale brown. No cluster cups associated with it.

The teleutospores, which are the last to arrive, are globose, rarely oblong, with the cell membrane thickened at the apex, externally smooth and brown (23–35×15–$22\ \mu$), a little narrowed below into the long deciduous pedicel.

Another name by which this brand is sometimes called is *Uromyces caryophyllinus*.

Hitherto its exploits have been chiefly confined to Germany, Italy, Moravia, and the Tyrol, in addition to Switzerland and Britain, but it has appeared at the Cape and in Australia.

No time should be lost, should the pest make its appearance amongst imported plants, to destroy the bad and spray the doubtful.

Sacc. Syll. vii. 1949; *Journ. R.H.S.* 1902, p. 652, t. II., f. 13.

Another species (*Uromyces Silenes*) is known in Italy, Germany, and Hungary on *Silene* and *Dianthus* (*Journ. R.H.S.* 1902, Pl. II., f. 14).

Carnation Black Mould.

Heterosporium echinulatum (B. & Br.), Pl. II., fig. 39.

One of the worst enemies of the Carnation. It was first observed in 1870, and has occurred very often since. The leaves become studded at first with large round whitish spots, upon which sooty brown mouldy patches quickly spread, giving a minutely velvety appearance from the tufted threads. These tufts have a habit of arranging themselves in circles, so that the mould has acquired the cognomen of "Fairy Ring of Carnations."

The threads are very regular, pale olive, and form little tufts or fascicles, each thread being simple or slightly branched, with very short branches, sometimes only like knots or nodules, the upper knots, as well as the apex of the thread, bearing the spores or conidia. These are cylindrical, with from two to five transverse divisions, mostly two or three, externally rough with minute warts (30–50×10–$15\ \mu$), slightly coloured. The conidia are capable of germination from each one of the separate cells.

Numerous minute sclerotia are said to be formed in the dying leaves, which remain as resting spores through the winter. These we have not yet had the opportunity of seeing.

Known in France, Switzerland, Cape of Good Hope, and Australia.

It should be vigorously attacked wherever it makes its appearance, and infected plants destroyed.

Sacc. Syll. iv. 2311; *Gard. Chron.* August 21, 1886, fig. 50, and 1870, p. 382; *Mass. Pl. Dis.* p. 320, fig. 87; *Cooke Hdbk.*, 1728; *Cooke Journ. Q.M.C.* 1877; *Grevillea*, v. p. 123; *Tubeuf. Dis.* 5, 6.

The small white mould (*Ramularia lychnicola*) has only been seen on Wild Lychnis. (*Journ. R.H.S.* 1902, p. 650, Pl. II., f. 10.)

Carnation Macrospore.

Macrosporium nobile (Vize.), Pl. II., fig. 38.

At first we were doubtful whether a species of this genus of black moulds could become parasitic, since, for the most part, the numerous species are saprophytes on dead and rotting vegetable matter. This is, however, only one of three or four species which are now known to be dangerous parasites.

This pest usually forms small black spots on the leaves and stems, which are sometimes confluent in patches. The mycelium is widely diffused in the tissues before the spots appear. The clusters of threads and conidia burst through the cuticle and are ultimately scattered. The conidia are large, and pale olive-brown, subcylindrical, pear-shaped, obclavate, or irregular ($60–80 \times 40\ \mu$), divided transversely, according to the length of the spore, from four to ten times, each division again subdivided by longitudinal partitions into somewhat cubical cells, in a muriform manner. Each cell capable of germination.

It is also affirmed of this species that later in the season numerous minute black sclerotia are embedded in the diseased parts. As these would act as resting spores, to reproduce the disease in the following spring, it is essential that every portion of diseased plants should be effectively destroyed.

Spraying with a solution of ammoniacal copper carbonate or potassium sulphate arrests the spread of disease.

Mass. Pl. Dis. 322, fig. 88, p. 440; *Journ. R.H.S.* 1902, p. 651, Pl. I., f. 8; *Grevillea*, v., p. 119.

The rot-mould (*Peronospora Dianthi*) has not yet been found in this country. (See *Journ. R.H.S.* 1902, Pl. I., f. 7.)

Bacteriosis of Carnations.

Bacterium Dianthi (Ar. & B.) Pl. II. fig. 40.

Examples of mysterious and inexplicable diseases of Carnations are occasionally being investigated, some of which may possibly be attributed to this disease, but until quite recently no other evidence beyond suspicion has been afforded.

In 1896 the results of investigations into the Bacteriosis of Carnations in North America were first published, and from those we learn that the disease is one of the leaf, rarely attacking the stem. In young leaves, when held to the light, pellucid dots are seen scattered irregularly over the leaf. After a time the dots show a distinct spot, and as the disease extends inside the leaf the surface tissues dry, the internal tissues collapse, and whitish sunken spots appear. As the spots enlarge the leaves wither. Very badly diseased plants have more yellowish green leaves than normal. The lower leaves die prematurely, and the vitality of the plant is lowered so as to check growth and decrease flowers.

The disease is caused by parasitic bacteria entering the plant from the air. The germ associated with the disease may be separated and shown, by artificial infection of healthy plants, to be the cause of the disease. The cells are described as elliptical, single, or rarely united ($\frac{3}{4}$–$1\frac{1}{4} \times 1$–$2\,\mu$), in fluid media more united, forming short filaments, afterwards elongated and convoluted zooglæa.

Plants may be kept essentially free from the disease by keeping the foliage dry, and preventing the presence of aphides. Unfortunately we examined British-grown plants affected badly by the disease in February 1902.

Purdue University Exp. Station Bull. 59, March 1896; *Bacteriosis of Carnations*, by J. C. Arthur and H. L. Bolley; *Journ. R.H.S.* 1902, p. 653.

Mallow Leaf-spot.

Phyllosticta destructiva (Desm.), Pl. II., fig. 41.

This form of leaf-spot is common enough on all the uncultivated Mallows, and sometimes finds its way into gardens on nearly any kind of malvaceous plant. It makes the foliage very unsightly, since the tissue of the spots falls out, and leaves ragged holes in the leaves.

The spots are somewhat rounded, of a pale ochrey colour, surrounded by a darker line. The perithecia, like little dots, are often in concentric rings, but the whole dead tissue of the spots is brittle, and soon crumbles away.

The sporules are oblong, with two nuclei, and are expelled from the mouth of the perithecia in flesh-coloured tendrils.

It is known in France, Belgium, Italy, and Austria.

Sacc. Syll. iii. 814; *Grevillea*, xiv. p. 73.

Another leaf-spot (*Phyllosticta altheina*) is found in France and Italy on Hollyhock leaves, and one, *Phyllosticta althæicola*, on the Marsh Mallow in France. One of the species with two-celled sporules, *Ascochyta parasitica*, favours the Hollyhock in France, and one with long thread-like sporules (*Septoria parasitica*) accompanies it on the same plants.

Septoria heterochroa (Desm.) (*Cooke Hdbk.* No. 1313) is found on leaves of uncultivated Mallows.

Hollyhock Brand.

Puccinia malvacearum (Corda), Pl. III., fig. 42.

This was at one time one of the most dreaded enemies of the Hollyhock, which suddenly made its appearance on the leaves of all malvaceous plants, and spread with extraordinary rapidity all over the country. It was first known in Chili in 1852, and in 1862 appeared at Melbourne, at which time no Puccinia on malvaceous plants had been known in Europe (*Gard. Chron.* Sept. 2, 1865). Afterwards it is heard of in the countries named below. It reached Spain in 1869 and France in 1873. In the latter year it was first heard of in the south and on the east coast of England; but it was not until afterwards that it was heard of in Bavaria, then in Italy, and later in Germany.

The pustules are round and firm, and are scattered over the leaves and petioles, being at the first of a greyish flesh colour, and afterwards of a reddish brown. They never become powdery, but the spores adhere together in a compact mass. No æcidium or uredo has ever been found associated with it, or suspected of any connection. The teleutospores are spindle-shaped, gradually attenuated towards each extremity, but sometimes with the thickened apex rounded ($35–75 \times 12–26\,\mu$). A cross-division in the centre separates them into two nearly equal cells. The whole surface is smooth and the contents yellow-brown. The pedicels, or footstalks, are long, firm, and persistent. The pustules often drop out from the leaves and stems, leaving holes and scars. It is easy enough to make these spores germinate in water.

The area of distribution is a large one, and it is probably even greater than we know. In Europe it was recorded in Britain, France, Portugal, Switzerland, Germany, Bavaria, Austria, Italy; in Eastern Africa, the Cape of Good Hope, and Algeria; in many parts of North America, and in Chili, Brazil, Argentina, Uruguay, Patagonia, and in Australia.

No efforts were spared, when the disease was at its height, either to eradicate or mitigate its evils, but with small success. One cultivator was sanguine in the application of diluted Condy's fluid, which, it is reported, caused the pustules to turn black and fall out, whilst the fluid did no injury to the plants.

It has been questioned whether the disease became hereditary, and whether the germs were contained in the seeds. One nurseryman affirmed that all their Hollyhock seeds exhibited in the seedlings when growing this fungus on their first leaves. Three other cultivators vouched for seeing young seedlings similarly affected, and the Rev. M. J. Berkeley confirmed this view.

Gard. Chron. Aug. 22, 1874, fig. 163; Nov. 11, 1882, fig. 106; Aug. 23, 1890, figs. 33–35; *Sacc. Syll.* vii. 2368; *Mass. Pl. Dis.* p. 252; *Grevillea*, i. 41, ii. 137, iii. 41; *Corda Icon.* vi. t. i. f. 12; *Cooke Fungi Uses &c.* p. 231; *Tubeuf. Dis.* 360, fig.; *Plowr. Br. Ur.* 212.

Hollyhock Anthracnose.

Colletotrichum Althææ (South.), Pl. II., fig. 43.

It is not quite certain whether this disease has already made its appearance amongst us, although it has for some time given considerable trouble in the United States. Any part of the plant may be attacked, but it is chiefly visible on the leaves.

Large brown or smoky patches occur on the leaves, which increase in size until the whole leaf is diseased or withered. On the petiole the spots are light yellowish brown, becoming blackish and sunken.

There are no true perithecia, but the little dots, or openings, on the spots indicate the small cavities beneath, in which the conidia are produced. These cavities are surrounded by abundant dark brown hairs (60–100 × 3–5 μ) which are once or twice divided by transverse septa. The conidia are irregularly oblong and colourless (11–28 × 5 μ), but flesh-coloured in the mass.

Spraying with diluted Bordeaux mixture at intervals, as soon as the leaves appear, proved to be the best preventive. Diseased plants should be destroyed.

Sacc. Syll. x. 6848; *Massee Pl. Dis.* p. 290; *U.S. Journ. Myc.* vi. p. 45, plate; *U.S.A. Dept. Agric.* 1890, pl. 1.

Hollyhock Black Moulds.

Cercospora (sp.).

It is rather remarkable that no instance has been recorded of the appearance of these black moulds on the foliage of Mallows or Hollyhocks in this country.

One of these (*Cercospora altheina*) not only has appeared in Italy, but also in the United States, and another, chiefly on the stems (*Cercospora nebulosa*), in Italy. A third species (*Cercospora malvarum*) has been found on fading Mallow leaves in France. Other species affect plants of Hibiscus, Sida, &c., but none of them have as yet crossed the Channel. These moulds are characterised by the very long and narrow conidia, which are attenuated upwards, and divided by more or less numerous septa.

Malvaceous Brands.

Uromyces (sp.).

About five species of one-celled brands (*Uromyces*) and about as many of two-celled brands (*Puccinia*), in addition to the Hollyhock disease, attack the foliage of malvaceous plants, especially of *Sida*, *Abutilon*, and *Hibiscus*. Of the former all of them are extra-European, and nearly all of the latter, so that little danger can be feared from them in our greenhouses, save by accident.

St. John's Wort Rust.

Melampsora hypericorum (DC.), Pl. III., fig. 44.

This parasite makes its appearance on the underside of the leaves of various species of St. John's Wort, including those which are found in gardens.

The pustules are mostly scattered over the leaves, and are rather small, but conspicuous on account of their bright yellow colour.

The uredospores are those which are usually seen, and are somewhat globose or ovate, and sometimes angular, orange-yellow, and powdery, with a rough surface (14–21 × 11–17 μ). The teleutospores are wedge-shaped, brown (26 μ long).

The area in which this pest has been recognised includes the greater part of Europe, Asiatic Siberia, and the Indian Himalayas.

So little injury is caused by this parasite in gardens that no experiments have been made with fungicides, which would probably be of some service should the rust ever prove troublesome.

Sacc. Syll. vii. 2114; *Cooke M. F.* 215, f. 174, 175; *Plowr. Br. Ur.* 243.

Leaf-spots, such as *Septoria Hyperici* and *Ascochyta Hyperici*, are at present confined to the small uncultivated species of Hypericum.

Pelargonium Stem-rot.

Fusarium Pelargonii (Cooke), Pl. III., fig. 45.

The disease attacks the stems of cultivated Pelargoniums, and at first the varieties 'Vesuvius' and 'Henry Jacoby,' and was first observed in 1896.

The plant seems to stop growing, and in a few days some of the lower leaves turn yellow, then the stem appears to turn black and decay.

The blackened stems exhibit over the decayed spots pallid, mealy-looking little patches, not more than a line in diameter, sometimes with a tinge of flesh colour. They seem to burst through the cuticle, and at first are somewhat gelatinous, soon becoming dry and powdery. This exudation consists of long spindle-shaped conidia, curved at each end and attenuated to a point ($60–70 \times 6\,\mu$), at first with three, and afterwards five, transverse divisions, or septa, and uncoloured.

As a recent disease the result of treatment by fungicides has not been ascertained, but as it seems to be an endophyte, which establishes itself in the tissues before it produces any external effects, it would be better to prevent its spreading by burning all the diseased plants and cleaning the soil, but the free application of diluted Bordeaux mixture would prevent its spreading.

Gard. Chron. July 25, 1896, p. 92.

Pelargonium Anthracnose.

Glœosporium Pelargonii (C. and M.), Pl. III., fig. 46.

This is also a recently developed disease on the leaves of Pelargoniums, which was unknown until 1889, and has scarcely been observed since.

The leaves are attacked on the under surface, but do not exhibit any distinct spots, only that the entire leaf soon droops and withers.

Minute pustules are to be seen scattered over the surface, especially in the neighbourhood of the veins, which cover the cells in which the conidia, or sporules, are generated, from which when mature they are expelled through a fissure in the epidermis. These conidia are quite colourless, oblong, rounded at the ends ($20 \times 4–5\,\mu$), and a little narrowed towards one extremity.

All known species of Anthracnose are tenacious and dangerous pests. Spraying with diluted Bordeaux mixture has been of some service.

Sacc. Syll. x. 6764; *Grevillea,* xviii. 1889, p. 20.

A supposed bacterial disease causes spots on Pelargonium leaves in America. (See Journ. R.H.S. xxvi. 1901, p. 550.)

Geranium Leaf-spot.

We have often seen Pelargonium leaves having large and confluent discoloured and decayed spots, without any evidence of the presence of fungi, but the spotting has been attributed to sour soil, from which the plants have recovered after a good cleaning of the roots and transplanting in good soil.

Spots caused on the leaves of uncultivated species of *Geranium*, such as *Septoria Geranii* and *Ramularia Geranii*, have not been recognised on cultivated species.

Geranium Rust.

The leaves of Pelargonium and Geranium have not been free from the attacks of cluster cups and rusts, but hitherto these have been confined either to uncultivated British or exotic species. Probably ten species of Uredines have been recorded under the several genera, but up to now the leaves of cultivated Pelargoniums have remained free from even an ordinary rust. *Uromyces Geranii* (DC.) is so common, in all its forms of cluster cup, uredo- and teleuto-spore, upon uncultivated Geranii that it would be prudent to be always on the alert against wild plants in the neighbourhood of gardens.

In South Africa a Geranium rust (*Puccinia granularis*) has latterly been causing trouble.

Tropæolum Rust.

Uredo Tropæoli (Desm.), Pl. III., fig. 47.

This rust is by no means common on the leaves of the commonly cultivated Tropæolum, and therefore is not likely to become a pest; in fact the species of Tropæolum seem to enjoy a remarkable immunity from the attacks of fungi.

The pustules are small, and are confined to the under surface of the leaves, over which they are scattered. The uredospores are powdery, elliptical, or rarely almost globose, and of a bright orange colour ($16 \times 10\ \mu$).

It has been found in France and Belgium, as well as in Britain, but is nowhere common, and hence it is unnecessary to trouble about fungicides.

Sacc. Syll. vii. 3119; *Cooke Hdbk.* 1578; *Cooke M. F.* 216; *Plowr. Br. Ur.* p. 258.

Tropæolum Leaf-spot.

Phyllosticta Tropæoli (Sacc.).

This is the only leaf-spot with which we are acquainted upon the leaves of Tropæolum, and this has not been recorded in Britain, but in Italy, Austria, and Portugal.

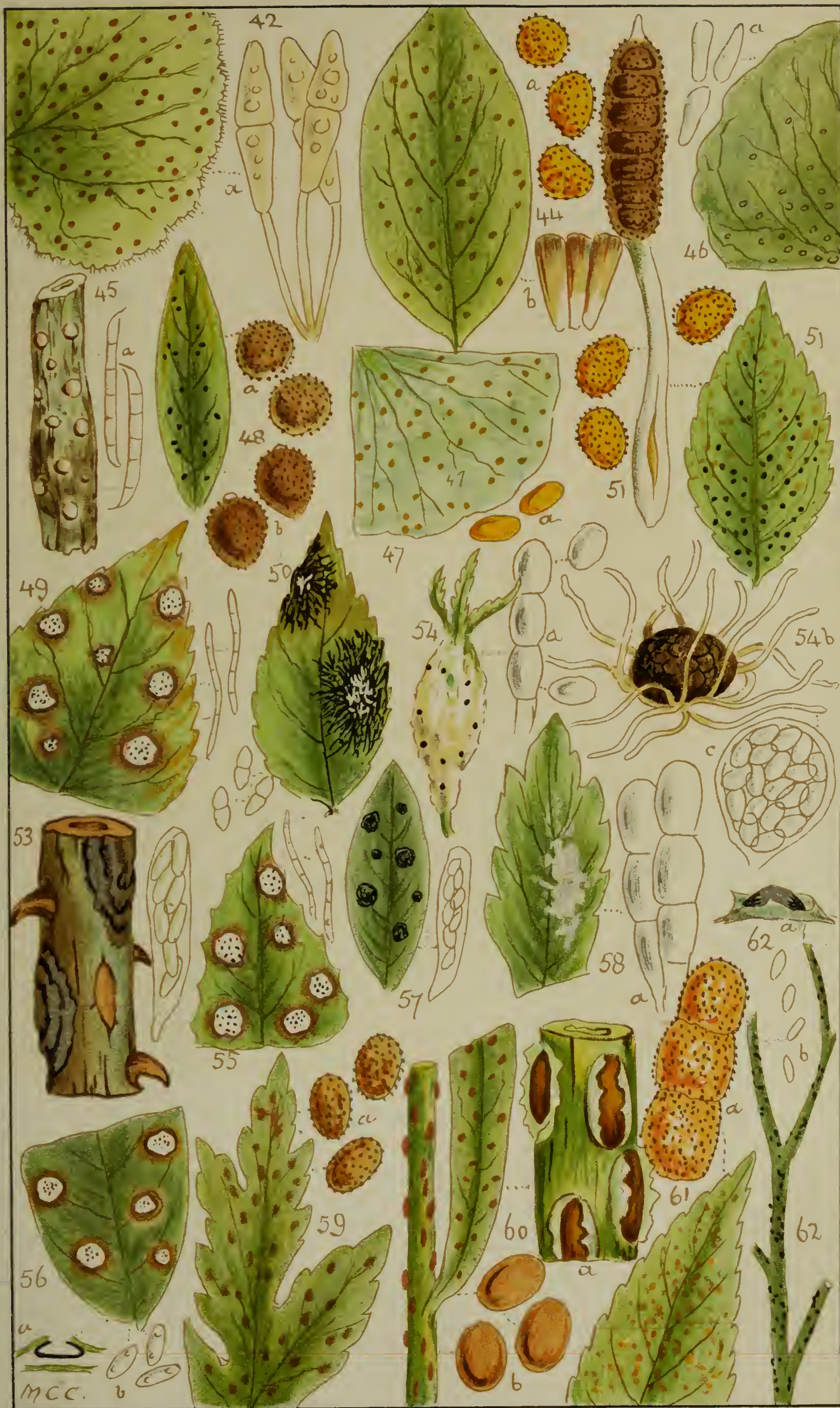
The sporules are oblong ($6–10 \times 3–4\ \mu$) and uncoloured, oozing out when mature from the orifices of the scattered perithecia.

Sacc. Syll. iii. 212.

Lupin Rust.

Uromyces Anthyllidis (Grev.), Pl. III., fig. 48.

This rust, with its brand form, occurs not only on the wild *Anthyllis*,



PESTS—FLOWER GARDEN.

but also on cultivated Lupins, as *Lupinus luteus* and *Lupinus albus* in Great Britain, Germany, and Italy, and appears on the foliage.

The pustules of the uredo are rounded, rather small, and of a reddish or chestnut brown. The uredospores, which are soon set free by the rupture of the cuticle, are globose and rough (22–24 μ diam.), of a pale chestnut-brown colour.

The teleutospores, or brand spores, are produced in dark-brown pustules, and are shortly elliptical, almost globose (19–22 $\times$ 17–20 μ), dark brown, clad with obtuse stoutish warts, growing at first on a slender hyaline pedicel, which soon falls away.

If applied early, fungicides will prevent the spread of this disease, but the teleutospores are capable of acting as resting spores, carrying the disease through the winter.

Sacc. Syll. vii. 1966; *Greville Eng. Flor.* v. p. 383; *Plowr. Br. Ur.* 135.

Another species (*Uromyces Lupini*) is found on the same Lupins in Italy, Germany, and Egypt, with smooth uredospores and smaller teleutospores. The North American species is again different.

DISEASES OF ROSES.

Fortunately the diseases to which cultivated Roses are subject in this country are few, and one of the most dangerous, the rot-mould, is rare. The common rose mildew is most troublesome and unsightly, and one or two of the others are very persistent, but they do not threaten Rose culture as that of some other flowers has been threatened.

Rose Leaf-spot.

Septoria rosarum (West), Pl. III., fig. 49.

So far as our knowledge and experience go, the leaves of cultivated Roses are liable to spotting by three different fungi, belonging to the genus *Septoria*, with threadlike spores. The one recorded as British is named above.

White rounded spots, to the number of ten or fifteen, occur on the upper surface of the leaf, surrounded by a rather broad purple border. Now and then the minute receptacles of the fungus are dotted over the spots, but these are often wanting, as they are upon similar spots on Strawberry leaves.

The perithecia, when present, contain long threadlike sporules (50–60 μ), which are furnished with a row of from three to six nuclei, ultimately divided by transverse septa into about six cells.

This spot fungus is recorded for Britain, Belgium, and Italy.

Spray with copper solution.

Sacc. Syll. iii. 2617; *Cooke Hdbk.* No. 1328.

Another species, under the name of *Septoria Rosæ sinensis*, is recorded for Italy and Portugal, but the pale spots have a brownish margin. The sporules seem to be the same, and possibly it is identical with the above.

Septoria Rosæ is probably distinct, and occurs in Belgium, France, Italy, Portugal, and Algeria. The spots are brownish and the sporules larger ($70–90 \times 3\frac{1}{2}–4$ μ).

Rose-leaf Black Blotch.

Actinonema Rosæ (Lib.), Pl. III., fig. 50.

This very common blotch on Rose leaves is to be seen in almost every garden, and many cultivators treat it as of small account, except for disfiguring the foliage.

The spots are somewhat rounded, and from half an inch to an inch broad, on the upper surface of the leaves, at first purplish and then black, without any well-defined margin. On the spots becoming black, closely adherent, flexuous, weblike lines radiate from the centre of the spot. Here and there are scattered the small black conceptacles, or perithecia, which contain the sporules. The latter are composed of two obovate cells, attached together by their broader ends ($18–20 \times 5$ μ), each containing two small nuclei, or guttules. The perithecia certainly are very obscure and difficult to discover, but sporules are readily found. Some authors deny the presence of perithecia altogether.

This parasite has been recorded in Great Britain, France, Belgium, Germany, Sweden, Austria, Italy, Portugal, and the United States.

If all diseased leaves were to be collected and burnt, scarcely a leaf would be left on some Rose bushes. Spraying has been recommended with diluted copper sulphates. Blue water, or Eau Céleste, is a preparation much in vogue with some cultivators, and is said to be of much service.

Sacc. Syll. iii. 2257 ; *Cooke Hdbk.* No. 1372 ; *Tubeuf. Dis.* 474.

Rose Rust.

Uredo Rosæ (Pers.), Pl. III., fig. 51*a*.

The uredines, or rusts of different kinds, are rather partial to the Rose family, and this, which is the uredo stage of a more elaborate fungus, hereafter described, has been known at different times as *Uredo pinguis* and *Uredo miniata*. It occurs on the leaves, petioles, and stems of cultivated Roses, bursting through the cuticle as a yellow powder.

The under surface of the leaves is sprinkled with the small pustules, either scattered or gathered together, which soon discharge the uredospores, which are rather variable in form, spherical, ovoid, or angular ($17–32 \times 12–24$ μ), with a minutely roughened surface.

Early in the year this yellow uredo may be detected upon the leaves, without any indication of the teleutospores which are to follow.

It is remarkable how this pest seems to follow the cultivation of Roses all over the world, and no efforts seem to make much progress towards either its extirpation or mitigation.

It may be said to be universal throughout Europe, and to have extended to Asiatic Siberia, probably to India and to South Africa.

It is recommended that plants which have been attacked the previous season should be drenched with a solution of copper sulphate in water, in early spring before the buds expand. The soil around may also be saturated.

Sacc. Syll. vii. 2622; *Gard. Chron.* July 7, 1877, fig. 5; *Mass. Pl. Dis.* p. 260; *Cooke M. F.* 34, 107; *Plowr. Br. Ur.* p. 225.

Rose Brand.

Phragmidium subcorticium (Schr.), Pl. III., fig. 51.

This is the advanced stage of the Rose rust, which it accompanies in the autumn, and forms little blackish tufts on the under surface of the leaves, in succession to the gradually disappearing uredo.

The uredospores having already been described, we have to concern ourselves with the teleutospores, as seen under the microscope. These are very long and cylindrical, terminated at the apex by a colourless point, and the base continued into a long and swollen, almost bulbous, translucent stem, which is longer than the teleutospore itself, and persistently adhering to it. The teleutospore ($75–100 \times 26–30\ \mu$) is of a clear but dark-brown colour, divided transversely by septa into from three to seven cells, each of which is capable of germination, and the surface minutely rough or warted. These teleutospores are usually collected in little tufts.

When germination takes place any one of the cells is capable of giving off a short germ tube, or promycelium, which becomes divided in the upper portion into several cells, each of which gives off a short process, which carries a small promycelial sporule. These promycelial sporules are charged with the destinies of dissemination, and are the medium through which other leaves are infected.

The area of distribution of the brand is accepted as the same as that of the uredo, of which the teleutospores are the recognised resting spores.

Spray with potassium sulphide and burn all fallen infected leaves.

Sacc. Syll. vii. 2622; *Mass. Pl. Dis.* p. 260; *Cooke M. F.* 201; *Plowr. Br. Ur.* p. 225; *W. G. S., Gard. Chron.* July 17, 1886, p. 76, with figs.; *Grevillea*, iii. Pl. 45, fig. 3.

Rose Rot-mould.

Peronospora sparsa (Berk.), Pl. VI., fig. 52.

This rot-mould was first discovered in 1862 on a quantity of potted Rose plants in a conservatory. Fortunately it has not become an established pest, and we doubt if it may not be almost extinct, although in such cases revival and re-establishment are always possible.

Irregular, pale-brownish, discoloured spots appeared on the upper surface of the leaves: these extended rapidly, and in a short time the leaves withered and shrivelled up, and ultimately the whole plant perished.

A delicate greyish mould on the spots was scattered over the under surface of the leaves. The threads which arise from the mycelium are scattered, somewhat torulose, and divided in the upper portion as much as eight or nine times in a forked manner, the final branchlets being scarcely hooked, bearing at their tips the elliptical conidia ($20–22 \times 15–18\ \mu$).

Hitherto resting spores have not been found, although there is no doubt of the relationship of the species to the rot-mould found on Hellebore, Anemone, and other plants.

Reference to other rot-moulds, of the genus *Peronospora*, will show the kind of treatment recommended. See Introduction, p. 3.

This species has made its appearance also in Germany and the United States of America.

Sacc. Syll. vii. 884; *Cooke M. F.* 161, 237; *Berlese Icones.* pl. lviii.; *Gard. Chron.* 1862, p. 308; *Cooke Hdbk.* No. 1790; *Tubeuf. Dis.* 133, fig.

Rose Mildew.

Sphærotheca pannosa (Lev.), Pl. III., fig. 54.

Very little description is needed of this very common and well-known disease, which clothes the leaves, twigs, and flower-stalks of all kinds of Roses with a dirty white felted mycelium of interwoven threads, distorting,

Fig. 4.—(1) Rose Leaf, blotched with the Mildew. (2) Chains of Conidia. (3) Cocidium germinating.

blighting, and spoiling the Roses, to the great disgust of the gardener, and almost drives him to despair in the face of his helplessness.

This is really an epiphytal disease, and makes its appearance externally before it invades the tissues. In its first and earliest stages it is a white mould called *Oidium leucoconium*, and is of a kindred with the *Oidium Tuckeri*, which affects the Vine.

In the conidial or oidium stage the profuse mycelium sends up short branches, which produce the oval conidia attached to each other, end to end, in a chain (20–30×13–$16\,\mu$) when mature: these separate at the joints, and fall away, each to germinate on its own account.

The more perfect condition of the disease is the stage in which little blackish points or globose receptacles appear scattered about upon the whitish mycelium. These receptacles are at first pale, but soon become of so dark a brown as to appear black. These receptacles adhere by little filaments to the mycelium, accompanied by free floccose appendages which do not adhere. The receptacles are composed of an outer coloured membrane, without orifice, and the gelatinous contents. When quite mature each receptacle encloses a single globose transparent sac, or ascus, which holds numerous elliptical uncoloured spores ($20-27 \times 12-15\,\mu$).

When the patches of mould upon the leaves have produced their conidia, the leaves generally curl up and fall away without producing the receptacles. On the stems and ovaries the perithecia are to be found, and within them the ascospores, or perfect spores, are produced.

The treatment suggested resembles that which has been successful in the allied Hop disease—flowers of sulphur mixed with about one-third of its volume of slaked lime dusted upon the foliage. Spraying with potassium sulphide solution has been recommended as equally efficacious. In this, as in all similar cases, it cannot be too strongly urged that all the diseased parts possible should be cut off and burnt to prevent the dissemination of the conidia and spores. Vigorous treatment would minimise disease.

Sacc. Syll. i. 6 ; *Cooke M. F.* 169, 238, figs. 217, 218 ; *Mass. Dis. Pl.* 444 ; *Tubeuf. Dis.* 172, fig.

Rose Tumour.

Botryosphæria diplodia (Moug.), Pl. III., fig. 53.

The living stems of Roses are often disfigured by the occurrence of blackish elliptical swellings or cancerous-looking spots marked with darker concentric lines. In former times they were called by the name of *Dothidea Rosæ* (Fr.), but names are apt to change.

The stroma, or tumour, is developed beneath the bark, and is of a tawny colour, in which the globose perithecia are immersed, becoming more or less erumpent, splitting the cuticle into flexuous fissures. The perithecia are rather crowded in this stroma, or tubercle, and are somewhat slow in arriving at maturity, when they contain numerous club-shaped hyaline asci, or specialised cells, which enclose eight sporidia in each, arranged in a double row. These sporidia are almond-shaped and colourless, or tinged with yellow ($17-20 \times 8-9\,\mu$), escaping and becoming free when mature.

We have no knowledge of any experiments in combating this disease, but presume that it is deep-seated, and has permeated the tissues before it makes any external appearance.

The distribution of this species is given as Britain, France, Belgium, Germany, and Italy.

Sacc. Syll. i. 1774 ; *Cooke Hdbk.* No. 2425 ; *Berk. Eng. Fl.* v. 255.

(*To be continued.*)

THE RENEWAL OF OLD FRUIT TREES.

By George Bunyard, V.M.H.

[Lecture delivered January 28, 1902.]

When reading a short paper before the Royal Horticultural Society last year I was challenged to give a few hints as to the renovation of old fruit trees, which I will now endeavour to do.

It frequently occurs that a halo of sentiment hangs around and envelops the old fruit trees of our gardens, dating, perhaps, from the days of youth, when it was a real pleasure to pick and eat a fruit (when the gardener was away), and to feel that by that unrighteous act one had added a mite to one's horticultural knowledge; for, as a member of the family, we felt we had rights in the fruits of the orchard and gardens which were not always recognised by the reigning chief. And as we grew up and came home—possibly to take the place of beloved parents—a certain fondness for the well-known old trees appealed to our minds, and we could not entirely yield to the gardener's suggestion that "them old trees wasn't no sort of use, and had better be made into faggots," and some fresh ones be purchased to put in their place. So it came to pass that, after a quiet talk, we assented to half-measures and gave the old trees another trial, either by grafting some new varieties upon them, or by cutting away the old mossy and gnarled spurry boughs, and assisting them by a liberal stimulant at the roots, and so started them into new growth.

Now it is possible in many cases thus to renew aged trees; Pears are particularly amenable to treatment; Apples partly so. But worn-out Plums, Peaches, and, in fact, all stone fruits (except Cherries in orchards) are better destroyed at once, and replaced by new trees of the best varieties, using a liberal supply of fresh turfy loam to start them in. Under such treatment they will soon respond to the trouble bestowed on them and quickly fill up the vacancies.

Stone fruits will not endure that severe pruning which is necessary to renovation, being liable to "gum" on the strong shoots produced, or to "collar" at the junction of the new growth with the old stem, and thus blow out under the strain of heavy winds, or choke with gum and become useless. Cherries in orchards, however, never get beyond treatment, and to renovate them the trees should be gone over as soon as the crop is gathered, all the dead wood removed, and the boughs which are injured by breakage, or "splits," from contact with ladders &c. at gathering time, or from the strain of an abnormal crop, be cut away. Then, if in pasture land, the long strands of grass, thistles, and weeds should be mown, and with the cuttings and prunings removed from the orchard and burnt. Sprinkle salt at 2 cwts. to the acre over the ground, and when a new growth of grass has set in turn in some ewe sheep and feed them with oil cake, chaff, oats, peas, or barley once a day; move the feeding troughs every other day to fresh positions, until the new grass is fed down as close as a Turkey carpet, and continue this treatment through the winter, giving more or less food to the sheep, according to the weather, naturally most in cold times. The droppings of the sheep will gradually improve the grass sward, and cause the Cherry rootlets to rise in March to the surface for the nourishment to be found there. An earlier crop of foliage will thus ensue, which will protect the young fruit from those severe frosts which often occur in May, and even in June. The fruit will be nourished by every shower that falls, and after it is gathered new growth will be stimulated and a store of vigour imparted to the trees for the following year's crop.

On light soils the land in Cherry orchards may be again dressed with salt or kainit, and on heavier soils a dressing of 20 bushels of soot, or 5 cwts. of basic slag, to the acre in February, will be of infinite value to the trees as well as to the grass. The same system will also renew or invigorate Plum, Apple, and Pear orchards, but the boughs should be very severely thinned, the useless spurs removed, and the centre of the heads of the trees be kept clear and regulated.

In renewing old Pear trees trained on walls one system is to cut out every other lateral tier six inches from the main stem and start the shoots behind the cut to form new tiers. Afterwards, the remaining worn-out tiers can be served in the same way, and thus the tree will in time be entirely renewed with young wood. In cases where the variety is only second rate (as so many of the Pear trees are that were planted some fifty years back) the lateral shoots can be grafted one foot from the main stem, and in two years' time will begin to give a small crop. Supposing a tree of eight tiers of branches, as many different varieties of recognised merit can be grafted in, or the tree may be used for the testing of new varieties, and in this manner a crop can be relied on in three or even two years, the root vigour of these old trees being very powerful; if needed some stimulant mulching lightly forked in may be used to assist the new growth. Another plan which I have seen successfully carried out is to remove all the branches and main stem down to the lowest tier, and by this radical operation the formation of strong new shoots will be stimulated from this lowest tier, which can be encouraged to grow in an upright form at such regular distances as are desired.

In this way a crop is readily secured the second year; and it is a very good plan for varieties which, like Jargonelle when old, often fruit on the ends of the branches only, and for other varieties which form a mass of fruitless spurs.

As regards overgrown pyramids and bushes both of Pears and Apples in gardens, I should advise that all of poor or doubtful quality be at once dug up and destroyed; while those which are of good recognised varieties should be allowed to grow in a free and natural way, merely thinning out the superfluous inside shoots; they will thus soon produce freely on the branches of two or three years' growth.

In cases where Pears are on the Quince stock, and Apples on the Paradise, they are more easily dealt with, as the roots are closer to the stem; and if a trench be made round each tree, the coarse roots removed, and the trench filled with fresh soil, the new rootlets formed will be so abundant that the tree can readily be lifted and removed the following

October, and be either placed in a new position, according to size and vigour, or be regulated in their former positions and refreshed with new soil to work in. We prefer, however, to make an entirely new plantation with the old trees elsewhere, and to substitute (after a year's fallow or inter-crop) a fresh lot of trees altogether to fill up the ground thus left empty. This gives a chance of renewing the old stale soil, and also of introducing new or desired varieties.

Where, however, the garden is limited, only half of the old trees should be operated on in one season in order to lessen the chance of an entire failure in the supply; but the old removed trees will after a season's growth more than reward the operator for any trouble he has taken with them.

So far as cordons on walls are concerned, we should prefer to replant entirely, remaking the borders at the same time, as new trees can be purchased in a forward state at a cheap rate, as severe measures frequently prove unsuccessful.

With old Peaches, Nectarines, and Apricots it is far best to destroy them outright and start with young trees. In all good gardens a reserve of young free trees is maintained, so that a gap can be filled at once by a vigorous, healthy subject of three to five years' growth, which itself is all the better for the check it receives in removal.

In the Society's Journal, vol. xxv., p. 363, a wonderful drawing is given of a large trained Pear tree which was so successfully renovated by rooting the lower branches that the main and original stem could be dispensed with. In other words, the tree first had one, then three sources of root nutriment, and finally two.

In all cases new soil should be introduced to the roots. Good, sound, turfy loam is better than heavily manured soil; and if stimulant be necessary it is best supplied as a top dressing.

There is yet another way of dealing with old overgrown pyramid trees. After two years of free growth, as before named, the resulting shoots can be tied into a frame, and made to assume a set form; thus treated they fruit freely, and the branches being secured the fruit is not bruised by the winds.

It should be mentioned that where large trees are headed back the new shoots are very strong, and must be duly nailed in or otherwise secured; and if a second lateral growth should be formed from the lower eyes, it should be pinched at the third leaf to encourage fruit buds to form.

Very old Figs often get bare below, and far too crowded at the top of the wall. These should have the large coarse boughs cut away at the base, and the best of the resulting new shoots be nailed into the wall.

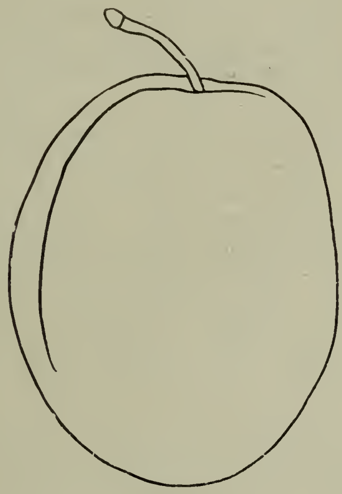
It is a great mistake to let Figs carry too much wood, and they more often suffer from over-manuring than the reverse. In fact, where they root into the vegetable borders it is as well to make a trench two feet wide and three feet deep, and fill this with broken bricks, porous stone, loam, and old mortar rubbish. The roots revel in this material, and the trees lay up good, hard, sound, fruitful wood.

Though the Grape scarcely comes under notice in this paper, old vines can be safely cut back, where the precaution of leading up one or two long rods from the base of the cane has been previously taken. But it must be borne in mind in such cases that the borders often get into a bad state, or that the roots go searching for nourishment in positions too far from the surface, so that the wisest economy may be to make entirely new borders and start with fresh vines.

In a small garden half the vinery should be taken in hand at a time, but where several vineries are in use, one house can be renewed in a season.

All small fruits, such as Gooseberries, Currants, and Raspberries, so soon bear fruit that old unsightly bushes are best destroyed to make room or new ones. It may be as well to say that Strawberries are of but little use after three years, and new beds should be made annually, so as to keep up a regular series.

Where old trees are to be grafted, the stems should be prepared in February and the new grafts be inserted by the end of March. As the shoots swell very rapidly, the junctions of scion and stock must be carefully watched, or the tying material may cut into the new growth, causing it to be a harbour for insects and making it liable to snap off, and so losing a season. The scions should be cut in February and be laid in the ground half their length deep, in a shady place until wanted for use.



NICOTINE: ITS USE AND VALUE IN HORTICULTURE.

By Geo. Edw. Williams.

[Lecture delivered February 25, 1902.]

Nicotine is an alkaloid which occurs in various parts of the Tobacco plant. The compound owes its name to one Jean Nicot, a Frenchman, who first introduced the seeds of the Tobacco plant into France in the year 1560. Nicotine when pure is a colourless compound of an oily nature, but readily soluble in water. It has rather a sickly smell, not at all like the odour we usually associate with Tobacco. It acts upon all animal life as an extremely powerful poison; it is the strongest insecticide known to the scientific world that can be used with safety in checking the ravages of blight and other insects that are injurious to vegetable life. It has a very high boiling point, and great care has to be exercised in extracting it from the Tobacco plant, as it is very easily oxidised.

Of course in the wide range of chemistry other compounds have been found that are strong insecticides; for example, the well-known carbolic acid is a very strong disinfectant and insecticide, but it also acts as a poison to vegetable life. Then we have substances of sulphate of copper and weak solutions of mineral acids, all of them splendid insecticides, but at the same time they check and in many cases stop vegetable life. They are, however, useful as fungicides. Quassia liquid, again, in some cases acts as a good insecticide, but is not sufficiently powerful to kill many kinds of blight and parasitic diseases common to plant life.

In studying the chemistry of insecticides and their relation to plant life one is bound to come to the conclusion that nicotine is the compound amongst all others that can be used by the horticulturist with perfect confidence and success. It is absolutely harmless to all forms of vegetable life if used under proper conditions. I am obliged to put in that saving clause because some people are much inclined to take advantage of broad general statements. Still, though I say "nicotine is harmless to vegetable life," no one, I imagine, would be so insane as to syringe his Rose trees with pure nicotine. Oxygen is not only harmless but essential to all animal life; yet it would be madness for us to breathe nothing but pure oxygen all day and every day, and if we did we should certainly not breathe very long. No, we must breathe oxygen under proper conditions, and then it sustains our life. So with the use of nicotine as an insecticide; it must be used under proper conditions; and if used under these conditions it will not injure or impair vegetable life, but will prolong and strengthen it.

Not only by practical experiment upon various forms of plant life do we find that nicotine is harmless, but by experiments upon forms of life just one step higher than vegetable life, viz. microbes. A microbe is a small bit of life, and is by nature more or less vegeto-animal. It is neither an animal as we ordinarily understand the word, nor is it a vegetable as we generally use the term, but it is half-and-half, somewhere between the two. A microbe is a peculiar sort of gentleman, a gentleman rather difficult to deal with, as the small-pox is showing us just now. Microbes are neither "flesh, fowl, nor good red herring." Vegetable life predominates in all microbes rather than animal vitality, and they are more closely related to the homely Cabbage plant than they are to the still more homely flea. Now by direct and careful experiment we find that nicotine has no appreciably injurious effect upon the growth of microbes. Many wonderful discoveries have been made in bacteriology within recent years. Microbes which cause or are found to be connected with certain diseases have been discovered, classified, and examined under the microscope, and celebrated bacteriologists have become so expert in the science that they can immediately say whether a group of microbes are those of typhoid fever, cholera, anthrax, scarlet fever, &c.

The following experiments have been carried out to ascertain whether nicotine acted as a disinfectant as well as an insecticide. The microbes of certain diseases such as typhoid fever, anthrax, and cholera were enclosed in sealed jars, and the vapour of pure nicotine was passed through the jars for a period of forty-eight hours. At the end of that time, after microscopic examination, the various microbes were found to be alive and capable of reproduction, nicotine having no appreciable effect upon these organisms. This is rather conclusive evidence against permitting smoking inside stage carriages during the prevalence of small-pox on the plea that it would keep off infection.

By direct experiment again we find that the vapour of nicotine will not injure the natural bloom on delicate fruit; it will not affect the scent of choice flowers, and so far as plant life is concerned it does not either injure or retard growth. Thus by experiment it has been conclusively proved that nicotine is harmless to vegeto-animal life and all organic life below this order.

There is one other interesting lesson that may be learnt from the previously mentioned experiments, which is this. All compounds that are good disinfectants are not necessarily suitable materials to be used as insecticides in horticulture; and *vice versa* all compounds that are suitable for use as insecticides in horticulture are not necessarily suitable as disinfectants. If this fact is borne in mind it will prevent a tremendous amount of damage being done by people who profess to understand the chemistry of insecticides which may be used on plant life, but who unfortunately have not even got as far as the experimental stage in these matters.

We must now therefore definitely state that the proper use of nicotine in horticulture is extremely valuable as an insecticide of the first order, and one which is reliable, efficient, and harmless to all forms of vegetable life.

There are three ways of using the compound.

First, by the application of heat, and so vaporising the nicotine, and bringing the vapour into contact with the plant or plants requiring treatment.

Second, by direct application in a liquid form to the plant.

Third, by mixing the nicotine with a combustible fibrous medium and burning it or by burning dried Tobacco leaf, which is practically the same thing.

The first and second methods of using nicotine are reasonable and scientific, and are strongly recommended to give satisfactory results. The third method is clumsy, unreliable, and by no means unlikely to cause injury to plant life. But I will take the three methods seriatim and explain the working of each.

The first and principal method, by the application of heat to nicotine (but not by direct flame) and by bringing the vapour so produced into contact with the plant or plants requiring treatment. In using this method it is necessary that the two following facts should be borne in mind, viz. first, that nicotine has a very high boiling point, 250° C.; and secondly, that the less heat we apply to nicotine to vaporise it, the more potent as an insecticide will the resulting vapour be. It is further essential that the vapour should be given off rapidly, so that even a small amount of heat should not be applied to the nicotine for a longer time than is absolutely necessary.

All these points are met by mixing nicotine with a volatile substance which prevents the temperature from rising too quickly when heat is applied, and also causes the nicotine to be rapidly vaporised, the vapour of the substance with a low boiling point carrying with it mechanically the greater portion of the nicotine with which it has been mixed. If the vaporisation of nicotine is carried out in this manner, then good and lasting results (and no damage) will accrue to plant life. Nicotine can be procured ready mixed with volatile matter in the proper proportions, and is sold under the name of fumigating compound. The amount of the compound required to fumigate 1,000 cubic feet is half an ounce.

The above method of using nicotine is the one usually adopted when it is required to cleanse all plant life in a hot or cold house, but sometimes there are individual cases in a house requiring treatment. Yet it would be waste of time and money to fumigate the whole house. This is where nicotine is applied under method No. 2, viz. by direct application to the plant in a liquid form.

When it is required to apply nicotine directly to the plant, it is usually mixed with other substances that cause it to adhere to the leaves, and the mixture is then diluted with water. A syringe with a fine nozzle is used, or, better still, a spraying apparatus, which causes the liquid to be more evenly distributed, and thus prevents waste of material. Nicotine so used brightens the foliage, does not stain, and will not injure the roots or retard the growth of the plant so treated.

The third method of using nicotine by mixing it with combustible fibrous material, or by using dry Tobacco leaf and burning the mass, is, as I said, clumsy, unreliable, and likely to cause injury to the plants so treated. Nicotine is destroyed if brought into direct contact with flame.

In the combustion of nicotine another compound, pyridine, is formed, which is distinctly injurious to plant life. People who indulge in excessive smoking are not injured by the nicotine in the tobacco used, but by the pyridine formed in the burning Tobacco. . . .

The method of fumigating by burning Tobacco paper or rags, or

Tobacco impregnated with saltpetre—burning, in fact, in any way in which direct flame is brought into contact with the nicotine or Tobacco—is to be strongly deprecated. There are only two efficient methods of using nicotine—by vaporising the compound and by direct application in a liquid form. I have been in large houses in the Channel Islands, and was surprised to see a tremendous quantity of blight, and also to hear that sometimes they get a perfect plague of various kinds of blight. However when I heard how they fumigate a great many houses both in Jersey and Guernsey, I knew the reason why they were so dirty. Tobacco is to be obtained duty free on the islands, and the method that was adopted was this. Dry Tobacco leaf was obtained and either burnt in a brazier or else saturated with saltpetre and lighted. No wonder the blight was not properly killed; no wonder that the plants so treated did not look fresh and healthy after fumigation. It was simply a case of sacrificing efficiency upon the altar of cheapness. Tobacco used in this way will never give satisfactory results; nicotine used properly will not fail to give them. Go through any large houses where nicotine is judiciously used as an insecticide, and what do you find? Clean, healthy plants, free from blight, all tending to success and profit.

I regret to say that even to-day in England there are many horticulturists prejudiced against the use of nicotine; but as time goes on, and they see the splendid results obtained by its use, their number is rapidly decreasing. Prejudice cannot stop scientific and economic progress; prejudice only recoils upon the people who indulge in it. In nicotine the horticulturist has a means ready to hand with which he can successfully fight against the ravages of blight in his glasshouses, only let him see to it that the compound is used properly. Abolish all rule-of-thumb methods. My own short experience has taught me that rule-of-thumb methods are useless in practical work. We must be in either an experimental stage or a practical stage, and we may be quite sure that the old truism still holds good—practice makes perfect.

At this point I should like to say a few words about the purchase of Nicotine or fumigating compound for use as an insecticide. First and foremost there is the question, where can we buy it? Now the law as it stands says you must buy it from a chemist. The Pharmaceutical Society of England claims the monopoly of retailing poisons both for industrial as well as for medicinal purposes. This ought not to be: the law is distinctly hampering an important branch of manufacturing chemistry. All respectable nurserymen, seedsmen, drysalters, &c. should be licensed to sell poisons for agricultural, horticultural, or industrial purposes. If a person requires a little advice as to which insecticide to use, or as to what is the best substance to kill some fungoid growth, and how much to use, and how to use it, is he likely to go to the same shop from which he obtains his cough mixture, pills, or teething powders? No, a man may be very clever in compounding potions that will ease or cure certain diseases of the human body, and yet be absolutely ignorant at curing diseases common to plants. Every man to his trade or profession. It is rather annoying if one goes to a pharmaceutical chemist and asks for something to kill green fly and is recommended to use Bunkum's fly papers; or complains that he is troubled with mealy bug, and finds a threepenny tin of Keating's powder offered as a remedy. But if one goes to a reliable nurseryman or seedsman and asks for advice on horticultural matters he generally obtains the information he wants. I am glad to say that strong efforts are being made to alter the law relating to the sale of poisons for horticultural purposes, and it is to be hoped that at no very distant date it will be possible to obtain nicotine from any respectable nurseryman or seedsman; but as the law now stands it can only be purchased from the chemist or from the manufacturer.

I will now briefly touch upon a few cases where the use of nicotine is indicated, and has been successfully used. In all cases of plants attacked by aphides, woolly aphis or American blight, scale, mealy bug, red spider. A great many nurserymen and fruit growers complain that they cannot effectively deal with red spider, but if all vines &c. were properly fumigated with nicotine, the insects would be destroyed. In nearly all cases in which plants and vines are affected with blight in hot or cold houses or out of doors, nicotine should be used either by fumigating or by direct spraying. I think that in the foregoing remarks I have said enough to show you that nicotine is of great use in horticulture, and that it is proving itself to be an insecticide of great value.

BIRDS *v.* GARDENING.

By Charles E. Pearson, F.R.H.S., M.B.O.U.

[A paper read at the Horticultural Club, March 11, 1902.]

The subject I have undertaken to deal with to-night is rather a difficult one, not for lack of matter, but on account of the pitfalls which surround it.

A lover of birds is tempted to stray into ornithology and half forget the garden, or to become sentimental, and, like Mr. Wegg, "drop into poetry," which would probably not be considered as "friendly," as I have noticed that this small assembly generally prefers practical suggestion to hackneyed quotations.

Another danger is that of taking up a brief for or against the feathered race. Some gardeners speak as though horticulture would benefit by the extermination of *all* birds, whilst others would strive to whitewash the sparrow and endeavour to prove that the sooty suburban raider is a very slightly disguised angel. Being myself fond of both birds and garden, I have tried to speak without prejudice and judge each of our feathered visitors to the garden on its merits.

Without going further into generalities it will, I think, be convenient to divide the feathered race into two camps—friends and enemies—dismissing for the time as foreign to our evening's discussion the third and largest section of neutrals and rarities. It is necessary to add, however, that some birds are rather difficult to classify, being friends at one time and enemies at another, according to the scarcity or otherwise of food and the pressure of strong temptation.

Taking our foes first, and leaving the pleasanter part of the subject to the last (like the youngster who leaves the sugar on his cake for a final *bonne bouche*), there is, I think, no doubt that the sparrow (scientifically known as *Passer damnabilis*) heads the list. The farmer, of course, suffers most from his depredations, and there are now few districts where corn, if not carefully protected, would not lose at least 50 per cent. before being harvested; but the suburban gardener is generally even louder than the farmer in his denunciations. The most annoying part of it is that the majority of the sparrow's iniquities in the garden are ascribable to sheer love of mischief rather than to stealing to satisfy his hunger. In the early spring, when even a few Crocuses are a joy to the amateur gardener as an earnest of summer glories to come, the sparrow makes that joy extremely brief by rending the flowers in pieces and strewing them about the border. Curiously enough, he seems to have a strongly developed colour sense, and attacks the yellows more persistently than any other shades. A "Primrose by a river's brim" is a subject of indifference to a sparrow, but he seems to take a fiendish pleasure in pulling out all the flowers from those which have been the objects of the gardener's solicitude. The cultivation of the Gooseberry is almost a hopeless labour where these pests abound, as they pull out all the buds from the twigs as soon as swelling commences. Something may be done by dusting the trees with lime, soot, &c., and by threading the branches with cotton. It is also wise under these circumstances not to go in for hard pruning, as birds seem to find more difficulty in abstracting *all* the buds from slender whippy shoots than from shortened stumps, and by leaving a sufficient number of whiplike shoots on lightly pruned trees you ensure at least a partial crop. I have seen beds of Carnations absolutely ruined by being pecked to pieces by this destructive nuisance, but must stop, as to catalogue all the villainies of the sparrow would need a fair-sized volume; in fact, one is already in existence in which the exhaustive researches of Mr. Tegetmeier and the late Miss Ormerod are chronicled.

So few ordinary observers differentiate between the house sparrow and its near relative, the tree sparrow, that comparatively few observations respecting the latter are on record; but I am inclined to think that, so far from increasing after the rapid ratio of the commoner species, its numbers remain stationary, if not actually diminishing. It lacks the aggressive cheek so characteristic of the house sparrow, being almost retiring (by comparison) in its habits, so that beyond levying toll upon the Wheat crops I do not know that there is much that can be said in its disfavour.

The greenfinch and the chaffinch have considerable affinity with the sparrow, consorting freely with him and partaking to a large extent in his sins. Perhaps the most annoying form which their destructive energies take is that of uprooting young seedlings just as they are pushing through the soil, the whole of the Brassica tribe suffering heavily from this cause. If the gardener attempts to save his own seeds of any of the Cabbage tribe, he will need to be an early riser to outstrip the greenfinch, which has an enormous appetite for seeds, being worse even in this respect than the common or brown linnet (gorse linnet in the Midlands), though it also is a voracious seed eater.

The linnet is more difficult to scare, though easier to kill, than the greenfinch, as it will fly in the face of a gun if it has tasted seed, while the greenfinch becomes very wary after a shot or two.

We have had an interesting addition to the list of garden robbers in the Midlands in the shape of the hawfinch, or grosbeak. This bird was a rarity in our part of the country twenty years ago, but has now spread all over the district and become quite common. "Numerous" would perhaps be the more correct word, as the bird is so shy and wary that many of those who have suffered from its visits have never seen it clearly enough to swear to the identity of the thief. Green Peas are its speciality, and, as the saying is, it is a whale for them. A pair of hawfinches will nearly strip a good row in a couple of days, or, at least, not leave enough to be worth picking. Their appetite is simply gigantic, almost upsetting one's belief in Euclid's axiom that "the less cannot contain the greater" and rivalling even that of the wood-pigeon. Even when busy feeding the hawfinch generally keeps one eye on the look-out, and it needs a careful stalk and quick shot to secure him. The best method of destroying these birds is trapping, a single green Pea on the plate of a common spring rat-trap being the most effective bait. A most interesting communication appeared in the December number of the *Zoologist* respecting the bird from Mr H. E. Howard, in which he gives the results of very careful observations on its habits. From this we learn that our Kentish friends have a new enemy to Cherry culture, as Mr. Howard watched the hawfinches devouring small green Cherries in May when they were, of course, scarcely formed, and would, one would think, scarcely have proved an attraction to the hungriest of birds. The fruit is at that time so small and inconspicuous from its colour, that its loss might well remain unnoticed for weeks until all chance of tracing the mischief is well passed, so that Cherry growers owe a deep debt of gratitude to this clever observer for placing them on their guard. I have known rooks and jackdaws play havoc among Peas, pulling the haulm out flat upon the ground to pick them ; but this was among seed Peas grown at a distance from a house ; they do not often venture into the garden proper.

I mentioned the sparrow's predilection for fruit buds, but must own that the bullfinch goes beyond him in this respect, being the worst sinner the gardener has to contend with in this particular line, and the destruction a pair can bring about in a short time is astonishing. The bullfinch is among the most handsome of British birds, and with the above-mentioned exception his character, if not "bearing the strictest investigation," is fairly up to the average ; but one's natural leaning towards a charming exterior cannot blind one sufficiently to accept the suggestion sometimes held out, that "he is only seeking for insects" when disbudding Plum trees &c. ; a theory often put forward, but for which I have never heard a shadow of evidence. In many country gardens surrounded by woods it is absolutely necessary to wage a war of extermination against "Bully" or give up any idea of a fruit crop. Any one with a fairly quick ear can easily distinguish the call of a bullfinch from any other note, and by repeating it two or three times a shooter can almost invariably bring one within easy range.

A common plea in mitigation of sentence upon the above-enumerated seed destroyers is that though they devour our choicest garden seeds they almost balance the account by eating large quantities of weed seed. This argument has been advanced by almost every writer in favour of birds, but I must say that I think a great deal too much has been made of it. A weed left to itself sheds perhaps some thousands of seeds in its immediate neighbourhood, which come up in a mass so numerous that their very number tends to smothering and weakness rather than healthy growth and further increase. Watch a bird attack that plant : he tousles it about and scatters the seeds over four times the area they would naturally have covered, and though he may perhaps account for 50 or even 75 per cent. of the crop of seeds, the remainder, thanks to his efforts, will have a better chance of coming to perfection than wind and weather unaided would have given it.

I have spoken of some troubles of the gardener early in the season ; but perhaps that which touches many people most nearly is the theft and damage done to ripening fruit when, after much trouble and many dangers, the crop is almost within their reach.

Among fruit robbers the blackbird is the king, being raised "to that bad eminence" by his appetite and the catholicity of his tastes. Every kind of small fruit suffers from the blackbird's attentions, and when these fail it attacks the Apples and Pears, especially fruits growing on bushes or espaliers which are low enough to be reached from the ground. We have had to trap them by hundreds the last year or two to save any fruit at all for ourselves from the nurseries, the dry summers we have lately experienced having made them unusually troublesome. When the Gooseberries ripen at Lowdham the blackbirds are reinforced by flocks of missel-thrushes, which are more numerous there than in any place I have seen ; in fact before we moved to Lowdham I had never known the missel-thrush to be at all troublesome.

Game birds are not usually included in a list of garden denizens, but in some of those attached to country mansions pheasants are a serious nuisance, pulling up Tulips and other bulbs and pecking things to pieces, often apparently from mere curiosity ; they are also rather clumsy walkers, trampling underfoot tender and brittle plants. Partridges, on the other hand, are quite harmless, though not often seen in a garden. I had last autumn great pleasure in watching a covey of thirteen which visited my garden regularly without any fear as to evil resulting from their presence. Peafowl add a grace to ancient gardens, but none to the gardener (unless fluency in "language" be described as such), being far more destructive than pheasants.

I was reminded this afternoon not to forget the lark in my list of feathered enemies, and I regret to say that there is some reason for its inclusion, as it makes great havoc among clover in the winter and early spring, eating all the heart out of the plants. This is a farmer's trouble, but it also visits the garden and completely skeletonises all the Spring Cabbage. No one would be Philistine enough to wish to lose the "fine careless rapture" of the skylark's song, but at the same time one is led to regard the slight annual thinning of its numbers for table purposes as so far beneficial as not to call for discouragement.

Turning now to the brighter side of the picture, one is glad to be able to chronicle a small army of friends whose manner of life causes the gardener to regard them with unmixed benevolence. These are the purely insectivorous birds, including, among residents, the modest hedge-sparrow, the graceful wagtail, the lively wren, and the robin. This last, though sanctified by common sentiment in this country, is a pugnacious little rascal, fighting to the death intruders on the small domain he has marked out as his own ; he has also one blot on his character, his principles failing to keep him in the path of honesty when ripe Cherries are about. Among the migratory hosts all the warblers, the chiff-chaff, willow-wren, white-throat, fly-catchers, &c. are without reproach and ought to be carefully protected. The cuckoo, too, though needing a kindly veil over its domestic affairs, is a gardener's friend, being a destroyer of caterpillars, and is the only bird I know of which will tackle the long-haired section of them.

It is a misfortune that several of our most actively useful birds have at times lapses from their ordinary standard of life which bring them under the ban of the gardener, who is apt on such occasions to forget their previous good deeds and insert them on his black list. The starling, for instance, is one of our very finest grub and caterpillar destroyers, but his extraordinary infatuation for Cherries often leads him to an untimely end, as nothing but shot will keep him from them. I have had starlings come and sit on the same branch with me and share the feast as coolly as if they were there by special invitation. Of all nature's checks on insect life the tit family are (among birds) the most effective, and to watch a pair of blue tits when feeding a big family (a dozen or fourteen is not uncommon) is a wonderful lesson; one would think some good-natured friend had shot a cartload of caterpillars close to their nest, so many do they bring, and so marvellously short is the time occupied in procuring a beakful. It is to be regretted that it discounts its many undoubted services by that most annoying trick of pecking little holes in the stalk end of all our very best Pears in the autumn, spoiling their appearance and inducing premature decay.

The great tit, too, though equally useful, is often shot by bee-keepers owing to his penchant for bees, which he devours one by one as they appear at the entrance to the hive in answer to his taps on the alighting board. However, in spite of these delinquencies we have no greater friends than the tits, and I always help them through the winter by suspending a few bones and a small net of suet on a temporary gallows as soon as cold weather sets in, taking care that it is commanded by the breakfast-room window, their acrobatic feats as they remove the scraps of meat from the bones being a constant source of amusement. The great, blue, and coal tits are constant visitors, and they are sometimes joined by the shyer marsh tit.

The song thrush is perhaps the commonest of all our garden visitors, but I have not mentioned it previously, as its tendencies are neutral rather than very active for or against gardening. Its partiality for snails is too well known to need mention, and the favourite stone upon which it cracks their shells is a familiar feature; but worms appear to form the major part of its dietary, and as these can scarcely be classed as pests I do not think there is any claim on our gratitude in this direction. Strawberries and bush fruits suffer rather heavily from the thrush's attentions, especially in dry seasons; but the trouble only lasts a short time, and is so fully compensated for by its glorious song that a small investment in herring netting is vastly preferable to the destruction of the best of our common songsters.

I am afraid my paper is getting too long, or I should like to say a word or two in favour of the owl and kestrel, both common victims of ignorant game preservers; the first never and the second seldom offends in this direction, and yet we are constantly overrun with mice, which destroy our Crocuses and devour our newly sown seeds before they have a chance to grow because the two birds which live almost entirely upon them are never allowed a fair chance. In closing it is scarcely necessary to recommend the protection of our feathered friends to any intelligent audience, but I may remind you of one of the best methods of encouraging them which has up to the present been much neglected in this country, viz. the placing of nesting boxes up and down the garden and orchard. These are now sold, made out of unbarked wood, so as to have a natural and not too conspicuous appearance, and in various shapes and sizes, from those suitable to starling, to flycatcher, and blue tit.

My remarks on injurious birds would seem to want their logical conclusion without some suggestion as to lessening their depredations, but I am sorry to say that I cannot offer much for your consideration in this line. As regards the sparrow I should like to see a national society for his suppression, but am afraid our individual powers are very limited. The trap, in form of a lobster-pot, which is much advertised, is effective where pheasant or poultry feeding brings flocks together, but is almost useless otherwise ; poison is unlawful and dangerous, and the indiscriminate use of the gun has the disadvantage that it scares away our friends while reducing the number of our enemies. Scaring devices for driving birds away become familiar so soon as scarcely to repay the trouble of erection ; witness the old tale of the nest up the scarecrow's sleeve. I think the best plan is to protect the choicer fruits, and if possible grow enough of the common ones to spare a share to the birds without too much regret. I may mention under the heading of protectors that a small card with a slit in it may be fixed over a Pear in a second by simply opening the slit and pushing it on to the stalk, and that this is an efficient guard against tits. Also with regard to Strawberries, one of our foremen evolved one of the best guards last summer which I have seen out of some lengths of old wire netting. This was three feet wide, and by bending it down the centre he formed an arch wide enough to cover a row, with the great advantage that the birds could not weigh it down by sitting on it and peck the fruit through the meshes, as they do with herring-netting ; it was also much easier to remove and replace. I might add a word of approval for the "Gooseberry garden," a small quarter planted with the best flavoured varieties and protected by a house, so to speak, of wire netting high enough to walk under. This is highly recommended to those who prefer to eat their own fruit from the bushes instead of after it has been spoilt by gathering and keeping.

As a rule seed and fruit protection is vastly to be preferred to wholesale destruction of birds ; it is almost as cheap in the long run ; while every lover of nature will admit that though bird ravages are trying at times to temper and pocket, a garden without its natural and proper feathered population would lose more than half its charm.

A CAPE GARDEN.

By Mr. H. M. Arderne, of Cape Town.

[A Paper read at the Horticultural Club, July 8, 1902.]

Shortly after my arrival in England I met a gentleman at the Drill Hall who, just as I was leaving, said to me, "You must give us a paper on your garden." I rather demurred to this, as I was on my way to Spain to see something of its trees, and shrubs, and picturesque scenery, and I knew that on my return I should be so immersed in festivities as to leave no time for anything like a set paper worthy of your acceptance. And my anticipation has been fully realised, for, since my arrival in England from my Spanish tour, function after function has succeeded each other in such rapid succession as to leave no time for anything like connected or methodical work, leaving alone the demoralising influence of a round of sight-seeing. So, if my garden talk is rather of a disjointed fragmentary character you must regard it with kind indulgence. I must further ask your indulgence if, in speaking of my garden, I appear to introduce too much of the personal element. It is very difficult to avoid doing so in speaking of one's own possessions and the part one has played in creating them. This is especially true of a garden where one's own handiwork has had to play so important a part, and where, by daily and hourly personal attention, a great result has been achieved.

As far back as 1840, when Australia opened up golden visions to the youth of England, my father embarked for Adelaide. The vessel was badly found, and put into the port of Cape Town to refit. There were no palatial mail steamers in those days. In Cape Town he found so many openings for enterprise that he determined to abandon his voyage to Australia and to make South Africa his home. As a boy he loved every green leaf, and the South African flora opened up a vista of delights. Shortly after his arrival he set to work to collect the South African flora, sending his specimens to Sir Joseph Hooker, who was then the Curator at Kew, receiving in exchange plants of a rare character, of which they had duplicates to spare. As soon as he had realised a sufficient competency he bought the property on which I now reside, at the base of Table Mountain. It was then pure veldt, or, as Americans would say, prairie land—rough bush land just as it came from the hands of the Creator. But the luxuriance of the scrub, the gentle slope of the ground, the rich character of the soil, and, last but not least, the lovely wall of green on the verdant slopes and sombre gorges and kloofs of the grand old geological sentinel, Table Mountain, which bounds the property on the north-west, all gave abundant promise of what might be made of an area with such natural advantages in the hands of an enthusiastic expert endowed with the love of landscape gardening. My father's idea was to make a garden which should, as far as possible, be representative of the flora of the whole world. A bold idea, and very difficult of realisation in most of the climates of the world, in which either winter's frost or tropical heat destroys two opposite classes of vegetable life; but the catholicity—for want of a better expression—of the climate of the Cape Peninsula, whose shores are washed by the warm waters of the Gulf Stream, where the thermometer never touches zero (Centigrade), and where the summer heat is always tempered by a breeze from the south-east, gave him great hopes for the realisation of his daydream. In how far he was justified in indulging this hope it will be for you to say after I have concluded my description of the garden and its treasures.

Some fifty-five years ago an Australian captain visited Cape Town. He had on board a small plant of the *Araucaria excelsa*, popularly known as the 'Norfolk Island Pine.' This plant was then six inches high. My father, ever on the alert for new botanical treasures, heard of this plant, and, knowing also that it was—as Mr. Veitch says in his "Pinetum"—the most stately and imposing of the Coniferæ, sought the captain and offered him £5 for it, which was accepted, and my father brought home the plant with all the enthusiastic triumph and ardour which all true gardeners feel after the acquisition of some such botanical treasure—more particularly so (such is poor weak human nature) if the happy possessor is the sole and unique owner of such treasure. Well, the plant arrived, and I well remember the fuss that was made over its being planted, and the strong ringed fence put up around it to keep off intruders. It has amply repaid all the care and attention bestowed upon it, for it now dominates an avenue of seedling Araucarias, and towers up to the height of 135 feet, and completely dwarfs some tall well-grown Oaks in its immediate vicinity. This was the first specimen planted in South Africa, and it is taller than any other plant of its kind on the Australian continent, whose botanic gardens I have had the pleasure to visit.

Next in order of importance and in rarity is the *Dacrydium cupressinum*, popularly known as the 'Weeping Pine of New Zealand,' known also in the Maori language as the 'Rimu.' Of all the Conifers this is, perhaps, the most graceful. In fact, it is difficult to realise that it does belong to the Coniferæ, whose characteristic features are associated with ruggedness and rigidity of form; whilst this *Dacrydium* has all the gracefulness and pendulous habit of a weeping willow. This plant was imported by the Botanic Gardens, Cape Town, of which my father was the founder. But it did not seem to be at home there, as the locality was open and exposed to the south-east wind, so it was removed to our garden, where the environment was more in keeping with its native habitat, and where it has flourished most luxuriantly and bids fair to be one of the most beautiful objects in the garden.

Between these two specimen trees there is a handsome group of the papyrus of the Nile, whose stems attain the height of from 12 to 14 feet, quite equal to those on its native banks; and they are largely used for decorative purposes. Within a few feet of the Papyrus, and on the banks of the stream which nourishes it, is a very well-grown English Holly tree, about 20 feet in height and 15 feet through, looking as grand and glossy-leaved as if it were growing in the New Forest. This tree, every Christmas Eve, has to yield at least one hundred sprigs to decorate the Christmas puddings of at least a hundred English families who rejoice in keeping up all the old time-honoured institutions of the homeland.

These sprigs of holly to my friends do duty as very acceptable Christmas cards. Not far off the Holly flourishes in half a dozen of its newer variegated varieties. Around the water, and not far from the Hollies, I have the Bamboo (*Arundinaria*) dominated by a clump, some 30 feet round and 60 feet in height, of the giant form, so largely used in China for household furniture, vehicles, buildings, and other purposes, the lighter form being used in South Africa for long ox-wagon whips and fishing rods, and the still more feathery forms surrounding the water are largely called into requisition for every decorative purpose. In close proximity to the Holly, and nearly overshadowing it, are some noble specimens of the *Ficus natalensis* of South Africa, closely allied to the *Ficus indica*, the well-known Banyan tree of Hindustan, which it closely resembles in its dark green glossy leaves and in its tendency to send down rootlets from its lower branches to the ground to form new trunks in connection with the parent stem.

Disputing possession of the rich ground near the water is a grand clump of the *Cinnamomum Camphora* (Camphor-wood trees), whose beautiful light yellowish-green foliage offers a pleasing contrast to the adjoining sombre dark green *Ficus*. The Oak is gloriously beautiful in its spring attire, when the green is unsoiled, but summer suns and approaching winter soon tarnish the foliage. Not so with the Camphor, whose leaves, from January to December, are perennially bright, the young shoots in the spring time being particularly so. As an evergreen it has with us no rival.

Not far off the *Platanus orientalis* is very strongly in evidence, having a circumference on its outer foliage of 120 feet. Under the shade afforded by the foregoing trees one thousand Rhododendrons, of the choicest and newest varieties (six of pink pearl), gladden the eyes of English visitors and establish beyond controversy the much-disputed point—the adaptability of these grand shrubs to certain localities in South Africa. I believe that they would do even better in Johannesburg, where, owing to its altitude, the cold of winter would serve as a tonic which the Cape Colony cannot give them. I am also succeeding very well with my newly imported Indo-Javanese hybrids. The Azalea family also seems to have found a home here. Some forty years ago my father imported two specimens of the *A. indica* varieties, one pink and one white, and I have since raised from these two plants over one thousand specimens, some of the bushes measuring 20 feet in circumference, one large one exceeding 30 feet, and in the flowering season they make a gorgeous display. Any one visiting the garden after dark during the flowering season would imagine that a snowstorm had taken place, for the masses of white blooms four to five feet in height would, in the partial light, look like banks of snowdrift.

In England the Arum (*Richardia africana*) is properly prized for its chaste beauty, and it is cultivated with much care. I could show you a picture of some three thousand of them growing with most lovely luxuriance, and, for nearly eight months in the year, adorning the lower swampy part of my garden, requiring no care whatever in their cultivation. Bordering the Arum field is an avenue of Hydrangeas, cobalt-blue and white, some of the specimens having a circumference of at least

30 feet, and rivalling the celebrated collection of the late Cecil Rhodes at Groot Schuur, not far off, where I had the pleasure of introducing some 1,500 English Rhododendrons which adorn the mountain slopes and give a pleasing variety to the native hedges of blue Plumbago.

Most hard-wooded plants do well with us, and the *Camellia japonica* is no exception, for some of the specimens on the lawn and in the open border have attained a circumference of from 30 to 75 feet, and serve to give colour and brightness in our winter season owing to their floriferous character. Almost touching the largest specimen of Camellia is a *Parkinsonia*, with singularly handsome light green feathery drooping foliage. So graceful is it that it has earned the sobriquet of 'The Lady's Tree,' and when, as in the height of summer, it is covered with its yellow blooms it is singularly beautiful, and invariably attracts a great deal of attention as one of the most graceful trees in the garden.

But I must hurry on to quite a different form of vegetable life, namely, the Aloe garden. In showing a photograph of this part of the garden some of my friends have remarked, "Surely this is a piece of New Mexico; if not, it is strikingly like it." However, this part of the garden is more essentially colonial than any other portion, for all the specimens are of colonial or South African origin. You will find there specimens of Euphorbias, *E. grandidens* and *E. natalensis* 20 feet high; Aloes, *A. Bainesii*, *A. speciosa*, *A. variegata*; *Agave mexicana* and *A. capensis*; *Encephalartos*, commonly called 'Kaffir Breadfruit,' in several varieties; the Prickly Pear; Stapelias and Crassulas. I may mention, in passing, that I was lately honoured by a visit from the botanists on board the *Discovery* and the German vessel *Gaus*, both vessels bound on a scientific expedition to the South Pole, and they were far more interested with this part of the garden—probably from its novel character to them—than with the European trees and shrubs, which, of course, they had seen in abundance elsewhere.

A very large number of the *Coniferæ* rejoice in our climate. Prominent amongst them are *Araucaria imbricata* and *A. Cunninghamii*, *A. brasiliana*, *A. Rulei*, *A. Bidwilli* and *A. lanceolata*; *Cedrus Libani* and *C. Deodara*, *Cupressus macrocarpa*, the Monterey Cypress; *Sciadopitys verticillata*, the Umbrella Pine of Japan; *Pinus canariensis*, *P. excelsa*, *P. insignis*, *P. Pinea*, the Stone Pine, *P. Pinasta*, the Cluster Pine; *Picea excelsa*, the Norway Spruce, *Abies religiosa pungens*, and many others; but it would only tire you if I were to enumerate them all. *Pinus Pinea* and *P. Pinasta*, which thrive on the Mediterranean littoral, were introduced into the Cape Colony by the early Dutch inhabitants. They have so acclimatised themselves to the Cape peninsula, where they grow in countless numbers, that they form the great economic trees of our end of the colony and sow themselves broadcast over the most sterile areas, flourishing where most other trees would perish.

I have also lately introduced some of the beautiful golden yews, Retinosporas and Cypresses, which I hope will take kindly to our climate and form a charming contrast to the dark foliage of the native trees with which the garden abounds, and which I must very briefly touch upon. One of the most prominent is the *Po locarpus capensis* (?*elongata*), popularly known as the 'South African Yew,' or 'Yellow-wood tree,' owing to the colour of its timber, which is used largely for bedroom furniture. It grows in the native forests to an immense size, and if planted singly on the lawn so as to develop its lateral branches regularly, it forms a very handsome tree. Next in beauty I should place the *Harpephyllum caffrum*, popularly known as the 'Kaffir Plum,' from the red stone-fruit which it bears. The leaves are of a very dark glossy green when mature, the new growth being of a terra-cotta red, and, when allowed free growth away from other trees, it assumes a beautiful spheroidal habit.

Calodendrum capensis, as its name denotes, is another beautiful forest tree with dark glossy foliage and lovely feathery pink flowers. I have rarely seen a forest tree with such attractive showy blossoms, which single it out from a distance as the most beautiful amongst its compeers.

Then follow: *Leucadendron argenteum*, well known and very popular as the 'Silver Tree,' which one could easily imagine to have been a cross between the *Coniferæ* and the *Proteacæ*, whose glossy leaves glisten in the sunlight and are largely used for all sorts of pretty baskets, hats, book-markers, and various other descriptions of ornamental work. This tree is most arbitrary in the choice of its habitat, being hardly if ever found away from the slopes of Table Mountain, and even there it is not found above or below a certain altitude. Many and many a time have I heard of the seeds being planted in other parts of the world, but I have never heard of any tree reaching maturity.

Next comes the *Erythrina caffra*, the tree-form which reaches an altitude of 30 to 40 feet, and whose coral-like red blooms, so well known to you, need no description. Then there are the 'Assegai Tree,' with wood like the Hickory, and used largely by the Kaffirs for their assegais or javelins; the 'Sneeze-wood Tree,' with Mimosa-like foliage, one of the hardiest of our colonial woods, used largely for railway sleepers; the well-known thorny *Mimosa*, an Acacia with round, yellow, fluffy blossoms, which grows throughout South Africa, lining the kloofs and ravines and forming impenetrable hiding-places for the Boers during the war; then there are trees known by the popular names of 'Saffron-wood,' 'Milk-wood,' 'Black-bark,' and many others which time does not allow me to describe more fully, for I must mention a few of our most striking flowering shrubs, such as *Pavetta caffra*, with snow-white flowers, which was figured in the *Garden* a few months ago; *Pavetta Burchelli*, with glossy leaves and orange-red blossoms; *Tecoma capensis*, now well known in England; *Plumbago capensis*, in blue and white varieties, which are largely used for avenues and enliven many of our country lanes; *Dais cotinifolia*, with its delicate lilac-coloured blossoms; *Greyia Sutherlandi*, with its Geranium-like foliage and corymbs of rich red blossoms; *Erythrina caffra*, dwarf forms, in three distinct varieties; *Toxicophlæa*, with heavy trusses of highly scented white flowers and purple berries; *Agathosma hispida*, syn. *Diosma capensis*, with highly scented white flowers; *Bauhinia Galpini*, with mauve-coloured flowers; and its Natal brother, whose flowers are snowy white; the *Asystasia bella*, syn. *Mackaya bella*, with its unique pale lavender trusses of bloom; and many others whose names I do not for the moment remember.

The transition from Cape shrubs to Cape bulbs is easy, for in bulbous plants the Cape peninsula holds a pre-eminence. But England is now so amply provided with them, and has succeeded so well in hybridising so many of them, especially the *Gladiolus* and *Ixia* sections, that I need do no more than refer to them ; but I may be allowed to refer for one moment to the large Lily-white *Watsonia*, named by the Botanic Society of Cape Town after me, *Watsonia Ardernei* (fig. 5). The original bulb was brought by me from a farm some eighty miles distant from Cape Town, and was found growing, a single specimen, amid thousands of the pink variety. The owner of the farm was as much astonished as myself when he saw this white variety, for he had traversed and retraversed the farm for years and had never seen any but the pink variety, *W. rosea* (fig. 6).

FIG. 5.—WATSONIA ARDERNEI ALBA. (*The Garden.*)

That one bulb has increased in arithmetical progression, and I believe at the present moment there are more than 100,000 of it in existence. The first box of bulbs was sent by me to the Countess of Lytton, who first saw the blooms in my garden, and was very much struck with their beauty. Another bulbous plant, very much admired by Mr. Peter Barr, V.M.H., who has paid my garden about a dozen visits, is the *Agapanthus umbellatus albidus,* which attains with me the height of between five and six feet and grows at the foot of the *Araucaria excelsa.*

The garden is further largely indebted to Australia and New Zealand for many of its most striking trees, but as time presses I can only briefly enumerate them, the most prominent being many varieties of the *Eucalyptus, E. Globulus* being specially striking from its colossal growth, trees planted by myself having already attained a girth, at three feet from the ground, of 25 feet; *E. ficifolia*, with its scarlet-coloured blossoms, rendering it a striking object in full bloom, in contrast with *E. robusta*, which has white flowers. Then there are many varieties of the *Acacia*,

FIG. 6.—WATSONIA ROSEA. (*Journal of Horticulture.*)

which in their season yield an abundance of yellow bloom; varieties of *Grevillea*, of *Casuarina*, of *Metrosideros* (both drooping and erect, and in three colours), *Castanospermum australe*, of *Pittosporum*, of *Veronica*, *Myrtaceæ*, *Jambosa*, and *Agathis australis*, syn. *Dammara australis* or the

'Kauri Pine,' whose resin yields a revenue of £200,000 per annum to the New Zealand Government; then there are fine specimens of the New Zealand *Dracæna*, *Cordyline australis*, and New Zealand Kentias. Cannas grow luxuriantly eight to nine feet in height with Banana-like foliage.

I have not touched upon the many beautiful Palms which give a pleasing variety to the foliage. *Phœnix reclinata* is a native; the finest clump on the lawn is 60 feet in circumference; *Archontophœnix Cunninghami*, syn. *Seaforthia elegans*, flowers freely and is very graceful when its stem is covered with its tassel-like pinky blossoms; *Latania borbonica*, *Cocos plumosa*, and *Chamærops australis* flower and fruit freely. The true Date Palm grows well and fruits, but the fruit will not ripen in our summer. I can give but a passing notice to *Paulownia imperialis*, with trusses of bloom three feet in length; *Jacaranda mimosæfolia*, with its trusses of pendulous blue flowers; golden and common Catalpas; *Schinus Molle*, with its Pepper-scented leaves; Magnolias in variety; Gardenias double and single, native and imported; *Hibiscus splendens*; *Strelitzia alba*, 20 feet high; *Sequoia gigantea*, from seeds collected by myself in the Yosemite Valley; *Sequoia sempervirens*; Oaks in seven varieties, a *Quercus Robur*, as strong as in Sherwood Forest; Weeping Willows of most graceful forms; Horse Chestnuts in four varieties; *Fagus sylvatica purpurea* and *F. s. tricolor*, six specimens doing well (this last no English visitor had seen in his own country, nor have I seen it in any private garden here); *Ginkgo biloba*, syn. *Salisburia adiantifolia*; Silver, Golden, and Common Elms; Cratægus in variety; Orange trees of various kinds; *Ailanthus glandulosa* and *Prunus Pissardi.*

I had almost forgotten the queen of flowers, Roses, which grow most luxuriantly in our climate. The 'Cloth of Gold' is our great yellow Rose; in England it will scarcely develop its grand blossom, but with us it is in evidence everywhere. You might count eighty blooms over the porch of my house. 'Crimson Rambler' has made 15 feet of growth in three months, and the 'Duchesse d'Auerstadt,' a splendid yellow, simply runs riot.

Marliac's lovely hybrid Water-lilies and other *Nymphææ* cover my ponds for seven months in the year, and I hope to try the grand Victoria Regia.

We cannot grow your Lawn Grass with effect, for our sun soon kills it, but we have green lawns which are infinitely softer to the tread than Turkey or velvet-pile carpets, being covered with 'Buffalo Grass,'* which throws out long stems, not rising from the ground, but running along its surface, and every joint roots as the shoots of Strawberry runners root; the result is a dense matting which the sun cannot penetrate, and which protects any moisture there is in the soil.

Before concluding I must say a word on the grand old wall of "Table Mountain," which practically bounds the property. I once had the great pleasure of escorting the Countess of Lytton round the estate, and, gazing from a coign of vantage facing the stupendous background, she remarked: "Mr. Arderne, we too have most beautiful spots in the

* A native South African name, and not to be confounded with the upright-growing Buffalo Grass of America.

homeland, but for five millions of pounds we could not build that garden wall of yours, which gives the finishing touch to all before us." And her ladyship was right. The "Hill Garden," beautiful though it be, were not the place it is without that eternal wall, whose grandeur has been aptly described by our South African poet:

> O thou stupendous Rock, while life shall last,
> How many treasured pictures of the mind
> Have thy vast background! Thoughts of thee are shrined
> With happiest memories; with dearest names;
> With splendours of such vision as inflames
> The kindred soul to think of, while to *see*
> Is like a draught of Immortality.

THE NEW SOIL SCIENCE.

By R. Hedger Wallace.

[Lecture delivered March 11, 1902.]

Many may recollect that in 1879 the Marquis of Salisbury, in a memorable speech, told English farmers to "manure their land with brains;" and although since then much has been done in respect to land manuring, and our knowledge of soil contents and plant action has increased, yet the inception of the science that now occupies such a prominent position in respect to soil cultivation goes back to a period more remote than that in which the Prime Minister spoke, a period when agricultural depression in this country was becoming very acute.

Yet the "new soil science," as the name indicates, is of recent growth, and is a happy term coined by a Scotch agricultural journalist to denote the biological, and more especially the bacteriological, point of view in manuring which to a great extent is to-day supplanting the purely chemical views that have for nearly sixty years held the field.

It is not my intention to trouble you with any historical data, for I take it that it is a matter of supreme indifference to the practical man whether it was Brown, Jones, or Robinson that first discovered or applied certain facts. He wants to know what the facts are, what commonsense conclusions can be drawn from them, and how he can utilise them to his personal advantage. The "new soil science," so far as it has already developed, has given rise to much controversy, and there are many claimants with their own theories in the field. I therefore limit myself in this paper to views that meet with general acceptance; for it must be borne in mind that our knowledge of soil bacteria as yet is very imperfect and limited.

Cultivators, be they termed agriculturists or horticulturists, have to deal with two factors—*i.e.* soils and plants. What is a soil? The usual reply to such a question is that it is disintegrated rock broken down by physical and chemical processes called weathering. It used to be regarded as a mass of dead inert matter containing plant-food material which by a chemical action was made available for plant growth. A plant obtains its food material through its leaves and its roots. This food material is of three kinds: (1) water, (2) chemical substances, and (3) gas. Water is an actual necessity to the plant, not only as a food, but as food solvent and food-material carrier. The chief chemical substances that affect plant life are potassium, magnesium, calcium, iron, phosphorus, and sulphur. These inorganic substances do not enter the plant as such, but combined with other substances and dissolved in water. The gases essential to plants are carbonic acid, hydrogen, oxygen, and nitrogen. By the aid of the green chlorophyll leaves absorb carbonic acid from the atmosphere. The hydrogen is obtained from the decomposition of water; and the oxygen is obtained from the same source and from the air in the interstices of the soil; and both these gases, it is stated, are absorbed through the roots. Experiment and experience have shown that over and above these substances and gases the most important food material required by plants is nitrogen; yet it has been demonstrated that a plant cannot absorb or obtain it in the same manner in which it obtains its carbon or carbonic acid, viz. by absorption through the leaves; nor can the plant take nitrogen in as nitrogen (with the exception of the flesh-feeding plants) through its roots; and yet a plant would perish unless nitrogen existed in some combined form (the nitrates and compounds of ammonia) in the soil, and in a state readily obtainable by means of its roots.

Experience, on the other hand, has also taught cultivators that though nitrogen was such an important factor and so difficult to obtain by plants, yet there were a number of cultivated plants that could obtain it somehow, and that when grown in a rotation or otherwise they left the land in a better condition in respect to nitrogen contents than before. Wheat, Rye, Oats, Barley, Potatos, Beet, Tobacco, Buckwheat, Mustard, Cabbage, and Vines have long been noted as nitrogen consumers because they drew large amounts of nitrogen from the soil, thus leaving the land poor and worn out after repeated croppings. These plants practically suffer from starvation, it was found, if the soil does not contain a sufficient supply of available nitrogen, and therefore this plant-food substance, if it was deficient, had to be artificially supplied. On the other hand, Peas, Beans, Vetches, and Clover, it was noted, did not respond to applications of nitrogenous manures, yet apparently they could obtain nitrogen by some natural means, and as such plants actually increased the amount of nitrogen in the soil they were practically regarded as nitrogen producers. Since the attention of observers and experimenters has been directed to the germ life of the soil, the study of which, as a special branch of bacteriology, constitutes the "new soil science," we now have some idea how such plants are able to obtain the requisite nitrogen.

The study of bacteriology as a science has within the past twenty years made a marvellous advance. It is a study that appeals to the imagination of the public, dealing as it does with our invisible friends and foes. The subject has, in fact, made such an advance that "bacteria" to-day is a common household word. We have of course used bacteria abundantly in the past, but till recently we were unaware that we were doing so, and their action was attributed to chemical and physical causes. The fermentative industries, termed by Professor Marshall Ward "the oldest form of microscopic gardening practised by man," such as brewing and vinegar making, depend on the action of bacteria; so do the maceration industries—*i.e.* the retting of Flax, Jute, and Hemp. To bacteria we owe the preparation of indigo and opium, the curing of Tobacco, the cleaning of sponges, the preparation of citric acid, and our butter and cheese.

We now know, through bacteriological research, that instead of being dead inert matter the soil is literally teeming with micro-organic life, and it is estimated that from one to two hundred millions of germs may be present in a single ounce of soil. It must be acknowledged that as yet we know but little of this soil life, but as far as we have progressed the species of bacteria found in the interstices of the soil can be classified, somewhat artificially, in five main groups.

1. The **denitrifying bacteria** which are held responsible for the breaking down of the compound substances known as nitrates, and the **decomposition bacteria** which break down complex organic products other than nitrates into simpler bodies.
2. The **nitrifying bacteria** which do not reduce compound products like the denitrifying bacteria, but oxidise and change from one form to another.
3. The **free nitrogen-fixing bacteria** to be found principally in the nodules on the rootlets of certain plants.

These three groups may be regarded as "economic" bacteria. There are two other groups, but they are not of much direct importance to the cultivator so far as at present known.

The fourth group is a provisional one, and includes the *common saprophytic bacteria*, which feed on decayed animal and vegetable matter. This group is by far the most abundant as regards number in the soil. They live on the dead organic matter of the soil and break it into simpler constituents; but their function is at present but imperfectly known, and when known they will probably be classified otherwise. The denitrifying, decomposition, nitrifying, and nitrogen-fixing organisms are all saprophytes that have, in a sense, been brought more or less into daylight. The business of the other saprophytes in the soil world is at present unknown.

The fifth group of bacteria found in the soil are the *pathogenic*, or disease-producing organisms. The three chief members of this group being the bacillus of lockjaw, the bacillus of quarter evil or symptomatic anthrax, and the bacillus of malignant œdema, or gangrenous septicæmia, the last two being similar in some respects to anthrax itself.

The "new soil science" deals chiefly with the "economic" bacteria present in the soil; but it must be borne in mind that though a considerable amount of knowledge has been obtained, there is still a great deal to be discovered before the micro-biology of the soil is complete. It must also be admitted that at present our knowledge is rather a heterogeneous collection of isolated facts and theories, some of which still require more ample confirmation. Yet with the limitations that this implies, an advance has been made sufficient to relegate many chemical theories in respect to soil cultivation &c. to a secondary place.

Some general factors affect all soil microbic life. Heat, for instance, is an important condition. A sweltering hot summer's day—90° F.—most favours their development, which will cease at 50° higher, or if it falls to freezing. In the tropics, where the mean temperature is about 90°, soil bacteria, as was to be expected, are far more abundant than in temperate regions; in fact, the enormous rate at which these germs can increase under suitable heat conditions is simply astounding. Soil germs further want plenty of air, and they also need moisture, while the absence or presence of an excess of water is bad for their development. Sunlight, on the other hand, is inimical to their life ; also certain physical and chemical soil conditions.

Surface soils and those rich in organic matter are the home of soil bacteria, but layers of the same soil at different depths exhibit marked differences in respect of its bacterial inhabitants both quantitatively and qualitatively. The uppermost layer of soil, however, does not contain the greatest percentage of organisms, as it is a layer exposed to too rapid alternations of excessive moisture and dryness, and heat and cold, as well as to the influence of the sun's rays. The largest bacterial content of the soil is always found at a depth of about 10 to 20 inches below the surface. As we go down below two feet bacteria become fewer, and below a depth of five or six feet only a few anaërobes—germs capable of development in the absence of oxygen—are found. The condition of the soil in respect to heat, aëration, and moisture therefore influences its bacterial population, and these are the conditions that go to make "tilth." The percentage of germs is also higher in summer than in winter, while it falls in dry weather and increases in wet ; but the condition which above all controls the quantity and quality of bacteria in a soil is the degree and quality of the organic matter in the soil. Virgin soils, however, contain much fewer bacteria than cultivated lands, and in cultivated land the number of organisms increases with the amount of cultivation given and nature of manures used.

Assuming that a soil is in a healthy state in respect to its germ life, let us see what work the economic bacteria perform. In most soils there is an average amount of organic matter derived from animal or vegetable sources. In order that this complex material should be of service and its constituents not lost, it is necessary that it should be broken down into simpler constituents. This is accomplished in a degree by the decomposition bacteria (and some of them denitrify as well as break down organic compounds) ; but the most important, from the cultivator's point of view, are the denitrifying bacteria which reduce the nitrates present to nitrites, or to nitric or nitrous oxide gas, or to nitrogen itself, and in all of these processes a loss of nitrogen is involved. The conditions requisite for bringing about denitrification are : (1) the specific micro-organism ; (2) the presence of nitrate and suitable organic matter ; (3) the usual essential conditions of bacterial growth ; and (4) a supply of atmospheric oxygen in the soil relatively not in excess of the supply of organic matter. The entire process either of decomposition or denitrification is not accomplished by one species. There seems to be a remarkable division of labour between the decomposition and denitrification groups, and also between different species of the same group, and by their action an enormous quantity of combined nitrogen is daily set at liberty in the soil. To replace this loss as far as possible is the work of the nitrifying bacteria. The results of the action of these bacteria, *i.e.* those that bring about decomposition and denitrification, are free nitrogen, carbonic acid gas, ammonia bodies, and nitrites. The nitrogen liberated passes into the atmosphere and is "lost" as far as the cultivator is concerned ; the carbonic acid is used by vegetation, and the ammonia and nitrites await further changes, as plants require their nitrogen to be in the form of nitrates in order to use it. Nitrates contain a considerable amount of oxygen, nitrites very much less than nitrates, and ammonia none at all; therefore to change the ammonia into nitrites, and nitrites into nitrates, a process of oxidation is required, and this is what the nitrifying bacteria perform, the process being termed nitrification. Although they are definite and different processes, yet denitrification and nitrification dovetail into each other, and in a manure heap, for example, both processes may be going on concomitantly.

The conditions necessary for nitrification are (1) the presence of oxygen in excess of the supply of organic matter, for without it the reverse process of denitrification occurs, and instead of a building up we get a breaking down. The use and value of tillage in promoting nitrification is, no doubt, due to the aëration the soil gets. The second (2) condition is the presence of a base with which the nitric acid when formed may combine. The presence of bases in the soil also neutralises the resulting nitrous or nitric acid, and they thus protect the bacteria from injury from this source. In the soil this work is usually performed by the calcium cabonate or lime that generally is present. The third (3) condition is a favourable temperature. The nitrifying organism can act at a temperature as low as 37° F., but at 54° F. it becomes really active, and its activity increases till the temperature rises to 99° F., after which it falls. A very high temperature or a strong light is prejudicial to its action. The fourth (4) condition is the presence of suitable food materials, phosphates being essential; but the main point of interest in this connection is that the nitrifying organisms, or, at any rate, some of the species of nitrifying organisms, can apparently feed with equal ease on organic or inorganic matter. Again, like the denitrifying bacteria, there is division of labour among the nitrifying bacteria, and they are classifiable into two sharply divided sub-groups, the nitroso-bacteria and the nitro-bacteria. The *nitroso-bacteria* oxidise ammonia to nitrous acid and nitrites, but go no further. For example, they are unable to alter nitrites. On the other hand, the *nitro-bacteria* cannot attack ammonia, but alter nitrous acid into nitric acid, nitrites into nitrates.

We have progressed so far in our knowledge of the nitrifying bacteria that two types of the nitrous organism—the nitroso-bacteria—can be differentiated. One is found in all the soils of Europe, Asia, and Africa, and is termed nitroso-monas, while the other type is found in Australia and America alone, and is termed nitroso-coccus.

The nitric organism—the nitro-bacteria (or nitro-monas, as it was once termed)—is allied to the nitrous organism, but so far no subdivision has been attempted. This may be due to the fact that they are the smallest of all known organisms. Both the nitrous and nitric organisms are widely and abundantly distributed in soils. The nitroso-bacteria are, however, the more active of the two, the nitro-bacteria, on the other hand, immediately oxidising the product made by the first. The one converts ammonia into nitrite, the other converts this nitrite into nitrate.

We have seen that in the decomposition brought about by denitrifying bacteria a portion of the nitrogen is dissipated into the air in the form of a free gas. To complete the nitrogen cycle this "loss" must be recovered, and to perform this vital function is the duty of the nitrogen-fixing bacteria, the third group of economic bacteria in our list. These micro-organisms exist in groups and colonies in the nodules, which appear on the rootlets of the Leguminosæ. How this group of bacteria fixes free nitrogen cannot at present be definitely stated, but three alternative explanations have been given.

1. That under the conditions of symbiosis that exist—the living together of two different forms of life—between the plant and the nodules, the plant is able to fix the free nitrogen in the atmosphere by its leaves.

2. That the nodule micro-organisms get distributed in the soil and there fix the free nitrogen, the resulting nitrogenous compounds becoming available as a source of nitrogen to the roots of plants.

3. That free nitrogen is fixed in the course of the development of the organisms within the nodules, and that the resulting nitrogenous compounds are absorbed and utilised by the host.

Most authorities agree that the absorption of nitrogenous matter must be by the roots, and if so, then the second alternative named will be the correct explanation. There are, however, some who hold that nitrogen-fixing bacteria are present and active both in nodules on rootlets and in the soil.

As yet we know comparatively little about the germ life of the soil. Some of these germs have been distinguished like the denitrifying, nitrifying, and nitrogen-fixing organisms, but there are many other organisms whose actions have been studied which have not yet been classified. The first formation of soil, for example, is to some extent dependent upon bacteria. It has been found that some species of bacteria live upon simple foods, such as free nitrogen and the carbonates. These microbes are of very wide occurrence and can develop on bare rock surfaces. Their secretions, being of an acid nature, help to soften the rocks, and thus they perform the first step in weathering. Again, there are certain soil organisms, as noted under nitrification, that are capable of existing on purely mineral food; for instance, the various sulphates which form important plant foods appear to be formed in part by bacterial agency, and the deposition of iron phosphates and iron silicates seems also to be aided by bacterial action. As data about the germ life in the soil accumulate, it becomes more apparent that the functions of bacterial life in the soil are not limited to the decomposition of organic matter and the preparation of suitable forms of nitrogen for the uses of plants, but extend also to the preparation of mineral food materials for plants.

The entire fertility of soil is stated to be due to bacteria. The fact is now recognised that a sterile soil which is devoid of germ life is an infertile one. Two soils, for instance, may have the same chemical composition, yet one may be fertile and the other practically barren; and the rational explanation seems to be that the one has abundant germ life while the other is deficient in soil bacteria. It has long been known that humus and the nitrogen content of the soil were important factors in soil fertility, and the humus theory was one that was common in the early part of the nineteenth century, till it was replaced by Liebig's mineral theory. The "new soil science," however, seems to favour the former more than the latter. Humus is the workshop in which soil bacteria work, as it contains nitrogen compounds in abundance, together with phosphates, sulphates, and other substances, and it offers the conditions necessary for the action of denitrifying and nitrifying bacteria.

The mineral theory with its chemical relationships and reactions in the soil does not now offer the same satisfactory explanation of the various processes of cultivation as it once did when it is compared with what we now know of the action of soil bacteria. In fact actions that were formerly attributed to chemical processes are now acknowledged to be due to soil germs. For instance, the denitrification and liberation of nitrogen in arable soils, now known to be due to a group of micro-organisms, were for long regarded as purely chemical processes. Again, the action we know under the term of nitrification was defined in 1846 as a purely chemical process of oxidation, and was regarded as a purely chemical process till 1888, when it was definitely determined that it was due to the action of living organisms. There can be little doubt that as our knowledge of the soil and its bacterial content increases our dependence on chemical theories will lessen.

Even now questions on manuring—a process which is usually regarded as an attempt to place plant-food material within the reach of plants—can be answered differently from what they would have been a few years ago. For example, horse dung is a "hot" manure because it contains denitrifying organisms in enormous numbers. If it be brought, especially when fresh, in contact with nitrates—nitrate of soda as a dressing, for instance—a loss of nitrogen will result, or the nitrates present in the soil will afford the special group of bacteria it contains an undesirable field of activity. Again the "ripening" of stable or farmyard manure is due to bacteria, and it is both an analytical and a synthetical process. The fresh animal secretions consist of highly complex compounds of nitrogen, and in the process of ripening through bacterial action they are decomposed and reduced to nitrites, ammonia, and even free nitrogen. Then a second process occurs, and, again through bacterial action, the results of this decomposition are built up into nitrates. In fact, the profitable cultivation of soil, according to the "new soil science" teaching, resolves itself into the proper handling of bacteria. These organisms have stocked the soil with plant-food material in the first place. They convert complex organic bodies in the soil and added manures into simple bodies, some of them becoming readily available as plant foods, while others are "lost"; and lastly, they may be made to reclaim the "lost" nitrogen. The natural fertility, the acquired fertility, and the continued fertility of a soil arise from bacterial action and depend on the cultivator's control of these organisms. It is not only in respect to the preparation of plant-food material that bacteria play a part, for even in the sprouting of seeds after they are sown in the soil bacterial life has its influence. In fact the land-cultivator's life from year's end to year's end is one that is in most intimate association with bacteria. It has been well said that a "successful farmer's life largely resolves itself into a skilful management of bacterial activity," and that "the most successful farmer to-day, and we believe the most successful farmer of the future, is the one who most intelligently and skilfully manipulates these gigantic forces furnished to him by the growth of his microscopical allies."

It must be borne in mind, even at the expense of reiteration, that we have yet much to learn regarding the germ life that exists in the soil, and many questions await a definite answer. Are soil bacteria the great preparers of food material for plants? With manures do we return plant-food material to the soil or simply food for soil bacteria? Is cultivation of the soil in the first instance the growing, sowing, and feeding of soil germs? Can manuring with chemical agents be replaced by inoculating the soil with specific germs?

The value of the bacterial point of view will have to be judged by the explanation it affords of the rationale of practical details, for instance, why is it that gardeners do not care to use fresh manure? The old reply used to be because the nitrogenous constituents in such a manure are not available for the use of plants, or that the chemical reactions which took place on decomposition were hurtful to the roots of plants. Bacteriological science has shown that fresh farmyard manure abounds in denitrifying bacteria, and their introduction into soil rich in organic matter will therefore do more harm than good unless the conditions are such that the products evolved can immediately be utilised. Again, the action of the nitrifying organisms has made clearer the theoretical explanation of many questions connected with the washing out of nitrates from fallows, the various processes occurring in the upper soil as contrasted with subsoil, and the advantages of autumn and winter sowing.

Before the germ life of the soil attracted attention it was demonstrated that the majority of agricultural and garden crops appropriated their nitrogen in the form of nitrates derived either from manures applied to the land or from nitrogenous substances in the soil which were converted into nitrates by the action of nitrifying bacteria. No hard and fast rules, however, can be laid down, for a few plants are able to utilise to a limited extent nitrogen in the form of ammonia or humate of ammonia, and some others are able to secure their nitrogen supply by the action of micro-organisms which develop tubercules upon their roots, and thus enable them to appropriate supplies of nitrogen which may be secured from the air in the soil or from nitrogenous compounds decomposing in it. These bacterioidal nodules are common to one family in the order *Leguminosæ*—i.e. the *Papilionaceæ*—but the faculty is also possessed by the other two families which form with it the order. Apart from the *Leguminosæ*, the organs in question are found in *Alnus*, *Elæagnus angustifolia*, *Hippophaë*, and *Podocarpus*, all of which are able thereby to thrive in soils destitute of nitrogen. Bacterial life in the soil seems also to have at least two different ways of reclaiming dissipated free nitrogen: one is by the nodule bacteria, and the second is by bacteria in the soil, for it has been found that soil entirely free from all common plants but containing certain kinds of bacteria if allowed to stand in contact with the air will slowly gain in its nitrogen content. The nitrogen compounds in such a soil are manufactured by the bacteria in the soil, for if they are not present they do not accumulate. It further appears that as a rule this fixation of nitrogen is not performed by any one species of bacteria, but by two or three of them acting together. The fact that fixation of free nitrogen occurs in the soil affords a new explanation of the activity of the nodule bacteria, viz. that the actual absorption of the free nitrogen goes on outside these root formations, the substances formed being, however, unassimilable by higher plants, but through the action of nodule bacteria they are converted into an assimilable form.

Some investigators having shown that an unfruitful soil could be made fruitful if inoculated with the micro-organisms producing and existing in these tubercules, various attempts have been made to carry out this idea in its practical applications; and under the name of *nitragin* a medium was offered for the inoculation of soils with proper germs for the production of the desired crop. As a scientific curiosity nitragin is of great value, but in practice it has failed to yield satisfactory results. The principle underlying the use of nitragin applies only to the nitrogen-gathering plants. Another step has been taken in offering under the name of *alinit* a bacterium which causes the soil to absorb atmospheric nitrogen and transform it into available plant food. This preparation, like nitragin, has also in practice been found to be a scientific curiosity.

Now it must be remembered when forming any conclusions regarding the "new soil science" that it is in its babyhood. We have just barely recognised the fact that the bacterial life in the soil is perhaps the dominant factor in agriculture and horticulture, and preparations like alinit and nitragin, especially the discoveries and conclusions on which they are based, are of great scientific interest, for they demonstrate the fact that agricultural scientists are to-day working very close to the line that divides them from discoveries of great practical value. Seven years ago Sir John Lawes asked the question, "Will the day come when seeds are sent out furnished with the appropriate organisms to supply the deficiency in our fields?" Before that day arrives we must know much more about the micro-organisms in the soil, their life-history and functions, than we do at present. We have, however, advanced far enough to see that purely chemical reactions and explanations are not satisfactory. The work of preparing the plant-food material in the soil is done entirely or in part by living organisms. It is this germ life that disintegrates, or at any rate assists in disintegrating, inorganic matter and decomposes organic matter. The food cycle seems to be that the food matter in the soil is first prepared by soil organisms for the plant; next it goes with the plant to the animal; and then from the animal, after it has been subjected to the action of a series of bacteria, back again to the soil. If in its progress some of the nitrogen is thrown off at a tangent, then it in turn is brought back again through the agency of bacterial life.

During the past century various theories have been propounded with the object of explaining the cause and effect of many of the practical operations and processes in soil cultivation. These theories may be classed as chemical and botanical, and they constitute what is usually termed the principles of agriculture and horticulture. The new soil science as yet cannot be said to replace the old chemical and botanical outlook, but when it does not supplant it very often supplements.

If we set aside general conditions, such as those of climate, locality, habitat, &c., it will be found that the views of De Candolle and Liebig have in the past century met with most acceptance. According to the former, plants of the same species could not be grown continuously in the same soil, as plants left a residue or ejecta in the soil which could be utilised by other types of plants, but not by the same species. Liebig's views were that the fertility of a soil depended chiefly on the solubility of its chemical constituents and also on the presence of all the constituents required by the plant, in the quantities or amount demanded and requisite for growth. The value we place on the germ life in the soil will depend a good deal on our conception of what is the life of a plant. If the plant be a living thing, then five points are summed up in the word "living," and the plant must therefore be held to eat, drink, breathe, grow, and multiply. It is with the roots of plants that cultivators of the soil are most concerned. The duties of roots are, first, to anchor the plant in the soil, and secondly, to drink rain water mixed with food-making stuffs; while the leaves are present for making food, and the flowers &c. consume the food made. The difference between Man and a Cabbage is that the former has no organ or machine to make food out of simple organic and inorganic constituents, while the plant has. Again, it would not be wrong to say that the breathing of a plant is the same as the breathing of an animal, and a soil should therefore have fresh air just as if man lived in it. The air in the soil must therefore be pure, and it follows that a well-aërated soil is a healthy one. This air goes into the root dissolved in water, but too much water in the soil will, of course, prevent pure air getting into the roots.

A soil may be said to contain sand, clay, organic matter, water, gas, bacteria, and we may add lime; in fact, no soil in which plants will grow is without carbonate of lime. Water, as already indicated, is of great importance to plant life: it envelops the particles of sand, fills up the interstices of clay, and is held by the organic matter as in a sponge. Sand holds the stuff the plant will absorb, and clay provides the plant with certain food-making stuffs; but neither sand nor clay can dissolve in water, and so enter the roots. It is, perhaps, with the organic matter in soils that the "new soil science" is most concerned, for it feeds the bacteria in the soil. Bacteria are also "living" organs or bodies, like plants, and it is held by many that it is really the voidings and excrements of bacteria, which must necessarily permeate the soil, that enter into the plant. Others, again, state that humus is not simply the organic matter in the soil, but is the vegetable matter which has been digested by soil germs; in other words, that humus is the excrements of bacteria; and it is added that roots do not feed on humus. The last view is probably correct, for after the growth of plants there is more humus in the soil than before, and cultivation of plants, it is acknowledged, increases the humic contents of the soil. The roots of plants use the soil, first, for space or room; secondly, for stability; thirdly, for obtaining raw material; and fourthly, for obtaining air to breathe. But if there is air in the soil there must also be, as the result of germ life, carbonic acid gas, and this must be a detrimental factor. How is it removed or overcome? That it has an influence we can conclude from the general observation that bacterial results are better and greater in fresh soil than in any other.

The main point, I take it, which has to be recognised is that the soil is not a chemical laboratory, and is not made up of a number of independent chemical substances in various stages of hardness and solubility. The soil, instead of being an inert physical mass, is teeming with germs. Do these germs prepare the soil for plants, or do they lead an independent life ? Our knowledge of soil bacteriology has as yet not advanced far enough for a definite reply to be given to such a question. The value of the " new soil science " is really the fresh point of view it gives. There seems to be both a life on the soil and in the soil, and a relationship exists between the two. My object will have been accomplished if I have directed your attention to this germ life in the soil, and if I can induce those who rely on chemical reactions to consider if biological actions do not afford a more satisfactory explanation for the various observed facts that constitute the basis of agricultural and horticultural theories, than the controlled chemical reactions common to laboratory practice.

In bringing before you the claims of the "new soil science" I cannot myself lay claim to originality, and I would further point out that many of the claims of this new point of view have already been advanced by Mr. John Hunter, of Edinburgh, in " Chambers's Encyclopædia." I must also acknowledge my own indebtedness on many points to Professor McAlpine, of Glasgow, and must add that in the compilation of this paper I have referred to and quoted from many authorities whom I have not named in detail, as I assume that practical men are not interested in names, but in the results that have been attained. To practical men I must in conclusion appeal. The " new soil science " does not pretend to offer a short cut to wealth by doubling or trebling the return per acre. Its primary duty is to give a satisfactory, rational, and conclusive explanation of the best practice in garden and field. First of all, we must accept the new point of view, and then to the practical man the questions that demand attention will be : How does this or that practice affect soil germ life ; and what influence has soil germ life on the cultivation of this or that plant ? It is with the hope that an interest in such questions may be aroused that I have brought the subject before the Society.

THE NEW SOIL SCIENCE.

By W. Dyke, F.R.H.S.

Do we require a new soil science? may be a question reasonably asked. Undoubtedly we do, and must have it, before the multitude of practical gardeners can be convinced that there is truth in our teaching.

That a plant lives, grows, and requires food are facts recognised by every grower; but that there is something wrong with the theories put forward by scientists to explain the condition in which the soil food is absorbed by crops, is evident to all who know by heart their text-book, and have to grow plants either for pleasure or profit. From a practical standpoint the whole subject seems to be a mass of contradictions; consequently the very men that should benefit by a knowledge of soil science have no faith in it.

I say this in no cavilling spirit, for no one could have been more impressed than myself by a book knowledge of soils, manures, and plant food, and it was not until many years had been spent in experimenting with every kind of manure in commerce, that I saw how little was known regarding this very important subject.

My object in writing this paper is of a twofold nature, first, to try and show where the theory is weak, and secondly, to point out the way to remedy the weakness.

Before proceeding to discuss the main question it would be well to see in what direction our present knowledge of manures and manuring leads us. Nitrogen in a combined state is a soil constituent necessary for the life and development of all crops. More money is paid for a pound of it than for any other constituent of plant food, or, to be precise, it costs from 6*d.* to 1*s.* a lb., according to the form in which it is bought.

The top foot of an acre of ploughed land contains 3,500 lb. of nitrogen, a good garden soil twice or thrice as much. Supposing in field cultivation we wish to grow a crop of Potatos, we should find it advisable to apply about twenty tons of farmyard manure per acre. The twenty tons of dung would contain 200 lb. of nitrogen. A fairly good yield of Potatos would be six tons to the acre, and to this must be added 4,274 lb. of haulm.

The six tons of Potatos and 4,272 lb. of haulm take from the soil but 67 lb. of nitrogen, and yet a soil containing 3,500 lb. of nitrogen is incapable of supplying this small amount, and we even have to give, in addition to it, three times as much as the Potatos require in the form of manure to get a satisfactory return.

Put in other words, it amounts to this, we have a balance at our bankers' of £3,500, and wishing to withdraw £67 the manager says we may if before doing so we pay into our banking account £200. The whole of this vast mass of soil-nitrogen seems useless or nearly so, and the scientist who can devise means of bringing it into an available condition so that our crops can utilise it will confer upon horticulture one of the greatest of blessings.

Botanical texts-books teach that plants absorb their food from the soil in the form of *inorganic* salts, such as nitrates, phosphates, sulphates, and chlorides, of potash, soda, lime, magnesia, and iron. We accept this teaching because at present there is no other to offer in its place; but when the source of soil fertility is discovered we shall not attach so much importance to these inorganic dead earthy chemical substances, for by then we shall have discovered what the millions of soil microbes are doing for the benefit of plants. Much has already been achieved in this direction, and many very able men are engaged in the work; but would not more rapid progress be made if the prevailing idea were given up that the inorganic salts are the only substances which constitute the soil food of crops?

I think the time will come when we shall find that plants have two kinds of soil food—the one the inorganic salts, the other some organic compound made or formed by soil bacteria. That plants absorb and use as food these salts is a fact beyond dispute; but that they need something else which every soil does not seem capable of supplying is also a fact very evident to all observant cultivators.

It does not require much reasoning to show indirectly that there is truth in my statement. The scientist says that plants absorb their food as soluble inorganic salts. Let us for a moment suppose they do. Sand forms a splendid rooting medium for most plants. If what the scientist says is correct, we ought to be able to grow splendid plants in sand by judiciously feeding them with what, from their point of view, is the very essence of plant food, *i.e.* the salts in a soluble condition. Those who have tried this know what miserable specimens are produced compared with others grown in fertile soil which supplies everything necessary for perfect growth.

Whence do plants get their nitrogen, and in what form is it absorbed? The teaching of to-day is that plants absorb their nitrogen from the soil principally as nitrates of lime, potash, or soda, and to a less extent as salts of ammonia; and also that the leguminous plants are able to use free nitrogen from the atmosphere.

So far as I know no writer has ever said that plants could and do absorb their nitrogen from the soil in the form of *organic* nitrogen and as ammonium nitrate. I know that plants have been fed with urea and one or two other organic salts of this description, but what I mean by "organic" is some form of organic nitrogenous food made by bacteria in which the other elements of nutrition are blended.

It was thought at one time that the conversion of soil-food from an unavailable to an available form was of a purely chemical nature, but this idea is now giving way to another, for now the change is known to be more or less the work of soil-microbes.

If we apply organic matter to soil, the nitrogen in it being present as organic nitrogen is changed by different kinds of bacteria, first of all into ammonia, secondly into nitrous acid, and thirdly into nitric acid. The nitric acid then unites with lime or potash, forming nitrate of lime or nitrate of potash, and is ready for plants to absorb. This is the explanation given of the way and form in which plants obtain their nitrogen.

I take it for granted that the bacteria do make nitric acid from organic nitrogen, but I cannot believe that this is the only product formed. Of what are their own bodies composed, small as they be? And if they are not actually soluble in water, they are so transparent as to be incapable of discolouring water even when there are millions present.

Is it not possible that in the formation of nitric acid some soluble organic compound is formed, which is absorbed and utilised as food by growing crops? Or may there not be present in soils microbes making an organic compound which is so used?

The compound may be, and no doubt is, a complex substance containing in addition to nitrogen some or all of the other elements of plant food such as potash, sulphur, phosphorus, magnesia, &c. This supposition may at first sight be thought incorrect, but why do we find it necessary to apply to soil phosphates and the other elements of plant food to supply the bacteria with the constituents necessary for their development if they are not utilised by them?

Professor Aikman says in his book "Manures and Manuring:" "In experiments on nitrification it has been found that the organisms will not develop in any medium destitute of phosphoric acid. Probably potash, magnesia, and lime salts are necessary. In the cultivating solutions used in the experiments on the subject the mineral food constituents added consist of lime, magnesia, potash salts, and phosphoric acid." If these things are necessary the bacteria must use them, and if used they must either be made into some organic compound or go to form the bodies of the organisms. Think of these millions of tiny microscopic bits of organic matter, living, dead, and dying, constructed of material similar to that of our garden plants, in close contact with their roots, and who can say that they are not absorbed and used?

A germinating seed contains sufficient organic food to enable the embryonic plant to grow and develop until large enough to provide for itself. The food consists of all the elements needed for perfect growth; the nitrogen, potash, phosphoric acid, &c., are all present in an organic form, and yet the plantlet feeds upon them after they are made soluble by the action of ferments.

Again, I suppose no one thinks the organic substance made by bacteria in the nodules on the roots of Peas, Beans, &c. is changed into nitrates before the plants use it.

Then we have certain plants which live upon organic nitrogen from the bodies of the insects they trap.

If plants can only absorb their nitrogen as nitrates and ammonium salts, whence do forest trees and bog plants get their nitrogenous food? The conditions in the forest soils and in bogs are unfavourable for nitrification, and yet the trees and plants grow freely enough.

If we take it for granted that there exist in soils bacteria whose function is to produce, or make, certain organic compounds for each of the different crops we grow, we could satisfactorily answer many difficult problems which now trouble us. I have in my mind two which are practically unanswerable except by supposing something of this kind does take place.

The first problem is, Why cannot we grow some crops year after year on the same soil? and the second, Why do some crops grow so splendidly in one place and do so badly in another?

Take for example a Tomato crop. If this is grown for more than two years in the same soil, it is almost a failure the third year. Chemists have analysed the Tomato plant and told us exactly what chemical elements they remove from the soil, but no fertiliser or combination of them can replace what has been removed. The soil is still fertile as regards *other* crops, for if they be planted in it they will grow freely enough. We can only suppose that there was either some organic compound in the soil when the Tomatos were planted, and that by constant cropping it is exhausted, or that the microbes are present in a healthy condition and make the food they need. We can see that when the supply of food is exhausted or the microbes become enfeebled the plants suffer, and is this not exactly what does take place?

A soil in a district that grows excellent crops may be one teeming with suitable bacteria, and these may be only sparingly found in, or entirely absent from, soil in which the same crops do badly.

It is said that each of the leguminous plants has a different microbe causing the nodules on their roots. Thus the microbes on the roots of Peas are different from those on Beans, and those on Clover different from those on Lupins. A soil gets sick of growing Clover, but it will grow good crops of Peas or Beans. This is an analogy worth noting, for we cannot suppose that the leguminous plants are the only class of plants having microbes making food for them, for different groups are constantly being added to them. It is true that their presence is known by the effect they cause, viz. the nodules; but may not each group of garden plants have a special microbe either attached to their roots or in close contact with them, making something for them?

Nothing suits crops so well as good farmyard manure, and may not its value lie in the fact that it is full of microbes? Organic manures are better for crops than inorganic manures: the first encourages the soil life, the other retards it. Burnt soil is not so suitable for plant growth as unburnt, even when nitrogen is added; the burning destroys the life.

Scores of facts could be given, but let these suffice.

I said in the early part of this paper that plants absorb some of their nitrogen in the form of ammonium nitrate, for there is plenty of indirect evidence to prove that such is a fact. What is ammonium nitrate? It is a chemical substance formed by the union of ammonia with nitric acid; consequently it is a salt very rich in nitrogen. To show the comparison of this with another rich nitrogen salt, viz. nitrate of soda, I may say that 100 lb. of ammonium nitrate would contain 35 lb. of nitrogen, while the same weight of nitrate of soda would contain a little more than 15 lb.

It has been proved that there is a class of microbes in the soil which change organic nitrogen into ammonia, and others which change ammonia into nitric acid. Ammonia and nitric acid are both being formed in the soil at the same time, and there is nothing unreasonable in supposing that they unite and form ammonium nitrate.

Professor Storer says in his "Chemistry in its Relation to Agriculture," page 297: "Out of contact with carbonate of lime or other alkali, a quantity of ammonium nitrate is formed, when nitrogenous matters decompose in the soil. This fact has been proved by experiments, and may be verified any day by testing the water in wells in crowded cities. Such water will almost always be found to contain nitrate of ammonia, often in large quantities." On page 319 he says: "Goppelsroeder in his trials computed that $21\frac{3}{4}$ lb. of nitrate of ammonia were brought to an acre of land in a year by rain and snow."

I believe it is a fact that all the combined nitrogen which comes to the soil in rain falls in the form of ammonium nitrate; and may not the refreshing influence of rains on crops be due to this substance?

PLANT COMMUNITIES.

By J. W. Carr, M.A., F.L.S., Professor of Biology in University College, Nottingham.

[Lecture delivered March 25, 1902.]

Plants, like animals, tend to associate together into groups or communities varying in character according to the diverse conditions presented by different areas of the earth's surface, those species which are adapted for existence under the same general conditions of temperature, moisture, soil, illumination, shelter, &c., being apt to live in company. The general character of such a company or society is determined by the nature of its more prominent members, or by that of the locality which it occupies. Thus, there are forest communities, dominated by trees; meadow societies, presenting a densely matted carpet or turf of grasses and low herbs; swamp and pond societies, heath and moorland communities; the plants of sea cliffs, shingle beaches, fresh and salt water marshes; sand and rock societies, and so on.

Just as closely allied plants frequently affect very different situations (e.g. *Ranunculus aquatilis*, submerged in ponds and streams; *R. Lingua* and *Flammula*, growing in marshes; *R. bulbosus* and *acris*, in meadows; *R. arvensis*, in cornfields; *Thalictrum flavum*, found by stream sides and in wet meadows; *T. collinum*, on dry limestone rocks; and *T. alpinum*, on high mountains), so conversely we find widely different plants living together under the same conditions, and consequently a plant society will often comprise representatives from many groups of the vegetable kingdom from the highest to the lowest.

The organisation or composition of a plant society is determined by the nature and permanence of the physical conditions to which the particular area in which it occurs is subject. The water supply is one of the most important factors in the composition of plant communities, and while at one extreme we find the plants of pond societies living entirely and permanently immersed in water, at the other are the species inhabiting dry sandy heaths and dunes, with a very limited and occasional supply of water.

Closely bound up with the water supply is the nature of the soil Stiff heavy soils retain much of the rain which falls upon them, so that it can only percolate downwards slowly and with difficulty. Loose sandy soils, being very permeable, rapidly lose their water and become dry and arid. The chemical composition of the soil, moreover, directly influences the character of the plant groups growing upon it, for it determines the nature and amount of the food materials supplied to them; clay, limestone, sandstone, peat, &c., all have their characteristic species. The soil-covering of turf, dead leaves, &c. is also of importance in relation to the regulation of temperature and retention of water.

Light is essential to the wellbeing of all green plants; but while some bask in the full blaze of direct sunlight, others shun intense light and

FIG. 7.—ON THE BANN AT GILFORD, CO. DOWN.

[To face p. 86.

Fig. 8.—Reed-mace by the River Boyne, Bective, Co. Meath.

Fig. 9.—Purple Loose-strife and Meadow-sweet in a Cavan Meadow.

Fig. 10.—Agave and Cereus ingens.

(After photo by Professor Stahl, in Schimper's *Pflanzen-Geographie.*)

[*To face p. 87.*

inhabit shady situations. Thus, in woods the leaves of the trees intercept a large proportion of the sunlight, while in the less brightly illuminated region below is an undergrowth of bushes, below which, again, are herbaceous plants, and in the deep shade close to the ground grow Mosses and Liverworts, and other lowly plants. Sometimes the shading is so dense, as in a thick Beech or Pine forest, that scarcely anything will grow in the deep gloom near the ground.

Wind has a drying action on soil and vegetation, and so reduces the available water supply and increases transpiration. When blowing more or less constantly and strongly in the same direction, as along our coasts, it has a considerable influence on the growth of trees and shrubs exposed to its violence. They are more or less stunted and dwarfed in stature, with their trunks and branches inclined to leeward.

Using the water factor as the basis of classification, we may group most of the principal plant communities under three heads, viz.—

I. *Hydrophytes*, or water-plants, which live wholly or partially immersed in water.

II. *Xerophytes*: plants which are exposed, constantly or periodically, to a very dry soil and dry atmosphere.

III. *Mesophytes.*—This is by far the largest group, and comprises plants growing under conditions of medium water supply.

To these may be added a fourth group, comprising plants growing on soil containing much salt, as on the sea-coast and the salt steppes of Asia. These are termed—

IV. *Halophytes.*

The boundaries of these groups are obviously not sharply defined, but merge imperceptibly into one another.

Hydrophytes, from the uniformity in their conditions of life, exhibit considerable similarity in general habit and structure. They are not subject to such extremes of temperature as land plants, nor is their growth so liable to be checked by drought. Moreover, the conditions leading to nutrition are especially favourable, particularly in plants which are entirely submerged, since all their food constituents, as well as the oxygen required for respiration, are present in solution in the surrounding water. These conditions, and also the diminution of the light in passing through water, all favour rapid and luxuriant growth.

Among the structural features common to most completely hydrophytic plants are a thin-walled epidermis devoid of cuticle and with few or no stomata, the great reduction of the root system and of water-conducting and mechanical tissues, and the enormous development of air spaces in the cortical region. The leaves are usually either long and ribbon-shaped or cut into numerous fine segments, or awl-shaped; but when floating leaves are present they are usually large and undivided, of oval or rounded form and leathery texture, and with stomata on the upper side only. Frequently much-divided submerged leaves and entire floating leaves occur on the same plant. Reproduction is largely vegetative, and is effected by detachable buds, tubers, or even branches separated from the main stem. In true hydrophytes flowers are not nearly so abundant or conspicuous as in land plants.

Pondweed societies include numerous species which float freely upon or below the surface of the water (*e.g.* many Algæ, Duckweeds, Bladder-wort, Water-violet, Frogbit, &c.), but the majority are anchored to the bottom (Algæ, Mosses, Pondweeds, Water-lilies, &c.).

Swamp societies consist of plants growing in shallow water, or in very wet soil, with stems and leaves rising well above the surface, and therefore agreeing more nearly with those of mesophytes or ordinary terrestrial plants in their structural characters. A distinct zonal arrangement can frequently be perceived in the grouping of such plants. Thus the edge of the fringe of vegetation bordering a lake or sluggish stream is often composed of clumps of Arrowhead, Water-plantain, &c. ; then comes a zone occupied by tall, slender, narrow-leaved plants, such as Flowering Rush, Reed-mace, Bulrush, Burr-reeds, Sedges, and Reed-grasses ; and behind these, again, are masses of Purple Loose-strife, Hemp-agrimony, Willow-herb, Meadowsweet, and *Angelica*, with Willows, Alders, and other moisture-loving shrubs and trees forming a background to the whole. (Figs. 7, 8, and 9.)

Here also belong peat bogs and fens, largely composed of Sphagnum Moss, with coarse Grasses, Sedges, Cotton-grass, Sundews and Butter-worts, Bog-orchids, &c.

Hydrophytes pass imperceptibly into mesophytes, and indeed individuals of the same species may grow under both sets of conditions, and then exhibit corresponding differences in structure and habit. *Polygonum amphibium* is a good example of this. When growing in deep water it has very long lax stems and smooth broad leaves which float on the surface. The terrestrial form, on the other hand, possesses erect stout stems, bearing numerous lanceolate and somewhat hairy leaves.

Xerophytes.—These are adapted to resist drought and attain their best development in arid, sandy, or rocky situations. The drought may occur at irregular intervals or may be periodic, as in regions where wet and dry seasons regularly alternate ; or it may be constant, as in certain almost rainless desert regions. It is obvious that in such areas the extremely limited water supply is accompanied by a tendency to increased transpiration—conditions which are directly opposed to each other. Hence these plants must develop contrivances for collecting and storing water and for diminishing transpiration.

Many xerophytes develop a special water-storage tissue—the *aqueous tissue*—in the leaves, generally in the form of a layer of large colourless cells between the upper epidermis and the palisade-tissue ; and an extension of the storage function to all the leaf parenchyma produces the thick fleshy leaves of *succulent* plants, such as the *Crassulaceæ*, Aloes, Agave, &c., in which the leaves are usually very numerous and closely packed together. Often the stem becomes stout and succulent, and the leaves are then generally greatly reduced or even absent, or else modified into spines or thorns : e.g. *Salicornia*, some Euphorbias, Cacti, &c. These succulent plants not only store water in considerable quantity, but they have a very great power of retaining it, and hence are able to survive long periods of drought. (See fig. 10.)

FIG. 11.—WOOD-ANEMONES IN CALEDON WOODS, CO. TYRONE.

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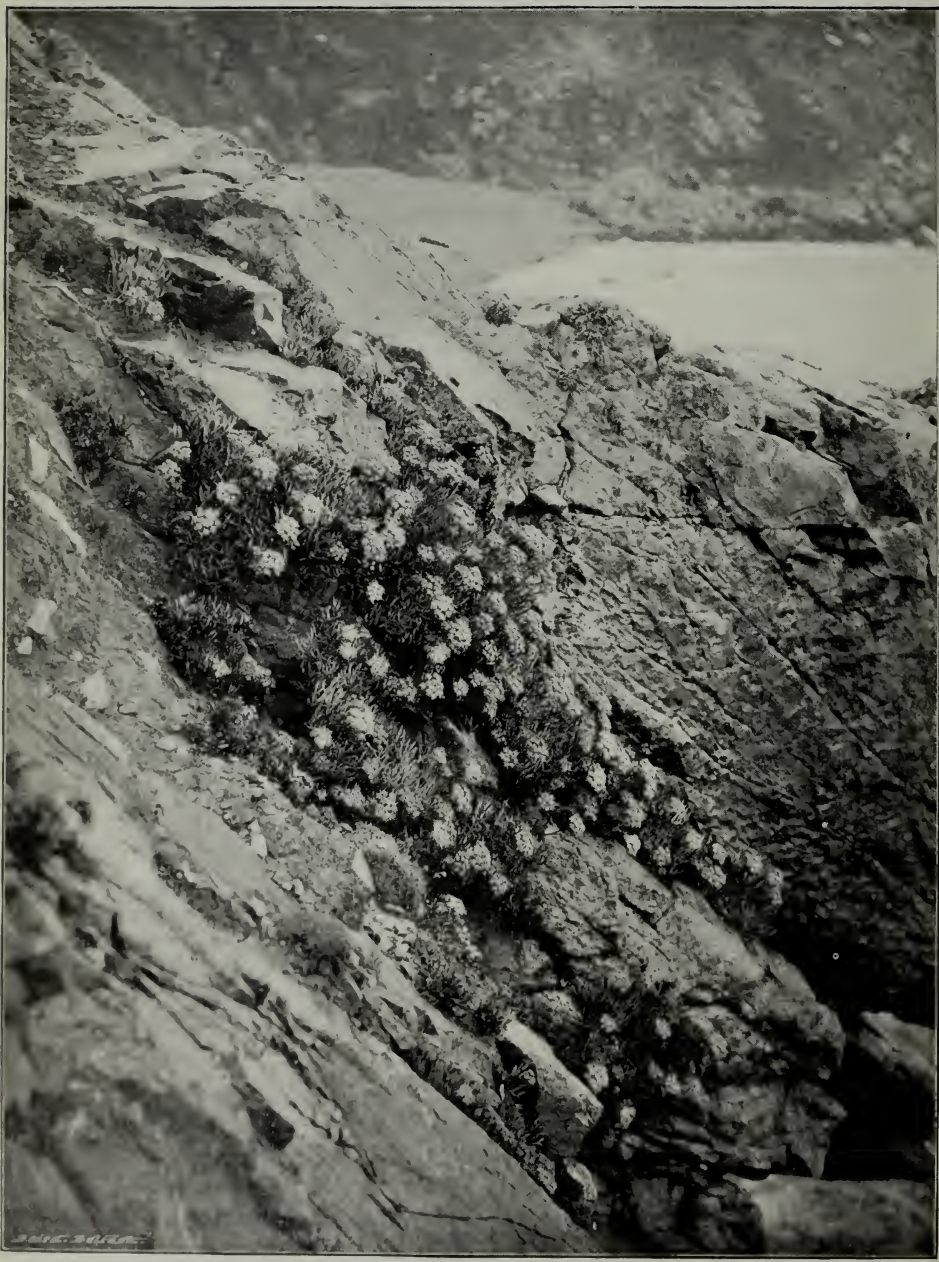

Fig. 14.—Common Samphire (*Crithmum maritimum*) on Howth Cliffs, near Dublin.

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As the amount of transpiration is related in a general way to the extent of leaf area on a plant, it is obvious that a reduction in the amount of leaf surface will be accompanied by diminished transpiration. Hence in xerophytic species, especially those with woody stems, there is often a very scanty leaf-development, much of the assimilation being then performed by the young green twigs. The leaves may even lose their assimilatory function entirely, becoming reduced to minute scales, in which case their function is necessarily performed by the stems, as in some species of *Spartium*, Asparagus, &c.

In *Pinus* and other conifers, *Ericaceæ*, &c., the leaves are narrow and needle-like, and in many Heaths and Grasses have inrolled margins. In nearly all xerophytes the exposed surface of the leaf is covered by a very thick cuticle or by a dense covering of hairs, both of which contrivances diminish loss of water; while the stomata are usually few in number and sunk below the surface or placed in the furrows in grooved leaves, or confined to the under surface of rolled leaves, so as to be more or less completely shut off from the outer air.

In countries where wet and dry seasons alternate many plants spend the dry period in a dormant state as underground bulbs, tubers, rhizomes or thickened roots, and only vegetate on the return of the wet season. Many trees and shrubs shed their leaves at the approach of the dry season, just as do the trees of temperate climates on the approach of winter. In some countries, notably in Australia, it is common for leaves to be so arranged on the branches that their edges instead of their surfaces are turned towards the sky and ground. The leaf surface thus escapes direct exposure to the sun's rays except when it is near the horizon and consequently least powerful, and so in this way also is the loss of water minimised.

Among xerophyte societies may be mentioned "rock societies" consisting of Lichens and Mosses and other plants which can contrive to live on exposed rock-surfaces; "Heath societies" characterised by Heather, Heaths and other *Ericaceæ*, Furze, Rest-harrow, Wild Thyme, *Sedum acre*, *Galium verum*, and various Grasses; the Pine forests of northern and mountainous regions; while the "bush" and "scrub" of Africa and Australia, and the Mexican Cactus-deserts, represent the extreme of xerophytic conditions.

Many arctic and alpine plants show marked xerophytic features, such as dwarfed and tufted habit, closely packed and inrolled leaves, thick cuticle and sunken stomata, hairy surface, leathery or fleshy texture, &c. Among these may be mentioned the dwarf Birch and Juniper, *Cherleria*, *Silene acaulis*, *Draba*, *Saxifraga oppositifolia* and other species, *Azalea*, *Vaccinium*, *Arctostaphylos* and other *Ericaceæ*, *Cerastium alpinum*, Edelweiss and its allies, *Sedum Rhodiola*, &c.

Many *epiphytes*—plants which cling for support to other plants, but derive no nutriment from them and are not rooted in the soil—show well-marked xerophytic characters, and frequently develop organs for collecting and storing water. Such are the epiphytic Orchids and Ferns.

Mesophytes form the bulk of the familiar vegetation of temperate inland regions, where the physical conditions show no very striking extremes of temperature or dryness or moisture, where the soil is more or less enriched with humus, and salts are not in excess. Notable features in a mesophyte society are the density of growth of the members composing it, and the variety of leaf form they exhibit as compared with xerophyte or even hydrophyte communities, in which the greater uniformity of the environment induces a corresponding uniformity and "sameness" in the character of the foliage.

Prominent among mesophyte societies are the *forests*, chiefly composed of deciduous trees such as Oak, Beech, Birch, Ash, Elm, Lime, with Larch and Pines (the last-named evergreen). Forming the ground vegetation among the undergrowth of young trees and shrubs are Ferns, shade-loving Grasses, and the numerous herbaceous plants whose masses of showy bloom make our woods so exquisitely beautiful in the spring before the trees are in full leaf and the light thereby greatly reduced. Anemones, Primroses, Violets, Garlic, Bluebells, Arums, yellow Dead-nettle, and a few others form the bulk of the flowering ground herbage in our English woodlands. (Figs. 11 and 12.) Epiphytic flowering plants are not found in our forests, but in damp places the tree-trunks are clothed with a growth of epiphytic Mosses, Liverworts and Lichens, and frequently Ferns.

Coppices or thickets, composed of shrubs and small trees such as Hawthorn, Holly, Hazel, Elder, Maple, Willow, Dogwood, and many others, often festooned with scrambling Roses and Brambles and sprays of climbing Honeysuckle, constitute another familiar mesophyte community.

Another comprises meadows and pasture lands, where Grasses predominate, accompanied by many sun-loving herbs, such as the Daisy (fig. 13), Dandelion, Cowslip, Buttercups, Plantains, Speedwells, Clovers and Trefoils, various *Umbelliferæ*, and very many others.

The "alpine carpet" of Gentians, Pinks, Saxifrages, *Myosotis*, &c. must also be regarded as a mesophyte society, although associated with many plants of xerophytic structure.

The forests and jungles of the tropics, where a high temperature, combined with a copious rainfall, produces a marvellously luxuriant growth of trees and shrubs of all kinds and sizes, with climbing Vines or Lianas, and epiphytic Orchids, Aroids, and other plants, also belong here.

Halophytes, or salt-loving plants, usually exhibit well-marked xerophytic characters, for owing to the presence of salt in the soil the roots absorb water with difficulty, and hence it is necessary to reduce transpiration. They are nearly all plants with blue-green or grey-green (glaucous) foliage, tough and leathery or thick and succulent, and with long fleshy roots and underground stems.

Rooting in crevices of the rocks in sea cliffs are such plants as the Common Samphire (*Crithmum maritimum*) (fig. 14) and the rarer Golden Samphire (*Inula crithmoides*) (fig. 15), plants with thick narrow fleshy leaves; the Sea-pink (*Armeria*), with green leafy cushions and clusters of rose-pink flowers; and the Sea-lavender (*Statice*), with rosettes of tough leathery radical leaves, and wiry flowering stems.

On the shingle beaches above the high-water mark grow the Sea-holly with stiff spiny greyish foliage, and heads of bright blue flowers; the Sea-spurge; the Horned Poppy, conspicuous on account of its

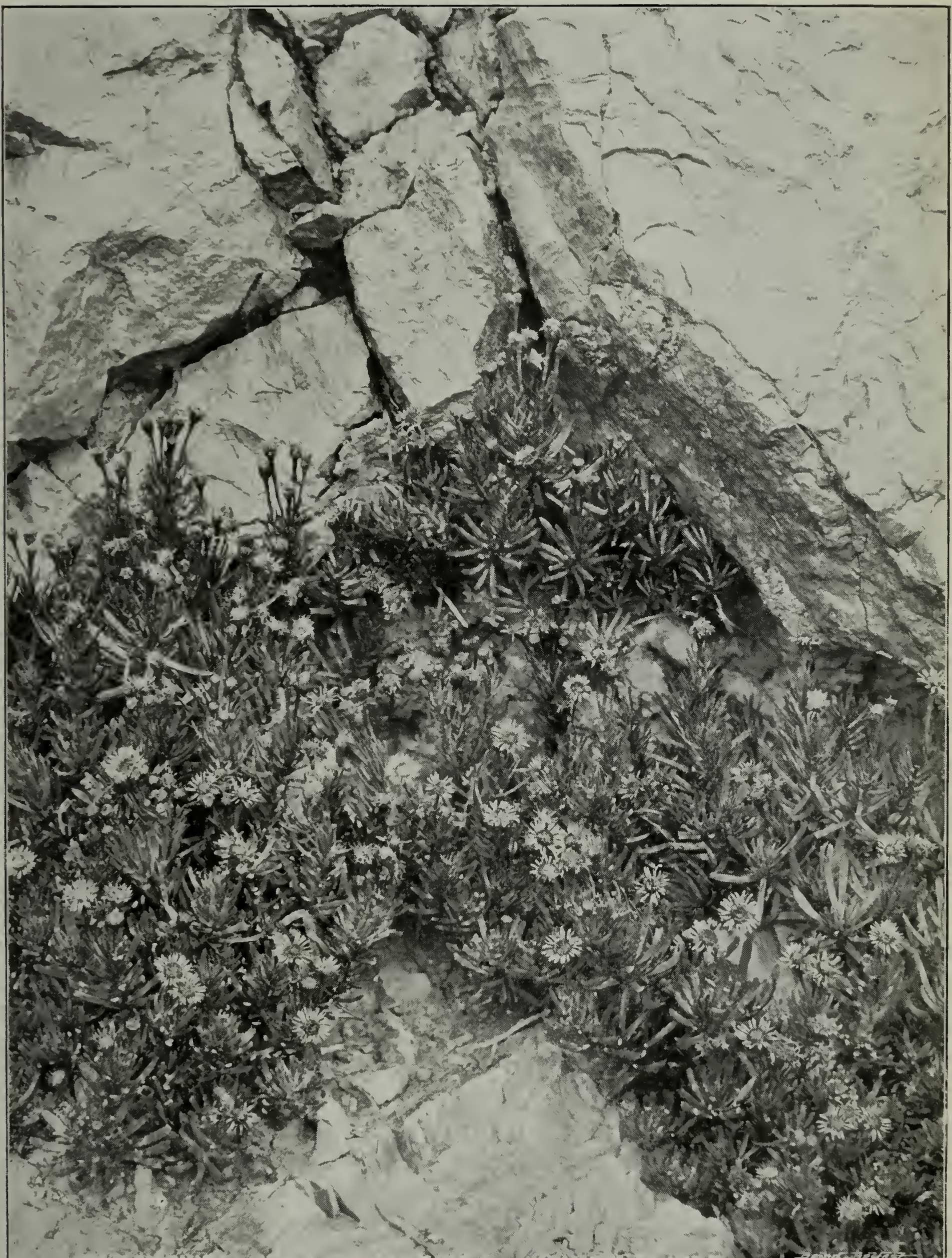


Fig. 15.—Golden Samphire (*Inula crithmoides*) on Howth Cliffs, near Dublin.

[*To face p.* 90

Fig. 16.—Sea-holly, Sea-bindweed, and Yellow Horned Poppy on Wicklow Coast.

[To face p. 91.

silvery leaves and large golden-yellow blossoms ; the lovely Sea-bindweed, Sea-purslane—both with fleshy succulent leaves, and many others. (See fig. 16.)

Nearer the sea, on the sand about high-water mark, are found the Sea-rocket (*Cakile maritima*), Saltwort (*Salsola Kali*), and various species of *Atriplex*.

On muddy shores, especially in estuaries, the Grass-wrack (*Zostera*) and Glass-wort (*Salicornia*) are often extremely abundant, and are completely submerged at high water; while higher up, and out of reach of all but the highest tides, occur such species as *Triglochin maritimum*, *Suæda maritima*, *Glaux*, *Aster Tripolium*, Sea-plantain, Scurvy-grass, and Sea-lavender.

The loose shifting sands of sand-dunes are occupied chiefly by Grasses such as *Ammophila*, *Elymus*, and *Agropyron*, all of which have glaucous leaves and long creeping rhizomes, which help to bind the dunes together. The Sand-sedge (*Carex arenaria*) is also an efficient sand-binder.

Few woody or shrubby plants occur, but along our east and south-east coast the Sea-buckthorn (*Hippophaë rhamnoides*) is abundant in places.

Besides the plant associations thus far considered—associations which depend on the varying adaptability of plants to different external conditions—there are others in which the determining conditions are the adaptability of plants to one another for purposes of support or nutrition. To the former set belong the climbing plants and epiphytes ; to the latter those which are associated in a symbiotic union, or in a state of parasitism.

Climbing plants have slender straggling stems with long internodes, and in the absence of a suitable mechanical support would trail along the ground and so become covered up and smothered by other plants. According to the nature of their climbing organs we may distinguish :—

(1) *Twiners*, those whose main axis twists spirally round the upright supporting stem of another plant. Such are the Hop, Convolvulus, *Tamus*.

(2) *Climbing plants* proper, which develop lateral prehensile organs or tendrils, which are very sensitive to contact and coil round a suitable support (Pea, Vine, *Bryonia*).

(3) *Root-climbers*, which develop adventitious aërial roots on their stems which insinuate themselves into the crevices and roughnesses of the bark of trees (Ivy).

(4) *Clamberers* or *Scramblers*.—These develop lateral organs not sensitive to contact, such as recurved spines, prickles, or hooked hairs, which enable the plant possessing them to clamber over and support itself upon other plants (Roses, Brambles, Goosegrass).

Epiphytes differ from the above in that they are not rooted in the ground, but merely "perch" upon other plants. They hold on to the support by means of rhizoids, or by adventitious roots, and usually exhibit contrivances for collecting and storing water. Their mineral food is obtained from the dust which settles upon them and—together with some organic matter—from the decaying vegetable *débris* which collects among their roots.

Association for purposes of nutrition, or symbiosis in the widest sense, varies in the degree of interdependence of the associated organisms. The simplest case is that in which one species is afforded shelter and protection by the other, as in certain species of *Nostocaceæ*, which inhabit cavities in the bodies of higher plants such as Liverworts, *Azolla*, &c. A more intimate association is that which exists between certain fungi and the roots of higher plants. The fungal hyphæ form a close meshwork round the ends of the young roots and penetrate into their superficial cells. They appear to take the place and perform the functions of the root-hairs in other plants, and in return receive food from the rootlets. This association of root and fungus is called a mycorrhiza, and occurs in a very large number of trees and also herbaceous plants.

Another remarkable association is that of the tubercle-forming fungi with the roots of Leguminous plants, whereby the latter are enabled to utilise the free nitrogen of the air.

It is now a well-known fact that Lichens are not single independent plants, but are constituted by the union of a fungus and an alga so intimately associated as to appear to form a single individual. The alga in virtue of its possessing chlorophyll can supply the fungal constituent with organic food, while the fungus provides the algal constituent with water and mineral salts. At first sight therefore the association seems to be one of *mutualism*, i.e. a partnership fraught with equal benefit to the parties associated ; but it appears that while the fungus cannot exist apart from the alga, the latter can and does live independently. Such a relation, which may be likened to that of master and servant rather than of partners, is often termed *helotism*.

A further association of one plant with another is that of host and parasite, the parasitism being partial or complete. Thus many fungi, the Dodder, Toothwort and Broomrapes are completely parasitic, while the Mistletoe and many *Scrophulariaceæ* are only partially so.

[The writer is greatly indebted to Mr. R. Welch, of Belfast, photographer to her Majesty the late Queen Victoria, for preparing the photographs from which the plates illustrating this article were made.]

THE PERGOLA IN ENGLISH GARDENS, ITS MAKING AND PLANTING.

By Miss Jekyll, V.M.H.

[Lecture delivered April 8, 1902.]

It is only of comparatively late years that we have borrowed the pergola from the gardens of Italy. Borrowed is perhaps, in its complete sense, not quite the right term to use, for borrowing implies returning or repaying, whereas, having borrowed the pergola, we have certainly kept it for our own.

Its main use in Italy is as a support for Grape vines and at the same time to give shade to paths. Here we use it, not only for shade, but as an important feature in garden design and for the display of the best plants of rambling growth, whether for beauty of flower or foliage. In the old English gardens of Tudor times there was something that approached the uses of the pergola in the pleached alleys of Hornbeam or some such tree trained on a framework of laths. But these shaded alleys were slow of growth and wasteful of labour, and did nothing to display the beauty of flowers. Our adaptation of the pergola gives a much quicker and better addition to the delights of the garden, for we have our shady walk, and in addition some of the most charming pictures of flower beauty that the garden can be made to show. It is therefore no wonder that a pergola or something of the kind is now wanted in almost every garden.

Before considering how it is to be planted it may be well to give an idea of the different ways in which it is made. The simplest form of pergola in Italy is made of stout poles guiding and supporting the trunks of the vines, connected across the path by others of less diameter, with a roofing of any long rods laid lengthways along the top. This is repaired from time to time by putting in fresh uprights or other portions in the careless happy-go-lucky way that characterises the methods of domestic and rural economy of the Italian peasant or small proprietor.

But often in Italy one sees solid piers of rubble masonry coarsely plastered, either round or square in plan, or even marble columns from ancient buildings. These have a more solid wooden beam connecting them in pairs across the path, and stouter stuff running along the length.

For our English gardens we have the choice of various materials for the main structure. If the pergola is to be near enough to the house to be in any sort of designed relation to it, and especially if the house be of some importance, the piers should be of the same material as the house walls—brick or stone as the case may be. Fourteen-inch brick piers laid in cement are excellent and easily made. Such piers may be said to last for ever, and if it is desirable that they should not be red, or whatever may be the normal colour of the brick used, it is easy to colour them in lime-wash to suit any near building. For association with refined brick building bricks are sometimes moulded on purpose of thinner shape, either square or half-round in plan, the latter being for piers that are to show as round columns. Brick, stone or marble, or wooden columns are also used in refined designs.

For more ordinary work the piers may be of oak trunks of a diameter of 8 to 10 inches. These if tarred or charred at the butts high enough up to show a charred space of a foot above the ground-line, and put into the ground like gate-posts, will last from fifteen to eighteen years, or have about the lifetime of an ordinary field gate-post. A better and more enduring way is to have the posts of Oak eight inches square, set on squared stones that stand a foot out of the ground, with a stout iron dowel let into the foot of the post and the top of the stone. Unless the appearance of the Oak post is desired there is little if anything to choose in point of cost between this and the solid brick pier, as the Oak has to be squared and the plinth shaped and bedded on a concrete foundation.

In most places local custom and convenience of obtaining local material will be the best guide in choosing what the pergola is to be made of. Larch posts are nearly as good as Oak, and Larch tops are the best of all materials for the top roofing.

Whatever may be the kind of post or pier, it is important to have them connected by good beams. The beam ties the opposite pairs of posts or piers together across the path. In the case of brick or stone piers it should be of Oak or Larch seven to eight inches square, not quite horizontal, but slightly rising in the middle. This is of some importance, as it satisfies the eye with the feeling of strong structure, and is actually of structural utility.

It is of course possible to make a pergola of iron with very flat arches, and supporting rods and wires or wire netting for the top ; but it is the material least recommended and the one that is the least sympathetic to the plants ; indeed in many cases contact with the cold iron is actually harmful.

A modification of the continuous pergola is in many cases as good as, or even better than, the more complete kind. This is the series of posts and beams without any connection in the direction of the length of the path, making a succession of flowering arches ; either standing quite clear or only connected by garlands swinging from one pair of piers to the next along the sides of the path, and perhaps light horizontal rails also running lengthwise from pier to pier.

This is the best arrangement for Roses, as they have plenty of air and light, and can be more conveniently trained as pillars and arches, while the most free-growing of the Ayrshires and hybrid multiflora ramblers willingly make swinging garlands. Roses are not so good for the complete pergola.

To come to the plants, and to take first the cases in which most shade is desired, with beauty of flower or foliage, the best are certainly Grape Vines, Aristolochia, Virginia Creeper, and Wistaria. They are all, except Virginia Creeper, slow to grow at first, but in four years they will be growing strongly. Vines should be planted a fair size, as large as can be had in pots, or two or three years will be lost at the beginning. Aristolochia, and especially Wistaria, though they grow fast when

FIG. 17.—ROSE ARCH. BY MR. ED. A. BUNYARD.

[To face p. 94.

Fig. 18.—Rose Arches. By Mr. Ed. A. Bunyard.

[To face p. 95.

established, always make a long pause for reflection at the beginning of their new life's journey.

It is therefore a good plan, when a pergola is planted with these as the main things for its future clothing, to plant at intervals several *Clematis montana*, or even the common but always beautiful *C. Vitalba*. These, especially *C. montana*, will make a fine show for some years, while the slower plants are making their first growth ; and as *C. montana* has in many soils not a very long lifetime, the best it can do will be over by the time the permanent plants are maturing and wanting the whole space. The Sweet-water Vines of the Chasselas class, known in England as Royal Muscadine, have foliage of excellent form that is beautiful in autumn with its marbling of yellow. The Parsley or cut-leaved Vine is another desirable kind. *Vitis cordata*, the sweet-scented Vine, has large wide leaves that give ample shade, and a strong habit of growth, and flowers that in hot sunshine freely give off their delicious scent; while for gorgeous autumn colouring of crimson and yellow the Vine commonly known as *Vitis Coignetiæ* is quite unequalled. There is also the Claret Vine whose leaves turn a low-toned red in late summer and autumn.

The height and width of the pergola and the width apart of the pairs of piers can only be rightly estimated by a consideration of the proportions of other near portions of the garden, so that it is only possible to suggest a kind of average size for general use. The posts or piers should stand from 7 ft. 2 in. to eight feet out of the ground when the piers stand from eight to nine feet apart across the path. In a garden where there is nothing very high close by, this kind of proportion, rather wider than high, will be likely to be the most suitable ; but there may be circumstances, such as a walk through a kitchen garden, where economy of space is desired, or when the pergola has to pass between tall trees at a little distance to right and left, when the proportion that is rather taller than wide had best be used.

In a whole or covered pergola, the pairs of piers would be further apart in the length of the walk than between the individuals of each pair *across* the walk, but in the open pergola, where there is no roof and either no connection or only garlands and level side rails—or garlands alone—they may stand closer.

For the open pergola without top, Roses are among the best of plants ; on one post a pillar Rose and on the other a rambler. A select list for this use would be: as pillars, 'Alister Stella Gray,' nankeen yellow ; 'Reine Marie Henriette,' red ; 'Climbing Aimée Vibert,' white ; 'Carmine Pillar' and 'Waltham Climber,' No. 1, reds ; and for ramblers, the 'Garland,' 'Dundee Rambler,' 'Bennett's Seedling,' and 'Madame Alfred Carrière,' all white or flesh white ; 'Crimson Rambler,' 'Reine Olga de Wurtemberg,' 'Longworth Rambler,' and 'Dawson,' reds ; as well as multiflora single and double, the large-flowered multiflora and *R. Brunonii*. To keep the bases of the piers clothed, some strong young shoots of the current year should be shortened so as best to cover the space, when, instead of making the whole length they would otherwise have attained, they will stop growing at the tips and throw their strength into preparation for flowering shoots at the lower levels.

Among some others of the best plants for the open pergola are the free Japan Honeysuckle, the common but always delightful white Jasmine, the new *Polygonum baldschuanicum*, *Clematis Flammula*, the little-known but quite excellent *Clematis paniculata*, blooming in October, the large-flowered Clematises, late Dutch Honeysuckle, *Cratægus Pyracantha*, *Rhodotypos kerrioides*, *Kerria japonica*, double flowered Brambles, and *Forsythia suspensa*.

There is another class of shady covered way made of flowering trees that differs from the pergola in that when mature it has no adventitious supports whatever, the structure being formed by the trees themselves. It may be of shade trees only, when it comes near the pleached alleys of our ancestors. For this the best trees are Plane, Hornbeam, Wych Elm, and Beech. The Planes should be planted ten to twelve feet apart, and pollarded at eight feet from the ground; their after-growth is then trained down to a temporary roofing framework of poles. In the case of this tree the sides are open. Hornbeam, Wych Elm, and Beech are trained as they grow to form both walls and roof. But many of the small flowering trees do very well trained as flowering shady ways, though when they have arched over and form a complete roof the flowers are mostly on the outer sides. One of the best for this use is Laburnum, but the beautiful Japanese flowering Apple (*Pyrus Malus floribunda*), the Snowy Mespilus, the Guelder Rose, the Siberian and other fruiting Crabs, are all amenable to the same treatment.

This leads naturally to covered ways of other fruit trees, and the delights of the fruit garden are much increased by the presence of a naturally formed pergola of Apple, Pear, Plum, Medlar, and Quince trees.

Some adaptation of the pergola, of a temporary kind, is also extremely useful in the case of a garden that is new and raw, or in some place that is held on a short tenancy, when the tenant wishes to enjoy shade without having to wait for the growth of long-lived and slow-growing plants. Any poles, from the hop-pole to the bean-pole size, put up as the framework of a covered way, can in one season be clothed with a grand growth of the great Orange Gourds, the Potiron rouge of our French neighbours. These, with others of the ornamental Gourds and quick-growing climbers, such as Japanese Hop, Major Convolvulus, *Mina lobata*, Canary Creeper, and the trailing Nasturtiums, will give ample shade in the hottest months and a glory of autumn fruit and bloom.

Plants that are suitable for the open pergola are equally suitable for verandahs, with the addition of some others of the tenderer kinds that will succeed in the shelter and warmth of the sunny house-front, especially in the southern counties. For here we may have, as in Devonshire, Cornwall, and the Isle of Wight, Fuchsia, Myrtle, Pomegranate, *Solanum jasminoides*, and *Solanum crispum*, and even a little further north the beautiful *Bignonia radicans* and the blue Passion-flower. Perhaps a well-grown Wistaria is the best of all verandah plants, for not only does it yield its masses of bloom almost unfailingly year after year, but its foliage is both graceful and handsome, and always looks fresh and clean.

It is well to think out various combinations for verandah planting that will give a good succession of flower. Thus, as one example, the

Fig. 19.—Rough Wooden Pergola.

[*To face p.* 96.

season of bloom might begin with Wistaria, or *Robinia hispida,* a capital shrub for this use; then in full summer would come white Jasmine and, later, *Bignonia radicans.* Wistaria, if allowed to grow at will, covers a very large space, but if rather closely pruned it can be kept within bounds and flowers with astonishing freedom.

The Ayrshire and rambling Roses are beautiful in their season on a verandah, but they have the disadvantage of being for one season only, and they cover so much space that but little room is left for any other plants.

FIG. 20.—SCHIZOCODON SOLDANELLOIDES. (*Journal of Horticulture.*)

THE GENUS CAMPANULA.

By Maurice Prichard, F.R.H.S.

[Read April 23, 1902.]

Perhaps no family of hardy plants is more generally admired than the Bell-flowers or Campanulas, presumably on account of the elegance and informality of their growth and wonderful freedom of flowering.

The greater number of the species are first-rate perennials; there are a few annuals and biennials and one or two greenhouse species. Very little care, however, is required to have most of them in perfection in the ordinary herbaceous border or rockery. An ordinary light garden loam suits them best perhaps, though many will succeed in stiff loam or in the sandiest peat; a little shade in the summer will help to keep the flowers in bloom.

As far as I know none of them are sweet-scented to any extent, but on the other hand they have no unpleasant odour. Several of the species are amongst the most useful of cut flowers, but are of such a character as not to admit of being easily packed up. They vary in height—from the giant *pyramidalis*, six or seven feet, to the diminutive little Alpine *cenisia*, two inches; but it should be remembered that climate and soil will often double the height of some of the species. For instance, *latifolia macrantha*, about three feet high at Christchurch in Hampshire, will attain a height of six feet in the northern counties. Some of the species grow well on a wall. June and July are the months when Campanulas light up the garden with their beautiful bells, mostly blue, a colour without them always most wanted in borders in summer.

Propagation is generally made by division of the crown in the spring as well as by seed, and also by cuttings of the choicer varieties in the month of May. In rare instances root cuttings may be resorted to.

A note before passing to the different species. The small tufted species should never be touched at the root while dormant, as they usually shrink to a very small size, indeed in the winter so much so that it is often difficult to find them, and they do not start into growth again till spring is well in. Most of them are very old plants; new species are seldom brought to notice. Hybrids in the last few years seem inclined to appear, and it may be fairly surmised that the beautiful rose colour of some of the forms of Canterbury Bell (*C. Medium*), a biennial, may before long become fixed in some of the perennial varieties.

I have roughly arranged the family into nine important groups, under the following names:—

1. Pyramidalis group.
2. Latifolia group.
3. Persicifolia group.
4. Glomerata group.
5. Carpatica group.
6. Rotundifolia group.
7. Muralis group.
8. Medium group (biennial).
9. Loreyi group (annual).

And in briefly noticing them I have thought it best to begin with the tall ones and pass gradually down to the most minute species ; but it must necessarily, from their number, be only a few passing notes. I have also endeavoured to confine myself to those I have personally known and grown, adopting the nomenclature of the collection at Kew.

The Taller Campanulas.

PYRAMIDALIS, the Chimney Campanula.—A well-known species, comparatively hardy in the open garden, but usually grown for green-

Fig. 21.—Campanula pyramidalis. (*The Garden.*)

house and conservatory decoration, a use it well merits. The massive bold pyramidal racemes are very lasting in character, and are usually produced in July and August. It is said that it acquired the name of the Chimney Campanula from its being often trained round bent stakes, fan fashion, and used as a fireplace ornament in summer. The Compact variety known as the 'Zion House' var. is of dwarfer habit, but useful. The white form is as handsome as the type. (Fig. 21.)

VERSICOLOR of Leichtlin.—A nearly allied species or a variety of *pyramidalis*. The plant produces masses of pale blue flowers with a darker zone surrounding a whitish centre ; the habit is not pyramidal but bushy, three feet high, and I can only liken it when in flower to a gigantic *Gilia tricolor*. They can be propagated from root cuttings and also by seed. Another method of propagation is to decapitate the crown in the autumn, when in the following spring many shoots will be found coming up, which can be easily separated.

LATIFOLIA.—A British hedge plant, very plentiful in Sussex, especially to the west of Steyning. The garden forms of it seem to be three in number, *macrantha*, *alba*, and the variety with whitish flowers and blue centre. The large blue corollas are always admired, and in good rich loamy soil the plant often attains a height of six feet. The finest examples of this species were once shown me in Hertfordshire, where I was called in to see some "curious Canterbury Bells," as the gardener called them.

I was greatly surprised to find a vast array of the white variety with the blue centre : it was a splendid sight. I could hide myself amongst them without bending. They were partly shaded by orchard trees (thinly overhead) and were close to the New River bank, which doubtless accounted for their unusual beauty and vigour. Propagation by seed and division.

LACTIFLORA.—One of the finest and most distinct of the perennial border species. When well established it often attains a height of six feet. Flowers pale blue, in dense umbellate panicles. The white variety seems to be a dwarfer but still very beautiful plant. Close to this species, and probably a variety of it, comes

CELTIDIFOLIA, rather more compact than *lactiflora*, but with dense broad panicles of rich blue bells. It ought to be found in every collection, as it keeps up the succession, coming in after the greater part of the species are passing over. Both this and *lactiflora* require to be planted at least two years before they attain their normal dimensions. The foliage of these two species is of a pleasing pale green.

BONONIENSIS.—A pretty species of moderate growth, with long profusely flowered spikes of nodding bells, both in blue and white. A really beautiful but little-known species. Height 2½ to three feet ; propagation by division and seed.

ALLIARIÆFOLIA.—Flowers white, pendulous on a one-sided spike ; foliage heart-shaped and covered with tomentum.

SARMATICA is rather like the preceding species, having pale blue bells with ovate foliage. Both of them grow from two to 2½ feet, and are desirable plants in the border.

PERSICIFOLIA.—The Peach-leaved Campanula. A very well-known plant, and one of the handsomest species, providing with its numerous varieties some of the most useful and decorative of all the perennials. The varieties are blue and white ; single cup ; saucer blue and saucer white ; double blue and double white ; and *gigantea alba plena* (*Moerheimi*). The last named is a good Dutch novelty, but I believe equally good forms have been raised by Mr. Ladhams at Southampton. The snow-white variety named *Backhousei* was an accidental find of Mr. Potter's in a cottage garden in Yorkshire. Height two to three feet. This species admits of division in spring or after flowering, and appears to do best in rich heavy soils, light soils often seeming to weaken its character. Seed is also produced plentifully in the type.

TRACHELIUM (*urticifolia*), the Nettle-leaved Campanula.—Flowers of various colours, the double white being especially pretty and lasting. Height 2½ to three feet.

FIG. 22.—CAMPANULA SCHEUCHZERI, VAR. ALBA. (*The Garden.*)

SPECIES WITH A GENERAL HEIGHT OF TWO FEET.

GLOMERATA.—A distinct native species, inhabiting our chalky downs, especially on Box Hill, near Dorking, where the height is scarcely above eight or 10 inches. The bells are arranged in an umbellate cluster or head, and in a lesser degree in the axils of the leaves on the stem. It is a rampant grower in any soil, but easily kept within bounds by timely division of the root. The garden forms are *dahurica* (syn. *speciosa*), of which there are three distinct varieties, *alba*, *pallida*, and *azurea* (syn. *aggregata*). The deep rich bluish-violet colour of *dahurica* is most

FIG. 23.—CAMPANULA ROTUNDIFOLIA SOLDANELLÆFLORA. (*The Garden.*)

effective. It should be massed in the border near Crimson Pyrethrums, *Hemerocallis flava* and *Inula glandulosa*, which flower at the same time in June; *pallida* often continues to flower till late in the autumn; *alba* is much smaller, not much over one foot in height; *azurea* (syn. *aggregata*) is also a compact-growing variety and a really scarce and beautiful plant.

GRANDIS.—One of the freest growing species, with broad bells, thickly arranged on terminal spikes. The white form is much recom-

Fig. 24.—Campanula thyrsoides. (*The Garden.*)

mended. The foliage is similar to that of the Peach-leaved Campanula. Height about two feet ; propagated by division of the root. This species should be tried in shady places, where I have often seen it doing well and making a bold show.

PATULA.—Flowers small, in loose spreading panicles, blue in colour, but not a perennial in the strictest sense, but it comes up abundantly round the parent plant from self-sown seed. Height one to two feet.

NOBILIS.—A Chinese species with creeping roots and large nodding reddish bells, spotted on the inside with white. The white variety I

FIG. 25.—CAMPANULA BURGHALTI PALLIDA. (*The Garden.*)

cannot distinguish from Mr. William Bull's *punctata*, which is a notoriously shy bloomer in Hampshire.

RAPUNCULOIDES.—This is a species which must *not* be placed in the mixed herbaceous border: it has drooping bells of a good deep blue in long spikes, but the creeping habit of its roots only fits the plant for the shrubbery border or the wild garden. Height two feet or more.

RHOMBOIDALIS.—A distinct and lovely Alpine species growing about fifteen inches high; flowers a good blue, in small loose clusters, half drooping. The foliage is small and slightly hairy. The variety *pallida* is rare and desirable, but for ten years I have not come across it.

SCHEUCHZERI.—A variable Alpine species with rich dark blue bells and narrow foliage. Height from eight to 15 inches. Flowers much larger than our English Harebell. (Fig. 22.)

ROTUNDIFOLIA (syn. *linifolia*).—The Common Harebell. Too well known to need description, but a charming little plant, seen in multitudes on grassy banks and often attractive even as late as October;

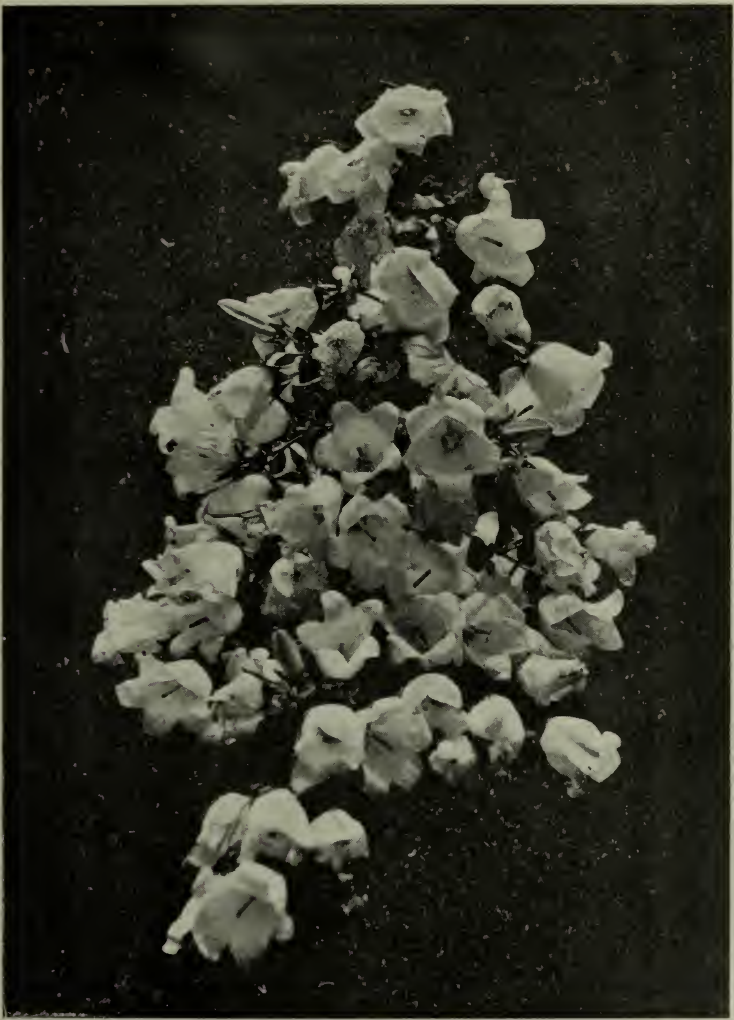


FIG. 26.—CAMPANULA MIRABILIS. (*The Garden.*)

it is lovely in masses in the wild garden. The white form is very pretty but rather difficult to propagate; we have up to the present been unable to strike it successfully or divide it well. The semi-double form of *rotundifolia* is in all other respects like the type.

HOSTII is an Alpine form with deep violet nodding bells on slender stems, a beautiful plant, but extremely variable, as I have observed, in its native home, where, of course, seed is the only natural way of preservation. The white form of *Hostii* is beautiful. Height eight inches.

SOLDANELLÆFLORA is a very rare old variety, seldom met with, having the corolla divided up into narrow fringe-like parts. It is an exquisitely beautiful variety, growing about 10 inches in height. (Fig. 23.)

FIG. 27.—CAMPANULA ABIETINA. (*The Garden.*)

THYRSOIDES.—A remarkable biennial species with densely flowered pyramidal spikes of pale sulphur flowers, each plant developing one spike only. I was much struck with this plant on the ascent of the Furkahorn. At 9,000 feet I saw several acres of it, and it appeared to be the only vegetation on one rocky slope—a wonderful sight for the botanist—but the plant is of no real beauty for garden-propagated seed. (Fig. 24.)

VAN HOUTTEI has very large rich blue pendent bells on spikes of about a foot to 18 inches high, and must be considered one of the best

FIG. 28.—CAMPANULA ALLIONII. (*The Garden.*)

border perennials in existence, moderate in growth and extremely floriferous. It is without doubt a hybrid, but I do not know the parentage.

PALLIDA (syn. *Burghalti*) is another hybrid with very long grey bells with chocolate-coloured buds. (Fig. 25.)

MIRABILIS.—A new species of great beauty, but not a perennial, dying after flowering. Report says that the collector Alboff believed the specimens he discovered at an altitude of 10,000 feet in the Caucasus were the last existing plants, but through Herr Max Leichtlin's exertions it is now pretty well distributed. Habit branching; foliage shining; flowers blue. It must be propagated by seeds. (Fig. 26.)

The Alpine Campanulas.

ABIETINA.—Cushions of delicate green, flowers rising eight inches on

Fig. 29.—Campanula Allionii. (*The Garden*

naked stems, almost solitary, of a soft grey blue. This species requires frequent division, or else it will be lost. I have found it somewhat shy flowering. (Fig. 27.)

ALLIONII.—Large solitary erect blue bells, practically resting on the cushions of green. This rare species grows freely in moist well-drained limestone soil; propagation by seed, or by cuttings, or by division of the roots in May. A native of the Southern Alps. (Figs. 28, 29.)

ALPINA.—Small rosette-like growth, with spikes of rich blue. I

FIG. 30.—CAMPANULA ALPINA. (*The Garden.*)

believe this rare species must be classed with the biennials, as flowering seems to utterly exhaust it. (Fig. 30.)

BARBATA.—A delicately beautiful biennial. The whole of the mouth of the bell is covered with fine hairs, like the mouth of a Goat-sucker. The white form is extremely pretty and easily grown from seed. The plant is very common in Swiss Alpine meadows at an altitude of from 2,000 to 5,000 feet. Height six to 12 inches.

CARPATICA.—This is one of the freest and most attractive of the

Fig. 31.—Campanula cenisia. (*The Garden.*)

large flowering dwarf Alpine Campanulas, very variable in size and height, but all the forms are first rate. The erect flowers are borne on branching stems, generally at a height of 10 to 15 inches. The white variety is equally good. *Pallida* is dwarfer and of an azure blue.

A variety called 'Riverslea' is a large-flowered spontaneous hybrid, raised from seed saved from a curious form found at Eastbourne by the late Mr. Robert Parker. The reputed parents, he told me, were *carpatica* × *isophylla alba*, and the wide, open, somewhat flattened salver-shaped blue corollas may perhaps be traced to the influence of *isophylla*.

CENISIA.—Very small, very beautiful, and, like *Elatines*, very difficult to manage. Sharp gritty loam in a well-drained fissure in the rockery

FIG. 32.—CAMPANULA ELATINES. (*The Garden.*)

seems to suit it; its great enemy is the slug. Height two inches, with erect bells. (Fig. 31.)

ELATINES.—A very rare, difficult, and beautiful species growing from four to six inches in height. The flowers, which appear in July and August, are bluish-purple, borne on a branched stem, and the leaves heart-shaped, downy, and deeply toothed. It requires a perfectly drained position on the rockery or, better still, on a wall. It may also be grown in rather large well-drained pots, a third of the pot being filled with stones covered with poor gritty loam and a little leaf mould. (Fig. 32.)

This plant must not be confused with *C. elatinoides*, which has an unbranched stem and much smaller very dark blue flowers.

Fig. 33.—Campanula excisa. (*The Garden.*)

EXCISA.—A rare plant and very distinct on account of the sort of holes cut out of the corolla at the bottom of each lobe. (Fig. 33.) The flowers are lilac-blue and nodding, each slender stem, five or six inches high, producing but one flower. It should have the same treatment as *Elatines* and *cenisia*.

FRAGILIS (syn. *Barrelieri*).—A tender species from South Italy with prostrate flower stems growing out horizontally from a perennial woody crown. It is beautifully grown by many cottagers as a hanging or basket plant, or may be planted out on the rockery in the summer and lifted again in autumn. It would probably make a splendid wall-crevice plant planted vertically. Autumn rains seem to seriously injure it. I believe there is no white form of this lovely plant. Propagated from cuttings.

GARGANICA.—Another Italian dwarf-habited bell-flower having

Fig. 34.—Campanula lanata. (*The Garden.*)

tufted growth and trailing flower stems of a deep blue colour with white centre: it is quite hardy in Hampshire. *Minor* is also one of the best crevice plants I know. *Hirsuta* (syn. *mollis*) has grey foliage, with masses of pale-blue flowers resting on the ground. Its white variety is rare and handsome.

HAYLODGENSIS is a charming hybrid from Hay Lodge, with a good deal of the *pumila* blood in its veins. Foliage pale green; flowers delicate pale blue.

ISOPHYLLA.—A highly decorative but tender prostrate species, said to be found on one rock only on a promontory on the west coast of Italy. I find it hardy only in vertical crevices in a limestone wall-like rockery; autumn rains seem to destroy all its vigour. The late Mr. Atkins used to grow it well on the open rockery in limestone soil at his elevated garden in the Cotswold Hills twenty years ago. The white form has now got extensively into cultivation as a hanging or basket plant, and is absolutely the best plant ever used for this purpose.

Amongst *isophylla* hybrids is *Mayi*, a very beautiful one brought to our notice two years ago: it appears to be quite hardy. *Balchiniana* is like the type, but with silver variegated leaves. It is, I believe, the only

Fig. 35.—Campanula Morettiana. (*The Garden.*)

variegated-leafed Campanula. It was raised from seed by Mr. Mitten, of Hurstpierpoint, from a cross made between the type and its white-flowered form, and this was the only plant that appeared. The stock passed into Messrs. Balchin's hands for distribution. The whole of the *isophylla* group are easily struck from the young growing tops. Any light soil seems to suit these *isophylla* hybrids, but they must not be considered any hardier than the type.

LANATA.—An exceedingly rare species with sulphur-yellow flowers, which, though first described in the *Acta* of the Hungarian Academy in 1837, seems never to have come into at all general cultivation. It grows to as much as 18 inches in height, and forms a pyramid of slender branches terminating in large bell-shaped blossoms filled more or less like *barbata* with long hairs. It is a true rock plant, and likes a full exposure to the sun. (Fig. 34.)

NITIDA.—A distinct little American species, with leaves in small rosettes, and having their edges frilled. The flowers are in spikes and like *isophylla* in shape. It is found in the blue and in white, and both single and double. Height six inches. Division in the spring is the best mode of propagation.

FIG. 36.—CAMPANULA MURALIS. (*The Garden.*)

MORETTIANA.—A very diminutive subject (fig. 35) with erect violet blossoms, one on each stalk. It is a difficult plant, but will thrive fairly well with the same treatment as advised for *Elatines*.

MURALIS (syn. *Portenschlagiana*).—This is rightly named the 'Wall' Campanula, for no plant will pierce the mortar of an old moist wall better than this. In ordinary garden soil it forms cushions of small toothed foliage of the brightest pea-green, completely covered with pale blue flowers of a most refreshing shade. Height four to six inches; any soil suits it. There is no white variety of this that I am aware of. (Figs. 36, 37.) The variety *major* (erroneously called *muralis bavarica*) first appeared in a consignment of *muralis* from the Southern Carpathians.

FIG. 37.—CAMPANULA MURALIS. (*The Garden.*)

It is larger in all its parts, deeper in colour, and is altogether an excellent plant. (Fig. 38.)

PULLA.—Of very dwarf creeping habit, with a rich deep indigo nodding bell. It grows rapidly in any light soil, but new stock should be struck from cuttings in May, for though the plant is a true perennial the tufts get weak after a time and gradually die out. Height six inches. A native of the Carpathian Mountains. (Fig. 39.) 'G. F. Wilson' is a handsome hybrid from *pulla*. (Figs. 40, 41.)

PUMILA (syns. *pusilla* and *cæspitosa*) is perhaps the commonest of all Alpine Harebells, but delicately beautiful, as it clothes the rocks and

FIG. 38.—CAMPANULA MURALIS, *var.* MAJOR. (*The Garden.*)

slopes in shaly soil and stony chippings in all the Alpine regions at altitudes of 3,000 to 5,000 feet. In England the white form is often met with, but during the whole of my visit to Switzerland in August 1899 I never saw a single white plant of it. It succeeds in any light garden soil. Height three to six inches. (Figs. 42, 43.)

RAINERI.—A rare species with small woolly foliage and huge erect flowers, and of a fine blue, quite distinct from *turbinata*, but often confused with it. Seedlings from it seem to grow much stronger than collected plants; hence the confusion. Height three inches. (Fig. 44.)

Fig. 39.—Campanula pulla (*left*) and C. abietina (*right*). (*The Garden.*)

TOMMASINIANA.—Very distinct indeed; very small linear foliage, very shiny; stems clothed with tubular lilac bells. A very small grower, but easy to manage in ordinary soil. Often erroneously sent out as *Tenorii* and as *Waldsteiniana.*

TURBINATA.—The true form has grey foliage scarcely rising above

Fig. 40.—Campanula 'G. F. Wilson.' (*The Garden.*)

Fig. 41.—Campanula 'G. F. Wilson.' (*The Garden.*

the ground, with large erect violet bells, and is one of the very best species known. Height six inches. Seedlings from it are very variable, and do not perpetuate the true species at all. *Pelviformis*, with pale almost flat bells, is extremely good, but growing about eight inches high. *Hybrida* is a good form, very free flowering. *Hendersoni* is a distinct pyramidal form, somewhat difficult to manage, but cuttings can easily be struck in May.

WALDSTEINIANA.—One of the most minute species, but very

Fig. 42.—Campanula pusilla. (*The Garden.*)

easy to manage in light soil. It has small stiff round grey foliage and light blue flowers, about half an inch in diameter. Propagated by cuttings and division of the little tufts in May.

ZOYSII.—The smallest of all the tufted Alpine Campanulas, and rather difficult to establish. Foliage pale green, with drooping pale blue corollas, cylindrical in shape. Sharp gritty granitic soil between rocks in the sun suits it well, but snails are always on the look-out for such a dainty morsel, and a good look-out must be kept for them. (Fig. 45.)

Other Campanulas and Allies.

CAMPANULA MEDIUM.—The common Canterbury Bell, a well-

Fig. 43.—Campanula pusilla (*centre*), C. muralis (*left*). (*The Garden.*)

known hardy biennial. The *calycanthema*, or Hose-in-Hose strain, is extremely beautiful, the rose-coloured variety being especially charming.

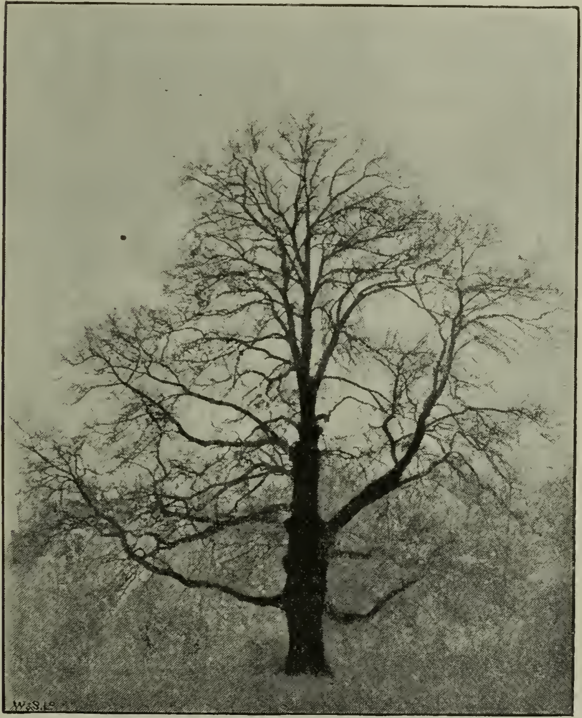
Genera closely allied to the Campanulas are *Platycodon*, *Wahlenbergia*, *Edraianthus*, and *Adenophora*.

Fig. 44.—Campanula Raineri. (*The Garden.*)

Fig. 45.—Campanula Zoysii. (*The Garden.*)

The *Platycodons* are among the most showy of late summer and autumn Bell-flowers.

PLATYCODON GRANDIFLORUM (syn. *Campanula grandiflora*). A Chinese species with white tuberous roots and flowers of deep rich blue, of a somewhat fleshy nature, and very large. Height one to two feet. *Album* or *pallidum* is a pale bluish-white variety with blue veins, and is extremely pretty and desirable. There are double and semi-double forms also. *Mariesi* is a very dwarf form with large erect bells. It is of Japanese origin and grows only about nine inches high. *Mariesi macranthum* is a splendid new form raised by Herr Max Leichtlin, 2½ feet in height, of firm, erect habit, with very large flowers indeed, and is extremely free-flowering. *Autumnale* is a very scarce tall late form, very desirable, and of a rich deep blue.



OUTDOOR FIGS IN WALES.

By J. Denman.

The result of the naturally warm atmosphere of North Wales is that the Fig (*Ficus Carica*) flourishes and bears fruit abundantly, especially if planted against or in close proximity to a wall. In mentioning walls it is not my intention to depreciate the various other methods of culture generally adopted, because instances have occurred in which the trees have done remarkably well when trained against a wooden or iron trellis. But the fact remains that Figs ripen their fruit better and bear, if possible, in greater abundance when planted against a wall, and as the instances which I have in my mind were cultivated by the latter method we shall ignore other principles and briefly consider—

1. The soil in which the Fig flourishes in North Wales.
2. The method of propagation usually adopted.
3. Pruning and training.
4. The application of manure and general cultural notes.
5. A brief list of varieties which have been duly experimented with and found to succeed on walls outside in North Wales.

Situation and Soil.

As I before mentioned, wall culture suits the Fig best in North Wales, but now comes the question, What aspect secures the best results? Undoubtedly a wall with somewhat of a southern aspect is to be preferred, and failing this a south-west exposure. After careful observation I observe that a south wall encourages too rank growth, and, further, the trees are more liable to be damaged by frosts during winter, so that, all points considered, a south-western exposure gives the best results, both as regards the fruit and also the general state of the trees during winter. The Fig is characterised by its luxuriant growth; especially is this the case if it is planted in rich soil, such as is generally found in gardens. This fact, then, teaches us (*a*) that the site must be specially prepared, and (*b*) that the roots must be prevented from extending too much, for if allowed to wander freely they will grow too luxuriantly, to the detriment of the crops.

In order to check the too free rooting of the Figs, and to induce them to make short-jointed wood, we must have recourse to special arrangements. I find that no method secures better results than constructing rough chambers, about three feet to four feet square, in which the roots have sufficient but not too much space to spread. When allowed to grow at will the roots have a tendency to develop strong laterals instead of a mass of fibrils, which so materially helps to produce a satisfactory crop. Some cultivators build brick chambers lined, except at the bottom, with cement; but this precaution is not only unnecessary, but costly; therefore after excavating, the inside should be lined with slates, set end on end, and the bottom may be inlaid with rough pieces of slates or tiles. But here a double layer should be placed, so that no opening is left for the roots to extend into the cold subsoil.

After a suitable site has been selected the next consideration must necessarily be that of a fitting soil in which the Fig will flourish and bear fruit without an over-luxuriant growth. I am convinced that the principal cause of failure as regards the growing of Figs in Wales and elsewhere may be attributed, not only to an unsuitable situation, but also to giving them far too rich a soil, which over-stimulates them, especially if they should happen to be young. What class of soil is used in the cultivation of the Fig in Wales? Perhaps I shall be best understood if I describe the natural soil which is found here. It is what may be described as a clayey loam resting upon a substratum of peat. Now Figs would thrive in this soil with hardly any extra preparation; but to be doubly sure the excavated chambers should be filled with a compost consisting of fibrous loam, old mortar rubble, and road scrapings in equal proportions, a little sand being added to keep the whole mass porous and sweet. The absence of manure will be instantly detected; but now comes the explanation. It is best to add no manure to the *soil* except in the form of liquids, applied when necessary, for reasons before stated. I may be too emphatic in advocating a poor soil, but after seeing so many trees become worthless through a liberal use of manure I must view this matter in a light which experience has proved to be correct.

I hardly need to add that a thoroughly dry bottom is indispensable, and before this end can be attained the subsoil must be thoroughly drained, so that no superfluous moisture is allowed near the tender roots The cultivator who possesses a natural substratum of chalk may be considered fortunate, for success is almost guaranteed under such circumstances, as it not only supplies ample drainage, but also prevents undue extension of the roots.

Approved Methods of Propagation.

Although Figs are propagated from seeds, layers, cuttings, suckers, and by grafting, it is of the three former methods that I shall speak. Propagation from seeds is adopted more with a view to obtaining new varieties than with an intention of continuing the same varieties in their primitive state. Mr. Loudon conjectured that some curious person may yet discover a mode of cutting out the male blossoms without destroying females, in which case the pollen from another variety may be introduced to take effect alone. But as this much-to-be-desired operation has not yet been achieved we shall simply state that in order to procure approved seedlings the seed, obtained from thoroughly ripened fruits, must be sown about February or March in a compost of light sandy loam and plunged in a hot-bed until it germinates, after which the seedlings may be transplanted into small pots and kept near to the light in order to obtain strong short-jointed plants. Repeated transplanting will keep them in a continual growing state and also ensure perfect health. The one drawback, as regards propagation from seed, is that the plants will probably not produce fruit for a period of six or seven years; but even this is counterbalanced by the probability of raising new and improved varieties which will be still hardier than those now in existence.

As regards the second method under consideration, viz. "Layering," it is a species of multiplication much in vogue, and one to be encouraged on account of its simplicity. It is best, if possible, to layer the plants under glass, although I have seen it practised with success outside. The plants to be operated on should be in pots, and the shoots bent down, a small notch being cut below a joint upwards and pegged down into small pots or boxes of sandy soil, a stake being used to keep the layer upright and to facilitate the formation of roots. When well rooted, the connection should be severed and the young plants potted singly in a suitable compost and kept continually growing for the first year. Fruit may be obtained the second or third year from trees raised by this method.

Propagation by means of cuttings is, after all, the best and easiest method, especially when trees are required in a short time. The shoots selected should be from eight to twelve inches long, well ripened, short-jointed, &c. It does not matter whether the cuttings are provided with a heel of the older wood or not, but the base must be smoothed over, and the cuttings afterwards inserted singly in 3-inch pots of sandy soil and placed on a moderate hot-bed to root. Supposing they were inserted in March, the cuttings will have sufficiently rooted by the end of the year to fit them for final planting the following spring. Care should be exercised to rear the plants with a single stem until they are about eight inches high, when laterals should be encouraged to ensure a regularly developed specimen.

Training and Pruning.

The usual method of training the Fig in North Wales is either perpendicular or fan form. Of the two the latter may be considered the better, not only as regards the general appearance of the tree, but in the production of fruit. Great care should, however, be taken to train the trees when young so as to ensure a symmetrical form and a well-clothed appearance towards the base. For this reason the branches should be kept well pinched back before they commence fruiting, and the leaders must not be allowed to make too much headway until the actual appearance of the base of the tree has been duly considered. As a rule, free-bearing varieties may be trained to suit the cultivators, but the shy growers and fruit bearers must be carefully and intelligently handled before they can be induced to make satisfactory growth.

As regards the pruning of the Fig it may be well to state that in this operation one must be guided more by actual circumstances than a too hard and fast rule. In North Wales, for instance, the method is not the same as that practised in South Wales; therefore I must explain the procedure which it is necessary to follow in order to secure a normal crop of fruit. I mentioned that the operator must be guided by circumstances. Now in order to reduce the risk of killing the trees to a minimum, pruning is best done in summer, because the cutting off of branches when in a deciduous state is attended by profuse bleeding from the wounds, and should frost then occur the tree will in all probability be killed. All that is required when pruning established trees is to cut out all vigorous shoots that are not required to lay in, also superfluous branches, preferably the older laterals, retaining the younger wood, as it is on such that fruit is borne. The fruit-bearing branches should be stopped in August to encourage the ripening of the fruit already formed, and also to induce the formation of fruit for the ensuing season.

The Application of Manure and General Notes.

As before mentioned, the soil in which Figs are grown must be destitute of manure, *i.e.* in a solid form; but although I advocate this it must be strictly understood that in order to facilitate the swelling and ripening of the fruit the trees must be supplied with liquid manure, and that, when the fruit has started to swell, administered frequently until signs of ripening are perceived. The manure is best when applied in the form of the drainings of dung heaps at the rate of one part to three parts of water.

It is seldom that the frosts in this locality register enough to seriously damage the trees, but I know of some instances in which a few specimens were cut down by a hard frost of twenty degrees simply because they had been but recently pruned; therefore this fact points out a moral applicable to all parts: prune Fig trees only in the summer by disbudding superabundant shoots and suppressing over-luxuriant laterals. "Prevention is better than cure;" therefore I find it best to roughly protect the trees during winter by the simple and primitive method of covering with fronds of the Common Fern (*Pteris aquilina*), which being light are not so liable to injure the buds by being blown about as would a heavier substance. It must be understood that the less protection Figs have, consistently with safety, the better, as it shades the buds too constantly from the light, the consequence being an unsatisfactory crop of fruit; all that is necessary is to provide against the fluctuating cold and frosty winds of winter, the coverings being left on for as short a period as possible.

The following varieties on trial have proved quite hardy and free-bearing when trained on walls outside in various parts of North Wales:—

Brown Ischia, a medium light brown fruit, the flesh sweet and highly flavoured.

Brown Turkey, large, very luscious, very prolific; the best variety of all for outside culture.

Brunswick, a very large brown fruit, very rich and excellent; a free bearer.

Castle Kennedy, large, green, yellow; hardy but not over-prolific.

Reculver, small purple fruit, very hardy.

White Marseilles, medium size; flesh melting and juicy; the second best variety for outdoor culture.

From the above it may be seen that Fig growing outside in North Wales may well be encouraged. A list of six varieties of hardy fruit affords ample scope for choosing those that are found to succeed best in each locality. As a last word it may be well to state that the less "coddling" given to the trees the better; simply attend to the main points of culture and leave the rest to nature, and the result will be success in the cultivation of the most delicious fruit extant.

THE SYCOMORE FIG.

By Rev. Professor G. Henslow, M.A., V.M.H., &c.

There is an interesting fact about the fruit of *Ficus Sycomorus,* the Alexandrian or Egyptian Fig, which is not generally known, and has some antiquarian interest. I refer to the custom of cutting off the top of the fruit to render it edible; for like the Caprifig, or Wild Fig (*Ficus*

a *b* *c*

Fig. 16.

Carica, var. *caprificus*), the fruits are infested by a minute wasp (*Sycophaga crassipes*, West).* There are not two forms of the Sycomore Fig, but every fruit appears to develop myriads of wasps.

* I am indebted to Rev. T. A. Marshall, Botus Fleming, Hatt, Cornwall, for identifying the insect, which he regards as synonymous with *Blastophaga grossorum* of the Caprifig.

I am indebted to the late Dr. E. Sickenberger, Professor of Chemistry and Botany at the School of Medicine, Cairo, for the following particulars, and also for the three instruments used for cutting the Figs, represented by the figures.

"The Sycomore Fig bears fruit three times a year, viz. in May, June, and in 'Nitz,' that is, August and September. The first two have naturally no pleasant flavour. The fruit of May and June are opened by a knife in a circular manner in order to let out the Sycophaga. The fruit which are opened remain small, but become very sweet and of a pleasant taste. Those which are not opened become three to four times larger in size, but are watery and tasteless, being full of Sycophaga. Both of these first two generations of Figs are cut circularly. It is done by boys, who cut off the 'eye' with a kind of tailor's thimble, made of a piece of twisted ribbon-iron sharp on one edge, or else the iron ends in a bent spathula-like process, something like a curved finger nail. (Fig. 46.*)

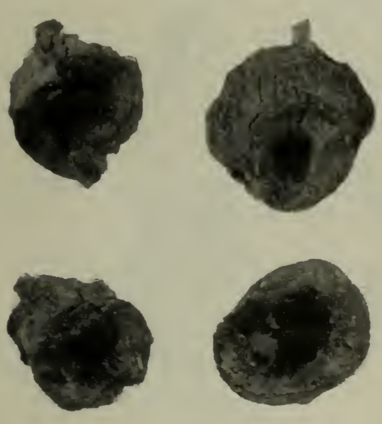


Fig. 47.—Figs cut open. Natural size.

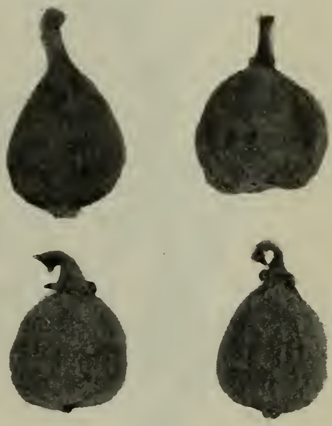


Fig. 48.—Figs uncut. Natural size.

The operation is only made upon the fruits which are fit to be picked the following day.

"The day after the operation the Fig is quite 'mature' and full of living Sycophaga. The male flowers are all aborted, and the female have never any perfect seeds. (Figs. 47 and 48.)

"The third generation consists of larger Figs of an agreeable taste and sweet-scented. They are not operated upon, only because in August and September, though the trees are much fuller of fruit than in May and June, the people have so much to do at that time. They are seldom sold, and only eaten by the owners of the trees, or else they are abandoned to the field mice, birds, and dogs, which latter are very fond of them. These 'nilg' fruits are also full of Sycophaga.

* Fig. 46 *a* corresponds closely with the description given by Theophrastus and quoted by later writers. The "hook" is fixed in a wooden handle. This specimen came from Damietta; but it is a form which is now generally replaced by *b* and *c*. It will be observed that these two are derived from *a* by converting the hook into a complete ring; *c* only differs from *b* by being made entirely of iron. The edge on the left-hand side is sharp, that on the right being blunt, as it is not used for cutting.

"I have never seen a seedling Sycomore Fig in Egypt, nor a fertilised germ. On the other hand, Dr. Schweinfurth has found in Yemen that the country is full of young Sycomores germinating from self-sown seeds; and he thinks that it is indigenous there, but not in Egypt."

The Sycomore Fig must have been introduced at a very early age into Egypt, for the wood was commonly used for the mummy cases; and the tree itself was adopted in the Egyptian cult as the "Tree of Life." It is figured on the walls of the temple of Thothmes III. at Karnak, being represented as dedicated to Hathor, and is here reproduced. (Fig. 49.)

With regard to the antiquity of this custom of cutting open the Figs,

Fig. 49.—The goddess Nuît in her sacred Sycomore bestowing bread and water of the next world.

it is interesting to find that the modern practice in Egypt appears to have been customary many hundreds of years ago. Thus the prophet Amos described himself (vii. 14) as "a gatherer of Sycomore fruit" (A.V.), or "a dresser of Sycomore trees" (R.V.). But the Hebrew expression bālas siqmīm is rendered by the LXX. *κνίζων συκάμινα*, and by the Vulgate *vellicans sycamina.*

The writers of the Septuagint appear, therefore, to have been familiar with the process as described by Theophrastus, who writes: *πεπτεῖν οὐ δύναται ἂν μὴ ἐπικνισθῇ· ἀλλ' ἔχοντες ὄνυχας σιδηροὺς ἐπικνίζουσιν· ἃ δ' ἂν ἐπικνισθῇ, τεταρταῖα πέπτεται* ("Hist. Pl." iv. 2). Pliny also writes as follows ("Nat. Hist." xiii. 14): "It bears fruit not upon the branches, but upon the trunk itself. The Fig is remarkable for its extreme sweetness and has no seeds in it; also for its fruitfulness, which, however, can only be ensured by making incisions in the fruit with 'finger nails' of iron, for otherwise it will not come to maturity. But when this is done it may be gathered within four days; immediately upon which another shoots up in its place. Hence it is that in the year it produces *seven* * abundant crops; and throughout all the summer there is an abundance of milky juice in the fruit. Even if the incisions are not made, the fruit will shoot afresh four times during the summer, the new fruit supplanting the old and forcing it off before it has ripened."

It will be noticed that while these ancient authors thought the "sweetening" indicated "ripening," it is in the sense of being "edible,' as no seeds are produced, in Egypt at least, now, any more than as Pliny records. The real purport is to rid the Figs of the Sycophaga, the sweetening being a secondary result.

With regard to the etymology of the Hebrew word bālas,† I have to thank the Chief Rabbi, Dr. Adler, for the following communication: "Bālas [in Arabic and Æthiopic, 'a Fig']—'cutting in' or 'nipping' into the Mulberry Fig, or Sycomore, in order to hasten their maturing, according to Pliny and Theophrastus—was an employment probably of shepherds (Amos vii. 14).

"With this verb the roots *paratz* and *parak* may be related with the English 'break,' as *l* and *r* are interchangeable. Dr. Davies in his 'Student's Hebrew Lexicon' gives a similar interpretation." ‡

* This seems doubtful.

† This word occurs nowhere else in the Old Testament.

‡ Gesenius in his *Lex. Heb.*, and Bochart in *Hieroz.* i. 384, ff., Smith's *Dict. Bib.* (*s.v.* Sycamore), vol. iii. 1394, and Pusey on Minor Prophets all follow the old writers, but add nothing new.

CLASSIFICATION OF PLANTS BY EVOLUTION.

By Rev. Professor G. Henslow, M.A., F.L.S., V.M.H., &c.

[Lecture delivered May 6, 1902.]

In a previous lecture on "The Making and Unmaking of Flowers" (Journal H.S., vol. xxvi. p. 115) I endeavoured to show how in their evolutionary history flowers had passed from extreme simplicity, as those of a Fir tree, to various degrees of complexity in ordinary flowering plants, often becoming highly "irregular," as of the Salvias.

Then by processes of degradation many flowers become simpler again, until they may be represented by a single stamen, as in Spurges, or by a pistil only.

In the present lecture I propose showing how these differences resulting from evolution provide systematic botanists with the materials for classification.

The doctrine of evolution maintains that all animals and plants now living have been derived from pre-existing ones ever since the first living beings appeared on this earth.

How they first came into existence is at present unknown and inconceivable. There is no evidence of any kind whatever of any "spontaneous" generation of living things; and how "protoplasm," or the "physical basis of life," as Huxley called it, can have arisen out of inorganic materials is at present unthinkable. Monists, who so name themselves from their idea of there being "only" matter and force, without any personal mind or other intelligence behind nature, say that if evolution be true, then life *must* have come out of the mineral kingdom. But science knows nothing of such a "must" in nature. Observation and experiment are the only means of investigation open to scientists. Inductive evidence and experimental verification are their only methods of proof.

Many evolutionists have looked at the lower forms of Algæ as possibly representing at the present day the forerunners of plant life in general; but we cannot be certain whether existing forms are "primitive" or "degraded;" for even some flowering plants growing in water of a high temperature have acquired a strong resemblance to seaweeds.* Whichever they are, they have had a world-long ancestral history of which we know nothing.

I propose, therefore, to pass over all the lower Cryptogams until we reach the highest groups, such as the Fern family.

We must now consider how evolution works in producing the limitless numbers of beings on the face of the world. In the first place, it soon becomes obvious that there is not, nor ever has been, any and only a linear series either among animals or plants, but there have been continual branchings off from the main stock, and then successive branchings have again risen from these; so that if all beings were known, past and

* *Podostemaceæ.*

present, their genealogy would prove to be as elaborate as the branching and twigs of a large tree. Only, instead of reproducing the same form over and over again, as of the flowers of a tree, all the buds of each year in succession must be imagined to be different from those of the preceding year on the same branch. For variations of structure arise in consequence of the seedlings or young animals varying as they grow to maturity. This they do (if they vary at all) on a change of environment or of "the conditions of life," as Darwin frequently expresses it.

The process we now accept was described by Darwin as follows: "If we ask ourselves why this or that character has been modified under domestication, we are, in most cases, lost in utter darkness. Many naturalists, especially of the French school, attribute every modification to the *monde ambiant*, that is, to a changed climate, with all its diversity of heat and cold, dampness and dryness, light and electricity, to the nature of the soil, and to varied kinds and amount of food. By the term 'definite action' I mean an action of such a nature that when many individuals of the same variety are exposed during several generations to any change in their physical conditions of life, all, or nearly all, the individuals are modified in the same manner. A new sub-variety would then be produced *without the aid of natural selection.*" *

As soon as the offspring are dispersed—for migration, as a rule, is essential—evolution begins. It is due to these two factors: (1) the direct action of external forces of the environment, such as food, climate, &c., or the *monde ambiant*, upon the organisms, and (2) a responsive power, which the living protoplasm possesses, so as to be influenced by them. The protoplasm and its nucleus then build up cells, the cells form tissues, and the tissues organs in direct adaptation to the new conditions of life.

Thus the plant shows differences in roots, stems, leaves, &c. from its parent.

In the next place, having acquired new structures, if the plant and its descendants continue to live for several generations under the same conditions and influences, the characters become "fixed," as horticulturists well know, and then they become hereditary, until, of course, fresh changes induce new variations to arise; but they will be, in part, superadded on the modifications of the previous ones.

* *An. and Pl. under Dom.* vol. ii. p. 271. With reference to "Natural Selection" it is true that Darwin thought that the action of the environment was generally "indefinite" and not "definite," as described above; by which he meant that *all* or most of the offspring of a plant or animal would vary in all sorts of ways, or "indiscriminately" as Romanes called it; so that one, two, or few individuals which were *perchance* better adapted to the new conditions would survive, while all the rest would perish.

This was called the "struggle for existence, the fittest only surviving." Unfortunately no evidence has ever been forthcoming in nature in support of this latter view; whereas the former, or the "definite action" of the environment, is universally true. The real function of natural selection is the bringing about the *Distribution of Animals and Plants.* Thus, if the seeds of, say, fifty different plants be sown together, an intense struggle for existence takes place among the seedlings; many of the *weaker* ones die. In a few years not half that number of species will have maintained their existence.

In this struggle for life it is those with the *strongest constitutions* which are "best fitted to survive," as they will have ousted the others. That is all natural selection can do; but it takes no part in the *origin of new variations of structure,* upon which *alone* varieties and species are based.

Hence those which one calls "hereditary structures" are only such as have originated as varietal, but have become fixed in the constitution of the being.

It may be somewhat difficult to see this going on in nature, but it may be abundantly witnessed under cultivation, and proved experimentally; but in nature the proof is not less convincing, though it be based on inductive evidence alone.

I will now consider the alterations in the structure of flowers brought about by adaptation, *i.e.* evolution in detail. We may group them as follows:—

1. *Freedom* of the parts of whorls precedes their *cohesion* and *adhesion*.

2. *Freedom*, associated with a *spiral* arrangement of an *indefinite* or many parts in a floral whorl, precedes their reduction to a *definite* number (1 to 12) which becomes verticillate in arrangement.

3. An ordinary floral receptacle precedes a receptacular tube, or any lateral expansion of the floral axis.

4. The freedom of the receptacular tube from the ovary precedes its adhesion to the latter.

Obs.—Reversion may take place, in which an "inferior" ovary may become "superior."

5. Regularity of a whorl precedes irregularity.

Obs.—Reversions to regularity may take place in irregular flowers.

6. Symmetry * precedes asymmetry by arrest of parts.

7. All arrest of parts is of later occurrence in flowers and often the cause of asymmetry.

8. Enations are of later origin than other parts in the structure of flowers.

9. Unisexuality among normally bisexual species is a later production; though unisexuality was (as far as is known) the primary condition of flowers.

These "principles," if we may so call them, must now be considered more in detail.

1. Freedom.—Commencing with the class *Dicotyledons*, its orders have long been arranged in four *Divisions* at least. The first is called *Thalamifloræ*. In this the petals are free from one another, and arise directly from the floral receptacle. The corolla and stamens are said to be "hypogynous," as arising from under the ovary.

Ranunculaceæ has been placed the first in the series. This order illustrates entire freedom among all the parts of the flower. One genus only, *Nigella*, has its five carpels coherent into a capsular fruit. Some have no corolla at all, as *Clematis*, *Anemone*, and *Caltha*, thereby indicating a more primitive condition. Lastly there are usually many stamens and carpels spirally arranged.†

The question now arises, How did a corolla appear?

That petals arose out of stamens is obvious from numerous instances,

* "Symmetry" in botany signifies that two or more whorls have the same or multiples of the same number of parts.

The term would be more useful in application to regular (radial symmetry) and irregular flowers (bilateral symmetry).

† The following are some other orders having the petals free and numerous parts often spirally arranged: *Nymphæaceæ*, *Magnoliaceæ*, *Rosaceæ*, *Alismaceæ*.

as explained in my previous lecture; as another instance *Atragene alpina* (allied to *Clematis*) may be added. In this flower a groove on the filament secretes honey, and a transition from stamens to petals can be easily traced, all being enveloped in the four large purple sepals. In these respects *Atragene* shows an advance upon *Clematis*. What brought it about? The theory the present writer would propose is that the developing of the honey-secreting surface on the filaments, and their alteration to petals, are the direct consequence of the irritations set up by the bees which visit this flower for pollen and honey.

Protoplasm is a highly "irritable" substance and "responds" in many ways to external influences, including mechanical weights, pressures, tensions, &c., and the theory is based on *innumerable coincidences* coupled with much *experimental evidence*.* Thus honey-secreting organs are always precisely where the proboscis or tongue of the insect can most easily reach them; and as in accordance with evolution nothing is ever made in *anticipation* or for direct use of any other being, we know of no other *cause* than the actual probing of the insect itself. Thus, we find the sepals producing honey in the Lime, the petals in Buttercups, Columbine, Larkspur, and Aconite, the stamens in *Atragene*, the carpels in Caltha, &c. But in the great majority of instances, as the proboscis goes down to the receptacle, it is *this* which produces glands, as, *e.g.*, two in Wallflower, five in Geranium, an entire disk in Maple &c.

The formation of honey-secreting glands &c. and the conversion of stamens into petals are, then, the first supposed results of insect agency.

The next to be considered is the "cohesion" which often takes place between the parts of a whorl. It is particularly conspicuous in the corolla; we thus get "tubes" and "bells," as in the Primrose and Campanula &c. It is believed that the freedom of parts always preceded such unions; as leaves on a shoot are always free.

2. Primitive flowers, such as the Buttercup, have often numerous stamens and carpels spirally arranged, after the manner of leaves on a shoot. These, as is well known, are arranged in "cycles" or groups of 2, 3, 5, 8, &c., and a long spiral of many stamens or carpels of course means several "cycles" of such parts; and the reduction to one or two cycles is one of the commonest features in flowers. In Dicotyledons the whorls are usually in fives or fours, and in Monocotyledons in threes.

The number of carpels is usually further reduced. Thus, while a Geranium has 5 sepals, 5 petals, 5 + 5 stamens (*i.e.* in two whorls), and 5 carpels, a Potato blossom has only 5 stamens and 2 carpels.

The reduction of carpels is common with high specialisation. Thus in the two "irregular" flowers of Aconite and Larkspur the carpels are reduced to 3, 2, or even 1; yet both these belong to *Ranunculaceæ*.

3. The floral receptacle is usually only a rather enlarged summit to the pedicel, or flower-stalk, as in a Buttercup. It becomes very large in a Strawberry in order to carry the numerous fruits (achenes).

In addition to this terminal expansion it may extend laterally round the pistil in the centre. This is called the "receptacular tube," and assumes various forms. Its primary function is to secrete honey. This

* The reader is referred to *The Origin of Floral Structures* and *The Making of Flowers*, by the present writer.

may be well seen in the flower of the Raspberry, in which the "tube" is more like a little trough within the stamens; but in the Cherry or Peach blossom it constitutes the formerly so-called "calyx-tube,"* and is lined with a honey-secreting surface. As the petals and stamens are thus carried away to some little distance from the pistil, they are called "perigynous," *i.e.* "around the ovary." In the Rose it appears to have lost its power of secreting honey, but forms the scarlet hep in the autumn.

In some flowers the floral receptacle develops several isolated "honey glands" (five in Geranium), or else a complete ring or cushionlike structure, so that some botanists intercalate the group *Disciflorœ* after *Thalamiflorœ*; but this must not be confounded with the receptacular tube, which contains all the fibro-vascular bundles belonging to the sepals, petals, and stamens, whereas a honey-disk is only a cellular outgrowth of the superficial tissues containing no such bundles.

4. The next step is seen in those flowers in which the receptacular tube is partly *adherent* to the *ovary.* This latter is then said to be "half inferior" (such occurs in *Saxifraga granulata*, Gloxinias, &c.); but if the adhesion be completely to the top of the ovary—the usual condition—then the ovary is "inferior," the calyx-limb, petals, and stamens arising from the top of the ovary.

The calyx is then "superior," but the petals and stamens are called "epigynous," *i.e.* "upon the ovary."

This condition is seen in Ivy, any umbellifer or composite &c.

Sometimes the summit of the receptacular tube spreads out above the ovary; it then carries the sepals, petals, and stamens to a distance, and the latter may be called perigynous, with a superior calyx. This condition is seen in Apple, Pear, and Currant.

The cause of this adhesion, as well as of the receptacular tube itself, is *supposed* to be due, primarily, to the irritation of the tissues incited by insects. But the theory awaits confirmation, and also possibly to be supplanted by some better one in the future, if such can be discovered.

All the orders possessing free petals, together with this receptacular tube, whether free from or adherent to the ovary, form the division *Calyciflorœ.*

Next follow all the orders in which the petals are coherent. They constitute the division *Gamopetalœ*, i.e. "petals united." A few have the ovary inferior, but in the majority it is superior.

The *Compositœ* thus represent the highest type. A floret has a gamopetalous corolla, coherent anthers, and stamens adherent to corolla.

On the other hand, the pistil is reduced to a one-ovuled two-carpelled ovary, and the calyx to a pappus or is wanting. A rudimentary calyx is the ruling condition whenever flowers are densely crowded.

5. Regularity characterises early types of flowers.

That all irregular flowers have descended from regular ones is to be inferred—first, from such a fact as that Larkspur and Aconite are the only two genera of the large order *Ranunculaceœ* which have irregular flowers; secondly, that plants normally bearing irregular flowers often produce

* It was at one time regarded as being the lower part of the calyx; in some flowers both seem to take part in it.

regular flowers, especially as terminal ones, under cultivation. Such flowers then resemble the normally regular ones Thus Salvias produce regular trumpet-shaped blossoms; members of *Leguminosæ*, instead of having the usual papilionaceous corolla, produce flowers like those of the Rose family &c. Such are regarded as "reversions."

For theoretical considerations as to how irregular flowers came about, I must refer the reader to what I have said elsewhere.

6. With regard to alterations in symmetry, I have referred to the very general reduction of carpels, so that while the outer whorls may be quinary, the pistil may be, and often is, reduced to two carpels, as in so many of the *Gamopetalæ*.

But it often happens that the principle of compensation comes into play, so that while some parts degenerate and vanish others alter in size or form. Thus while in Mulleins (*Verbascum*) we find the size of the five stamens decreasing from the front to the back of the flower, in most of the genera of the same order (*Scrophularineæ*), as well as of *Labiatæ*, the fifth or posterior stamen has become totally arrested, and the two posterior stamens are with rare exception shorter than the two anterior.

Again in the minute yellow disk florets of a Daisy there are both stamens and pistil, but in the larger white ray florets (though the corolla has really lost two petals in the change, the other three being greatly enlarged) the stamens are totally arrested, those florets being female only.

7. As special instances of "arrest" it may be seen how the calyx is more or less reduced or vanishes when flowers are borne in clusters. Such occurs in British *Rubiaceæ*, *Dipsaceæ*, *Compositæ*, *Umbelliferæ*, Rhododendrons, &c. On the other hand in the *Incompletæ* it is the corolla which is usually wanting; we then generally find the stamens opposite the sepals, indicating a lost intermediate whorl of petals, as in Nettles, Daphne, &c. Such are believed to have been derived by processes of degradation from orders having petals. Thus Nettles are allied to Mallows, Daphne to Roses, &c.

In Cornflower (*Centaurea*) the ray florets have their corollas much more greatly enlarged; but this is done at the expense of the pistil as well as the stamens; hence it is neuter and sexless. A similar process is seen in Guelder Rose and Hydrangeas.

The "cohort" or group of orders known as *Amentales*,* from the general presence of "catkins" (*amentum*), appears to represent primitive forms. Alder is the only one which seems to have arranged its bracteoles of the male flower into a whorl; all others have nothing to indicate a calyx except perhaps Poplar. Of these one is inclined to regard *Casuarina* (the beef-woods of Australia) and our Sweet Gale (*Myrica*), of which there are several species in South Africa, as representing the earliest types, though the actual links with Gymnosperms are absolutely wanting.

All other members of the *Incompletæ* are probably degradations from plants which possessed both calyx and corolla.

* This group includes the following orders: *Betulaceæ* (Birch and Alder), *Plataneæ* (Plane), *Myricaceæ* (Sweet Gale and *Comptonia*), *Casuarina* (Beef-wood), and *Salicaceæ* (Willow and Poplar).

8. "Enation" is a word applying to any part of a flower which is developed last, or later than the organ itself which bears it.

Thus when the flower of the Toadflax (*Linaria*) has its corolla nearly complete, the spur is added, so that the corolla *at first* resembles the permanent pouched form of Snapdragon (*Antirrhinum*), until the pouch elongates into the spur.

9. When unisexuality appears in plants whose allies of the same order or genus are all or mostly bisexual, it is a legitimate inference that the former condition is a subsequent occurrence. Thus, in the degraded tribe *Poterieæ* of *Rosaceæ* we find Salad Burnet has two sexes, the upper flowers of the head being female, and the lower ones bisexual or male.

The causes of unisexuality from bisexuality are obscure and may occur anywhere in the orders of flowering plants.

Before giving a list of classificatory terms in the order of evolution it will be as well to state that the botanists are firmly convinced that the flowerless plants were the forerunners of Gymnosperms or "naked-seeded" orders. Ferns, *e.g.*, appear to have led off to Cycads; but other groups may have supplied links to existing and extinct Gymnosperms; but I need not repeat what I have said before, only referring the reader to my paper on the "Making and Unmaking of Flowers."

We may now tabulate the results hitherto sketched out as representing the probable order of evolution, each group in succession having given rise to the next, though the links may now be wanting.

Sub-kingdom—CRYPTOGAMS. (Ferns and extinct plants.)

Class I.—DICOTYLEDONS:—

Sub-class . . .	Gymnosperms.
,, . . .	Angiosperms (Amentales)
Division i. . . .	*Thalamifloræ*
,, ii. . . .	*Discifloræ*
,, iii. . . .	*Calycifloræ*
Sub-div. 1 . . .	Ovary superior
,, 2 . . .	,, inferior
Division iv. . . .	*Gamopetalæ*
Sub-div. 1 . . .	Ovary superior
,, 2 . . .	,, inferior
Division v. . . .	Incompletæ (except Amentales)

Class II.—MONOCOTYLEDONS:—

Division i. . . .	*Hypogynæ*
Sub-div. 1 . . .	Perianth petaloid and ovary superior
,, 2 . . .	Glumiferæ (Restiales and Glumales; degraded forms).
Division ii. . . .	*Epigynæ*
	Perianth petaloid and ovary inferior.

I will now give details of a theoretical origin of Endogens or Monocotyledons from Exogens or Dicotyledons.

With regard to the number of "aquatic" orders the percentage of those in Monocotyledons is 33, whereas in Dicotyledons it is only 4.

So long ago as 1835 Meyer noticed that the distribution of Monocotyledons over the globe is regulated, not by temperature, but by humidity; *e.g.* in Alabama swamps there are 139 species of Monocotyledons, but only 77 of Dicotyledons.

One of the most characteristic differences between these two great classes of flowering plants is that the embryo of Exogens has two cotyledons, that of Endogens having only one; but there are several plants among the former class, the embryos of which have only one, while some of the latter have at least a rudiment of a second. Thus *Trapa natans*, *Ranunculus Ficaria*, and *Carum Bulbocastanum* are examples on the one hand, and *Asparagus* and *Tamus* of Monocotyledons illustrate the other.

The first-named is an aquatic plant; the ancestors of the second undoubtedly *were* such; but the third cannot be *now* grouped with it. Though the cause of a monocotyledonous embryo in Monocotyledon is in *this* paper attributed to degeneration brought about by water, yet as nature has the power to bring about like results from very different causes, it would be rash to say that the single cotyledon of an embyro of *Cyclamen*, for example, was due to a watery medium. When, however, we find that the development of the embryo of *Carum Bulbocastanum* is precisely like that of *Sparganium ramosum*,* and that this character is, as will be seen, associated with so many others to be also found in aquatic Dicotyledons, the presumption is in favour of my contention.

Following the development of a seed, the next point is the fact that the primary or tap-root is always arrested in Monocotyledons, though it may be temporarily present as in Maize and the Date; such, however, soon gives place to a succession of adventitious roots issuing from the stems in ascending series.

Such is also the case with aquatic Dicotyledons, as the Water-crowfoot (*Ranunculus heterophyllus*), Water-lilies, *Trapa*, many aquatic umbellifers, *Ceratophyllum*, &c.

Anatomical details follow suit. Thus, while in Dicotyledons the origin of the root-cap is part and parcel with the initial cells at the apex of the root, in Monocotyledons and *Nymphæaceæ* the initial cells of the root-cap are distinct from those proper to the root. The large increase in the size of the central vessels is also a common feature in both.

The rhizome of Water-lilies was at one time supposed to indicate an affinity with Monocotyledons; but other Dicotyledons also agree with it in the general "dislocation" of the vascular cords so characteristic of the former class. *Nelumbium* with regular sub-concentric series of cords seems to indicate the transition.†

The next important point is the leaf arrangements prevailing in Endogens, viz. the "distichous" or two-ranked, as of Grasses and many Orchids, *Gladiolus* &c.; and the "tristichous" or three-ranked, as of Sedges; while the latter leads us to the ternary arrangement so universal in the flowers.

I have elsewhere shown how the pentamerous arrangement prevailing in the flowers of Dicotyledons arises from opposite leaves, through the

* Compare the figures by Hegelmaier, *Bot. Zeit.* Taf. vii. figs. 28–41.

† De Bary's *Comp. Anat.* fig. 112, p. 255.

"pentastichous" or five-ranked foliage,* starting from an embryo with two cotyledons.

When one cotyledon is wanting, nature appears to have adopted a different method. Thus it has been discovered that in *Asparagus* and *Tamus* the first leaf is situate just over the site of the missing or rudimentary cotyledon. Then the second and third leaves are in a plane at right angles to that in which the cotyledon and first leaf stand,

3
thus: 0.1 cot. These three appear to lay the foundation of a tri-
2

stichous arrangement, as in *Carex*, by slightly shifting the positions:

3 the three ranks being at an angular distance of 120°. A
1.4 6 similar shifting occurs in making the trimerous whorls of
5 the flower, and we arrive at it thus:—
2

3
6
1 5
4
2

That nature has the power to "shift" the "insertion" of leaves may be seen, for example, in the common Laurel. In the horizontal boughs coming from the side of the bush the leaves are "distichous"

1 3 5 7
2 4 6 8 but on a vertical shoot issuing from the top of the

bush, the leaves are "pentastichous," the sixth being in the same vertical line as the first on *the spiral line* passing through the numbers 1 to 6.

6
5
4
3
2
1

With regard to the development of the foliage, if we compare that of *Victoria regia* with *Sagittaria sagittifolia*, a remarkable similarity will be observed. The first leaves of the former are incompletely developed; they have no limb at all; that of the next has a lanceolate blade, the third has a hastate, the fourth a sagittate, then comes an orbicular blade; and in *Nelumbium* a peltate one is finally acquired.

Sagittaria begins with a ribbon-like phyllode in deep water; then a spathulate extremity indicates the commencement of a blade. This becomes hastate, then sagittate. The further stages are not reached in that plant; but the orbicular is found in Frogbit, and hastate-peltate in *Caladium*.

There are several other points of agreement between the morphology of aquatic Dicotyledons and Monocotyledons, which all tend to afford an accumulation of probabilities that this latter class has been descended from aquatic forms of the former. It is quite impossible to say *when* and from *what* plants it took place, but it is interesting to see that the late Robert Brown (*facile princeps* among botanists) actually put Cycads among Monocotyledons in his "Prodromus." For further details I must refer the reader to my paper elsewhere.†

* "The Origin of the Prevailing System of Phyllotaxis," *Trans. Linn. Soc.* 2nd ser. vol. i. p. 647.

† "A Theoretical Origin of Endogens from Exogens through Self-adaptation to an Aquatic Habit," *Journ. Linn. Soc.* vol. xxix.

P.S.—After the preceding lecture was written I met with a paper on "The Phylogeny and Taxonomy of Angiosperms," by C. E. Bessey, Ph.D., published by the Botanical Society of America, 1897; and it was satisfactory to know that from the researches of Schimper and Lesquereux upon fossil plants of the Cretaceous, Eocene, and Miocene floras of the United States these authors follow almost precisely the same general lines herein suggested by myself as based upon morphology. Thus Dr. Bessey summarises the results as follows (abridged). He places Monocotyledons first because of their simpler structure; but I regard this as not indicating *primitive* but *degraded* features, the result of an aquatic medium.

"It is probable that Monocotyledons and Dicotyledons appeared at about the same time, namely, early in the Mesozoic or late in the Palæozoic.

"The hypogynous Monocotyledons appear to have preceded the epigynous; and similarly the petaloideous, hypogynous species seem to have somewhat preceded the spadiceous * and glumaceous species.

"Apparently the Thalamifloræ and Calycifloræ are the two earlier types of the Dicotyledons.

"The Bicarpellatæ [common in the Gamopetalæ, *Labiatæ*, &c.] and Inferæ [inferior ovaries] appear to have developed later than the other types, and to have rapidly increased to the present time.

"In the development of the Bicarpellatæ, the Polemoniales and Gentiales [with regular flowers] preceded the Personales and Lamiales [with irregular bi-symmetrical flowers].

"'Polypetaly' appears to have been the common condition in the Cretaceous, Eocene, and Miocene periods.

"The first modification from polypetaly probably was in the direction of apetaly [by degradation], a condition reached by many plants in the earlier periods, but by relatively smaller numbers in the present.

"Gamopetaly, from small beginnings, has increased rapidly to the present.

"Hypogyny has measurably decreased, while epigyny has correspondingly increased."

The author has given an elaborate scheme as to the distribution of orders on evolutionary lines, but it appears to be rather too speculative to be altogether trustworthy.

* The *Aroideæ* and *Lemnaceæ* are undoubtedly degraded aquatic forms

THE ENGLISH OR FLORIST'S TULIP.

By A. D. Hall.

[Lecture delivered May 20, 1902.]

It is not the object of the present paper to give any account of the history or origin of the Florist's Tulip: this has already been done in these pages by the Rev. F. D. Horner (Journal R.H.S. Vol. XV. 1893, p. 99), by Mr. J. W. Bentley in the pages of the *Journal of Horticulture* for 1894–5, and by Count Solms-Laubach in a short monograph (*Weizen und Tulpe*, Leipzig, 1899). It will be sufficient here to indicate that the Tulip, when introduced by Gesner into Western Europe in 1559, was already a florist's flower, with numerous varieties owing their unknown origin to the Turks; that it soon became a favourite flower and many new forms were raised, Flanders rather than Holland being the chief centre of improvement; until about the beginning of the last century the London florists, who had their gardens in the City Road, Camberwell, and other unlikely places, began the creation of the English Tulip as we now know it. It is rather the object of this paper to put before the reader the florist's point of view as to what constitutes a fine Tulip—a simple mystery perhaps, but one that needs a little more study than is given to it, either by the one kind of critic who assures us that our standards are all obsolete nonsense, or the other who tells how he goes direct to Holland for his bulbs, and gets just as good stuff at 10*s.* a hundred as anything we have to show. The latter gentleman is simply ignorant; the former is sometimes wilfully so, because he will only look at flowers through the spectacles of a theory: to him we can only say that the Florist's Tulip is the outcome of some three hundred years' work of those who best knew and loved the flower. The excellences the florist admires, the standards he demands, represent a tradition, not an external arbitrary dogma, but the accumulated experience of many generations of what will best bring the innate qualities of the flower to their highest perfection. It is easy to raise a cheap clamour against formality and to obtain the approbation of the unthinking public by decrying anything that looks like line and rule in connection with flowers; but taste grows in flowers just as in the greater art of painting. First comes the appreciation of a mass of colour, the trumpet call of so many square yards of red or blue thrown violently at the spectator; the next stage sees the revulsion from the old crudity in an admiration of the flowing curve, the indeterminate outline, the melting half shades, all that is picturesque and quaint and artistic; only at a later stage does one awaken to the sense of pure form, the severer beauty that comes of proportion, and the restraint of the grand style. A show of florist's flowers, whether they be Roses, or Tulips, or Carnations, is a very artificial affair and easily contrasted to its disadvantage with the beds of a garden, or the trade "displays" of masses of inferior examples of the same sort of flower. But to compare the two things is only to confuse the issues;

a show of florist's flowers is a competition, not a display, and all its arrangements are made to let the flowers be examined nakedly and thoroughly by experts, not to produce an "effect" on the casual spectator drifting by. A show is not the best place to enjoy even a florist's flower, which is at its best at home on the bed; but it is only the stern discipline of showing and the stress of competition which have made the present beauty of our beds possible, for the flower that is never shown moves but slowly and imperfectly along the path of improvement.

Of course there are critics who go further and deny the "improvement" outright: to them a wild Rose in the hedge is more than the finest gold medal bloom that was ever staged; we can only assure such critics that the florist's work has consisted in taking qualities latent or dimly

A B

FIG. 50.—FEATHERED FLOWERS. (A) 'GARIBALDI.' (B) 'LORD STANLEY.'

seen in the wild flower, such as symmetry, texture of petal, marking, &c., and pushing them to a higher degree of excellence.

CLASSIFICATION.

The Florist's Tulip belongs to the general class of late or May flowering Tulips, being in fact only a highly specialised race of the old Dutch Tulip, of which the so-called Darwin and Rembrandt Tulips constitute another strain, originated in Flanders. Like all members of this class, the flower, when it first blooms as a seedling, is almost invariably self-coloured, in which state it is known as a "breeder" or "mother" Tulip, probably because of its vigour and rapid increase. At some time or other it may be after a year or two, sometimes only after ten or twenty years, a remarkable change comes over the breeder: the colour previously diffused all over the petals becomes concentrated into markings on the edges or centre of the petals, which show a white or yellow ground colour. The flower is now said to be broken or rectified, and remains in this state for the rest of its existence, without reverting to the self-coloured condition ; the offsets, also, by which it is increased, partake of the same marked or broken character when they have grown to blooming size. The cause of this extraordinary change, which is without parallel in the floral world, cannot be explained, nor can any reason be assigned for the "breaking" of a breeder in any particular year ; we know that some varieties break more easily than others, and that a change of situation, particularly to a warm soil, is likely to induce breaking. The older florists only esteemed the broken flowers, "conquests" as they were termed, because of the long time that must elapse before new ones could be acquired ; but for many years the breeder has been grown for its own sake, and shown in separate classes. Both in the breeder and rectified states Tulips are divided into three classes, called Bizarres, Bybloemen, and Roses.

In the Bizarres the ground colour is yellow, the markings—or in the case of breeders the self-colour—range through all shades of brown from scarlet to black.

Both of the other two classes possess white grounds, but the marking colour of the Bybloemen is purple, varying from dainty lavender to practically black ; while the Roses, as their name indicates, possess rose markings, of various shades of scarlet and crimson. There still exist varieties with a white ground, and a marking colour indeterminate between Bybloemen and Roses, deep crimson when the flower is young, and dull purple as it ages ; but such kinds, however common in the past, are being steadily eliminated. Every seedling raiser is aiming, among other things, at getting as great a diversity as possible, not only between the classes, but inside the limits of each class. Among Bizarres we want to work towards scarlet markings on the one hand, and black on the other ; the Roses must be made scarlet, and the Bybloemen as pure a purple or black as can be.

It has already been indicated that most Tulips exist both in a breeder and in a "rectified" or marked state ; in this latter condition two styles of marking are recognised and distinguished. In one case the marking colour is confined solely to the edges of the petals, in which state the flower is said to be "feathered" (see fig. 50). In the second or "flamed" state the flower has a beam of colour up the centre of the petal, and running off into the feathering, which it also possesses at the edges (see fig. 51). As feathered and flamed flowers exist in each of the three classes, we thus get a second tripartite division, making nine types of flower in all :—

	Breeder	Feathered	Flamed
Bizarre	br. biz.	fr. biz.	fld. biz.
Bybloemen	br. byb.	fr. byb.	fld. byb.
Roses	br. rose	fr. rose	fld. rose

The usual practice is to show breeders separately, and the rectified flowers in "stands" or "pans," containing an equal number of feathered and flamed flowers of each class. Thus a stand of twelve must contain two feathered and two flamed Bizarres, two feathered and two flamed Bybloemen, two feathered and two flamed Roses. There must be no duplicates, but the same flower may be shown in both feathered and flamed states.

When a breeder breaks it does not necessarily follow that all the bulbs which have been derived from the original seedling will break at the same time, or into the same style of marking; thus it sometimes happens that specimens of a particular flower exist in the breeder state, and broken, both as a feathered and a flamed flower. At most shows blooms will be seen

A B

FIG. 51.—FLAMED FLOWERS. (A) 'DR. HARDY.' (B) 'LORD STANLEY.'

of 'Sir Joseph Paxton,' 'Mabel,' and 'Adonis,' in each of the three possible states, and other sorts show the same characteristics.

It must be understood that each seedling, and only the seedling, is an individual; the multitudinous bulbs arising from the first seedling are essentially only parts of that original bulb, and possess the same form, habits, and constitution, despite the seeming great variations of breeder, feathered, and flamed states.

PROPERTIES OF THE FLORIST'S TULIP.

It now remains to discuss in detail the properties of the Florist's Tulip, the points which distinguish it from the other races of Tulips, and the features by which it is judged. The three chief points are Form, Purity, and Marking.

Form.—The form aimed at is the perfect cup, a little greater than a hemisphere when young, and not less than "the half of a hollow ball" when fully expanded in the sunshine. Fig. 51 A and B and fig. 54 A show what is admired, 51 A being about the shortest, and 54 A the tallest, that is desirable. To attain this perfect cup shape the petals must be broad, gently rounded at the top, without point or indentation, and must themselves be portions of a sphere, so as to clip closely together. Long narrow petals cannot form a cup or expand freely without showing gaps, a very bad fault known technically as "quartering." The gently rounded top is essential to a proper display of the marking; a Tulip with pointed petals may be itself beautiful enough, *e.g.* the well-known 'Golden Eagle'; but as the Florist's is fundamentally a marked Tulip we must choose the cup shape which will best show the markings, and therefore the rounded petal, which is required for the perfect development of the chosen form. This is the real *raison d'être* of the florist's "laws": they are not arbitrary conventions, but the formulating of certain principles which will bring out the inherent properties of the flower to their higher pitch of excellence.

If the petals individually are not portions of a sphere they cannot fit closely together; many otherwise good varieties possess the grave fault of throwing the three outer petals away from the inside three and making something like a cocked hat instead of a cup. Fig. 53 B represents an old-time variety, 'Count' or 'Comte de Vergennes,' beautifully feathered, but the outer petals are long and spoon-shaped, so that they stand quite apart. A on the same figure represents another excellent feathered flower, 'Bessie,' of a good enough shape when young, but when old or overpowered by heat and sun it has a bad habit of reflexing the tips of the outer petals, as shown in the photograph.

Sometimes the petals are too much curved and form an ugly shoulder, instead of springing in a gentle rounded curve from the stem. Fig. 54 B shows a finely feathered bloom of 'Masterpiece' with this great defect of shape. In some blooms the defect of shape arises in the opposite way: the base is too narrow, and the petals start from the stem like a funnel rather than a wineglass; 'Annie McGregor' possesses this defect. Some flowers are too globular, others like 'Mabel' curve the edges of the petals inwards near the top; others again, like 'Chancellor,' may have a good shape but open with difficulty, except in warmth or sunshine. In all these cases the result is similar: the true cup is not found, and the interior is more or less hidden from view.

The pericarp should be bold and shapely, the stamens large and conspicuous.

Lastly, whether dwarf or tall, and the heights range from eight inches to three feet or more, the stem should be sturdy enough to carry the cup nobly erect.

Purity.—The great feature which distinguishes the English from the ordinary Dutch and from the 'Darwin' Tulips is their "purity," the possession of a clear, stainless circle of ground colour at the base of the flower; yellow in the case of the Bizarres, white in the Roses and Bybloemen. The older forms of the Tulip, as may be seen in the common garden variety known as *T. Gesneriana*, possess a dark blue blotch at the base of the flower from which the pericarp and stamens spring; and though in many of the Dutch and Darwin Tulips this heavy colour is replaced by a lighter shade, in the English Tulip there must not be any suspicion of stain; the ground colour should be of the utmost clearness and brilliancy, and the filaments of the stamens must also be free from any tinge of blue. The fundamental importance of purity was a doctrine chiefly fought for and won by the southern florists in the first half of the nineteenth century; it had always been desiderated, but their action rendered it indispensable, and many a well-marked favourite had to disappear from the show table, because it would come foul or tinged at the base. At the present time practically none but pure flowers are grown, but some trace of original sin is still to be seen in many white

A B

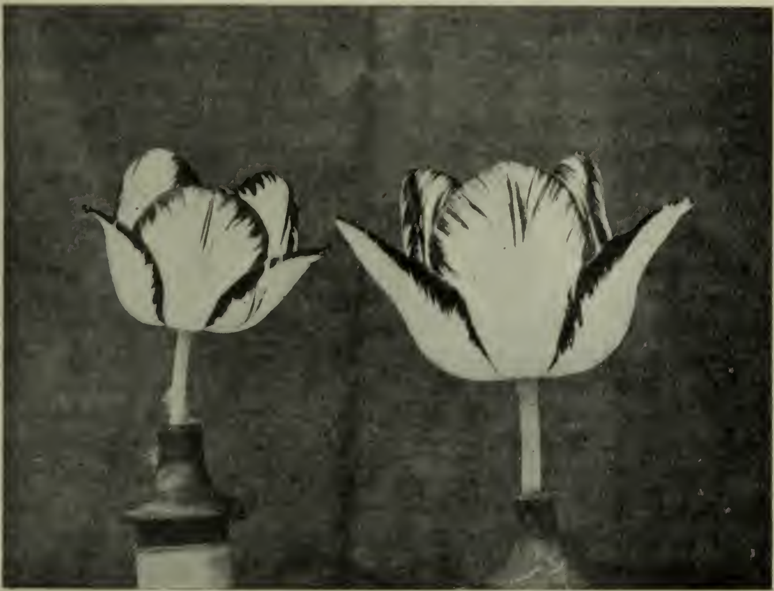
Fig. 52.—Flamed Flowers. (A) 'George Edward.' (B) 'Duchess of Sutherland.'

ground varieties, which open with a cloudy yellow base, only bleaching after a few days' exposure; some Bizarres again show an indefinite green shade or greasiness in their yellow base. A batch of seedlings will always contain a large proportion of impure flowers, which should be at once destroyed, root and branch, without mercy, however excellent the other qualities they show. A want of purity is the great defect of those otherwise excellent breeders, the 'Darwin' Tulips; it is true that many of them have rather an ugly square shoulder, but in substance of petal and shortness of cup they are excellent. There are, however, only two varieties known to me, 'Loveliness' and 'Zephyr,' which can be termed pure.

The value of purity lies in the great increase of brilliance given to the flower by a wide circle of pure colour at its base; the marking tells better by the contrast, the anthers stand out on the clear bright filaments; even a small base is by no means so effective as a large circle of white or yellow.

Many critics of the fancy object to the importance assigned to purity; they profess to like a pale blue base at times, at any rate they consider such flowers should be judged on their merits and not disqualified off-hand. But the good is ever enemy to the best; only the pure flower can show the Tulip at its highest pitch of development; and in his efforts to realise the ideal he carries in his mind the florist rightly refuses to put up with a quality, which though passable in an individual, would be intolerable in the race. To admit a stained flower would be a defection from the path of perfection in order to reap a temporary advantage, a defection all the more unnecessary because of the numbers of brilliantly pure varieties which exist. And after the eye has become trained among Tulips, and learned to enjoy the contrast offered by the pure base, any stain then becomes intolerable and even violently unpleasant. The photograph of breeders (fig. 55), two pure and two stained, shows something of the superior effectiveness of the clear base, and the flamed flowers (fig. 56), of which a photograph looking right into the bloom has been attempted, will give an idea of how the base sets off the marking.

Marking.—Assuming that the form of the flower is good and its purity undoubted, its merit is then judged by the marking, of which, as has already been indicated, two types exist, the feathered and the flamed state. Fig. 57 shows a photograph of a number of finely feathered petals, from which it will be seen that the marking must be confined to the edge of the petals. A good feather should form a finely pencilled edging round the margin of the petal, broader at the top than at the sides. The width of the feather varies in different varieties: it may be narrow or broad, but it should be regular and continuous, should neither "skip" at places, nor run too deeply down the centre of the petal, though a single narrow stripe is sometimes seen. The most common faults in a feathered flower are a want of precision in the markings, the occurrence of scratchy streaks of colour in other parts of the petal, worst of all perhaps is a streak of solid colour running from the base to the edge of a petal. The marking should be firm and boldly pencilled; an undecided flushed outline is a great defect, as also is the occurrence of two shades of colour in the marking, when it is known as "grizzled;" a delicately pencilled outline is also preferred to one flatly laid on or "plated." Figs. 50, 53, and 54 show finely feathered blooms: in fig. 50 the photograph looks more directly into the blooms; on the left is rather a heavy plated bloom; on the right the feathering is better pencilled, but rather too light at the tips of the petals. The feathered state is the one most difficult to obtain in a state of perfection, and though the true enthusiast perhaps considers that the flamed state shows the Tulip at its best, a first-rate feathered flower is more taking at first sight, and is very much rarer. While there are many flamed varieties which can be trusted to "come good" year after year, a large collection must often be scanned with great care to get together two dozen feathered blooms fit for exhibition. And here it may be explained that the markings of the Tulip are very inconstant, and even the successive flowers from the same bulb are subject to great variations from year to year; if a bulb yielding a feathered flower gets at all big and over-vigorous, it is apt to flower too full of colour, and to produce more or less a flamed flower. More often perhaps, ill-defined patches of colour, or a total break in the marking, mar the symmetry of a feathered flower; one must grow as many bulbs as possible of feathered strains and trust to getting some of them as nearly right as may be. Without doubt correct cultivation will increase the proportion of well-marked blooms; one must aim at getting sound and well-ripened bulbs, avoiding especially the grossness and overgrowth produced by rich soil or manure. Free exposure in the early months of the year, so as to secure a slow growth, seems to aid in producing refined flowers; the strong premature growth, which results from early planting or leaving



A B

FIG. 53.—FEATHERED FLOWERS. (A) 'BESSIE.' (B) 'COUNT.'

the bulbs in the ground, generally flushes the whole bloom with undesirable colour. Most varieties seem to throw fewer and fewer feathered blooms as they age; of some sorts, once famous as feathered flowers, practically only the flamed state is now known; but this is not invariably true, as may be seen in the case of 'Count' or 'Comte de Vergennes,' an old Dutch or Flemish variety known to have been cultivated for more than a century, yet yielding feathered flowers with regularity to-day. Because of this tendency to go flamed and because of their inevitable inconstancy, the Tulip fancier should grow on to blooming size every offset he can find of finely feathered varieties.

In the *flamed* state the flower possesses, in addition to the feathering on the edge, a bold beam of the same colour up the centre of the petal, branching out into pencilled streaks to mingle with the feathering.

Fig. 58 shows a series of well-flamed petals; the beam should start from the edge of the circle of white or yellow forming the base, as if the base is absent or small the effect of the flower is much depreciated; the white or yellow ground should also be seen between the foot of the beam and the feathering at the edge of the petals. When beam and feathering meet at the base the flower is said to be "fast," a common fault when the bulbs are overgrown; the beam again should not "run out" at the tips of the petals, but should break into fine pencillings which merge into the feathering. Above all, the colouring of the beam should be bold and decisive and well branched, a simple pillar of colour not being esteemed.

Figs. 51 and 52 show finely flamed flowers; in fig. 51, to the left is 'Dr. Hardy,' to the right 'Lord Stanley'; in fig. 52 to the left is 'George Edward,' to the right 'Duchess of Sutherland.' The two latter flowers, but reversed, are also shown in fig. 56, but the foreshortening, due to looking down into a cup-shaped flower, rather obscures the markings in this latter case.

The excellence of both feathered and flamed flowers much depends upon contrast between the markings and the ground colour; hence the markings should be decided and the ground colour clear. A dull white or a flimsy translucent petal is a great defect; the finest flowers possess a smooth solid petal, glossy and brilliant.

Texture of petal is the quality *par excellence* of the pure florist; the flowers which show this feature, like the Rose, the Carnation, the Auricula, as well as the Tulip, are the true florist's flowers. Of course, only a Tulip with a solid petal will last well and keep its shape in hot weather; many varieties perish at the tips, open too widely, or fall into a loose undecided shape after being a short time open.

Breeders are judged by the quality of the petal alone: they must show a good shape and a clear wide base. Their brilliancy of colour and freedom from blemishes, such as frost or hail marks and irregularities of growth, form the basis on which they are judged.

Lastly, in making up a stand, the fancier aims at getting a lot of blooms as uniform in character and as even in size as possible, not mixing big, fully grown, and rather loose specimens with others that are young, compact, and small. He also should aim at contrast—dissimilarity—as much as he can; in a stand of twelve, two of the Bizarres should be of the red sort, and two of the black; one feathered flower should be heavy, the other lightly marked &c. But these are counsels of perfection. Too often, through the vagaries of the weather and the provoking inconstancy of the flower, the fancier is reduced to showing what he can scrape together to fulfil the conditions of the schedule, without considering too deeply such fine points as uniformity and dissimilarity.

It is this inconstancy of the flower which is apt to disgust the beginner with the fancy. He obtains what is said to be a good feathered sort, and when the flower appears it is worthless and quite out of character, whereupon he rather begins to think he has been swindled. Let him take courage, the bulb itself will probably come right another year; the offsets in their turn are likely to yield some fine flowers. He must accumulate a stock and cultivate carefully to raise his proportion of refined bloom. All the same, the inconstancy of the Tulip is one of its defects; one cannot count on any variety coming good year after year, as one can with Auriculas or Carnations, or even Roses. Still, many of the best varieties are pretty constant, and in time one may reckon on breeding out this tendency to variation in the wrong direction.

Varieties.

An immense number of varieties of the English Tulip have been raised from time to time, and are still grown. Mr. Bentley's catalogue, published in 1894–5, contained descriptions of something like 500 varieties. Many of these are indeed obsolete, but I find that I am growing about 150 varieties, exclusive of seedlings. But the novice who wants

A B

Fig. 54.—Feathered Flowers. (A) 'Sir Joseph Paxton.' (B) 'Masterpiece.'

to form a collection for show purposes or for pleasure should not burden himself with anything like these numbers; the really first-rate ones are few in number, and a better result for all purposes can be obtained by growing only the best in quantity, than by the search after variety or varieties. It is the inconstancy of the Tulip, and particularly of the feathered sorts, which keeps so many varieties in cultivation; the fancy abounds with kinds which occasionally come beautifully feathered, which are always promising and very rarely performing, and which stave off the execution they deserve, by now and then producing a flower of supreme excellence. This is seen and admired, others beg or buy the sort, and are thus in their turn lured into cumbering their beds with a needless variety. Varieties too grow old, and seem to lose something of the habit of producing "feathers," so that many are grown because they once were good, and may recover their early glories. Still the advice I would give a beginner is to stick as much as his human nature will let him to a few good sorts, and not to be tempted to run after others by their occasional appearance in first-class form at a show. Above all he should aim at getting good "strains;" despite the inconstancy of the flower, a bulb which has bloomed fine is the more likely to do it again and throw offsets of the same quality. As his numbers increase he can keep weeding out the bulbs growing poorly marked blooms, especially if they come in bad character two or more years in succession, and replacing them with offsets grown on from his best stock. But while numbers are small, it is a good plan to have a waste bed in some out-of-the-way part of the garden, and give the cast-offs a year or two there before they are finally rejected. A little starvation and exposure have sometimes a marvellously refining influence. In the following list only really first-rate varieties are mentioned, which can be readily obtained either from the trade or the members of the Tulip Society; and many good ones are omitted either as being insufficiently tested, or scarce and difficult to obtain. The flamed flowers are by far the most satisfactory class, and most of the following can be trusted to come practically perfect every year: *Bizarres*—'Samuel Barlow,' 'Sir Joseph Paxton,' and 'Dr. Hardy;' *Bybloemen* — 'Talisman,' 'George Edward,' and 'Chancellor'; *Roses* — 'Annie McGregor,' 'Mabel,' and 'Aglaia.' Feathered flowers are difficult to secure, especially feathered Roses, but the following are perhaps the best: *Bizarres*—'Sir Joseph Paxton,' 'Masterpiece,' and 'Lord Frederick Cavendish'; *Bybloemen*—'Bessie,' 'Elizabeth Pegg,' and 'Talisman'; *Roses*—'Mabel' and 'Modesty.' Good breeders are more abundant, but on some soils it is hard to keep up a stock of them, so readily do they break; *Bizarres*—'Sir Joseph Paxton,' 'Goldfinder,' and 'Sulphur'; *Bybloemen*—'Glory of Stakehill,' 'Adonis,' 'Elizabeth Pegg'; *Roses*—'Annie McGregor,' 'Mrs. Barlow,' 'Rose Hill,' and 'Loveliness.' The following description of the above varieties may be useful; for details of other varieties Mr. Bentley's list, before referred to, should be consulted.

Bizarres.

'*Dr. Hardy*.'—A beautifully marked and very constant red-flamed Bizarre; the petals are broad, smooth, and of good substance; the base is large and a fine orange-yellow, the marking colour is a bright red-brown, so that a well-grown specimen has a glow and brilliancy that is still almost unrivalled. It rarely makes a good feathered flower, and is very scarce in the breeder state. The shape is excellent and lasts well. Vigorous and plentiful. (Fig. 51.)

'*Goldfinder*' is a beautiful scarlet breeder, excellent in shape and superb in colour. Unfortunately it breaks very readily, and is then invariably worthless. The most brilliant of all the breeders.

'*Lord Frederick Cavendish*.'—The petals are rather long and pointed, and weak in substance. When in condition this variety makes a fine red feathered Bizarre, though the feathering is rather "plated," and lacks quality. It is inconstant and worthless as a flamed flower, and should not be grown strong.

'*Masterpiece*' is a very old feathered Bizarre, with a thoroughly bad shape: the three outer petals are apt to have an ugly hump, while the inner ones hook in together. It is also one of the most inconstant Tulips grown, and the grower may be satisfied if more than one in twenty is anything better than ugly. But when 'Masterpiece' is caught right, it is still worthy of its name, so superb is the black feathering on the brilliant yellow ground. Sometimes it can be shown as a flamed flower. It is a free grower, cheap and abundant; and despite all its

Fig. 55.—Group of Breeders.

inconstancy and bad shape every one must keep a good stock of it. (Fig. 54.)

'*Samuel Barlow*' is perhaps the finest of the flamed Bizarres, for it is larger and more refined in its markings than 'Dr. Hardy,' and possesses rather a better shape than 'Paxton.' It is a red Bizarre, with finely pencilled red-brown markings on a good yellow ground. The base might be larger and the petals would be better for more substance; still it is a noble flower of great size and quality. It is early in bloom, but stands well. It sometimes comes rather too lightly flamed, "short of work," and even makes a good "feather," but as a rule it is a very constant flamed flower. Vigorous, but not very free, nor over-plentiful as yet.

'*Sir Joseph Paxton*.'—For fifty years this has been the leading Bizarre, good in all three of its states. It makes a fine chocolate-brown breeder, its only defect being that the petals are rather spoon-shaped and narrow at the top. When feathered the marking is dark brown, and beautifully pencilled on a clear yellow ground, but it is as a flamed flower that 'Paxton' is at its best, for the base is large, and the beam both bold and refined. Vigorous and a free grower; a good strain of 'Paxton' is about the most satisfactory of all Tulips. The petals possess great substance and stand in the hottest weather. (Fig. 54.)

'*Sulphur*' is rather an attractive yellow-brown breeder, with broad solid petals, which make up into a rather triangular shape. The flower is deliciously scented, and when broken is sometimes good in either feathered or flamed state. But it is very inconstant, often shows two colours in the feather, and cannot be trusted. 'Sulphur' is an extraordinarily vigorous grower, makes huge broad leaves, and increases very fast, being also given in rich soil to such freaks as three flowers on a stem.

Other Bizarres that may be recommended are 'Lord Stanley,' which, though rather small, is excellent both in shape and marking, either as a feathered or a flamed flower; and 'William Wilson,' which makes a fine heavily feathered flower of a somewhat ugly shape. Bizarres are more numerous than either of the other classes, and many other sorts are grown which yield good feathered flowers on occasion.

Bybloemen.

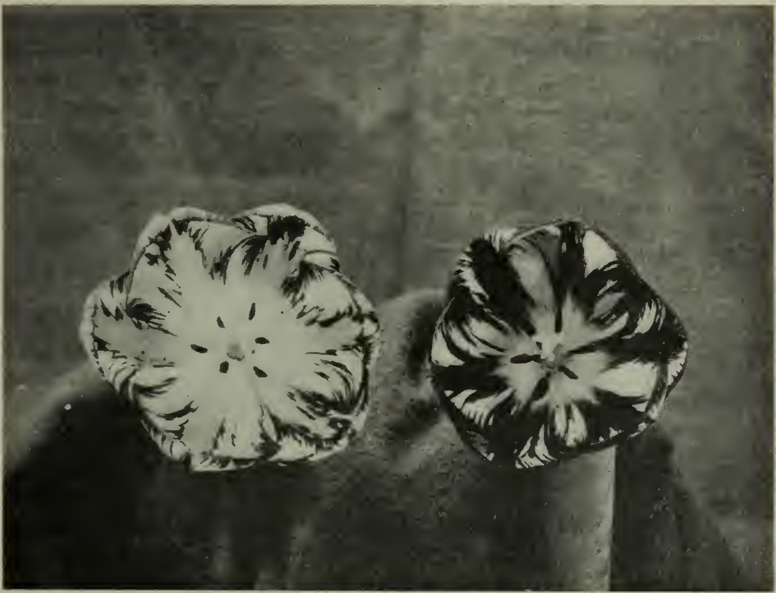
'*Adonis*.'—A beautiful dark purple breeder, with a clear wide base, of a fine shape when young, though the petal is a little flimsy and reflexes at the tip with heat or age. 'Adonis' breaks well, both flamed and feathered, and is often useful for exhibition in either state, its defects being a lack of brilliancy in the white ground, and a tendency to forget the feathering at the tips of the petals. 'Adonis' is cheap and plentiful, and still the finest dark purple breeder.

'*Bessie*,' another old flower, is chiefly famous in the feathered state, when it possesses a beautifully pencilled continuous feather of dark purple on a clear white ground. When flamed it is rarely valuable, and the breeder is unknown nowadays. 'Bessie' must be shown fairly young, for it falls nearly flat, and quarters with age or great heat, which also is apt to spoil the texture of the somewhat flimsy petal. At the same time 'Bessie' cannot be shown immediately it opens; the base and even the white ground are somewhat yellow at first, and require a little time to bleach. 'Bessie' must not be grown too richly, or it will develop an excess of colour. (Fig. 53.)

'*Elizabeth Pegg*' is one of the finest Bybloemen, at its best when feathered, but often valuable for exhibition, either as a breeder or a flamed flower. The shape is good, the base wide and of spotless purity, the anthers bold and black. As a breeder it is of a pale lavender, very dainty in colour; when broken the feathering is a beautiful pure purple colour, of medium depth, and charmingly pencilled. When flamed the beam is light purple, but hardly bold enough. This variety is a little tender, and often crippled by frost at the tips of the petals: it is rather late to bloom and very prolific. There are a good many sister seedlings in cultivation, and the whole batch is hopelessly mixed in the breeder state. They have a tendency to break partially, showing a weak edging of purple on the breeder colour. These should not be immediately thrown away, but tried for a time in an out-of-the-way corner of the garden, for they sometimes come right. Some of the breeders break with a dirty brown shade in the beam and are worthless.

'*George Edward*,' though by no means a new flower, is only just beginning to be generally grown. It forms a perfect cup, with petals of great substance ; the base is rather yellow and wants a good deal of bleaching. It sometimes comes feathered, but is best flamed, when the beam is dark purple and boldly marked. The flower is early and of the largest size, and the constitution vigorous. (Figs. 52 and 56.)

'*Chancellor*' is only known in the flamed state, but forms one of the



A B

FIG. 56.—FLAMED FLOWERS. (A) 'DUCHESS OF SUTHERLAND.' (B) 'GEORGE EDWARD.'

most trustworthy Bybloemen for exhibition. It is vigorous and forms a flower of good size, rather late to bloom, and wanting sun and warmth before it will open properly. Its colour is a lighter purple than either of its chief rivals as flamed Bybloemen, 'Talisman' or 'George Edward.'

'*Glory of Stakehill*' is a large rosy-purple Bybloemen breeder, with a good shape and a wide base, of exquisite purity. It is the best flower of its class, but is getting scarce because it breaks easily ; when broken it may at once be thrown away because it never marks well.

'*Talisman*' is perhaps the best flamed Bybloemen that is grown, but is also sometimes superb as a feathered flower, and well worth growing as a breeder. The breeder colour is rather a dull slaty purple, but the base is wide and clear and the shape excellent. When broken the feathering is practically black and most delicately pencilled ; the beam is bold and branching, and the whole flower of full size. 'Talisman' is a good grower, vigorous and free, and cannot be too highly praised, both for the fine quality of its marking and its constancy.

The Bybloemen forms a good class with a higher proportion of really trustworthy flowers than either of the others.

'Trip to Stockport' and 'W. Parkinson' form fine feathered flowers, not very common as yet; 'Ashmole's 112 and 126' are heliotrope-coloured breeders, opening early and easily, which sometimes make passable broken flowers; 'Duchess of Sutherland' is a beautifully flamed flower, but defective in shape. 'Universe' is another fine Bybloemen, unsurpassed when feathered right and good as a flamed flower, but not very common as yet.

Roses.

'*Aglaia*' is a very old sort only known as a flamed flower, of a rather dull dark crimson shade, opening very yellow but easily bleaching. The shape is long and rather loose, the beam is somewhat indefinite and lacks the fine working which is desirable, but good Roses are so few that Aglaia, with all its faults, is still a very useful flower to the exhibitor.

'*Annie McGregor*,' though introduced half a century ago, is still the best Rose in cultivation. It forms a beautiful scarlet breeder with a dazzling white base; as a flamed flower the markings are rich in colour and beautifully pencilled; occasionally it comes feathered, but is not first-rate. The petals are stout and the bloom stands well; the only defect is that the cup is rather contracted and narrow at the base. Vigorous, increasing freely, and cheap, 'Annie McGregor' is equally a flower for the exhibitor and the gardener who wants an effective bed.

'*Mabel*' is a sister seedling to 'Annie McGregor,' a pale soft Rose as a breeder, but when broken the markings are darker and have more of a crimson shade. 'Mabel' makes much better feathered flowers than 'Annie McGregor,' and is equally well marked as a flamed flower. Its drawback, which causes both breeder and flamed flower to be less esteemed than 'Annie McGregor,' is a defective shape; the cup is too long and the petals hook in at the tip. Nevertheless 'Mabel' in either state is among the best Roses we possess.

'*Loveliness*' is one of the 'Darwin' Tulips, but differs from most of that race in possessing a pure white base. It is a charming bright rose in colour, possesses very stout petals, but with something of that ugly square base characteristic of the 'Darwins,' and has been known to break well. The broken flower is little known, but the breeder is cheap and common and well worth growing, even for exhibition.

'*Mrs. Barlow*' is a beautiful soft rose-coloured breeder, with an excellent shape. Unfortunately it always breaks badly and may then be thrown away.

'*Modesty*' as a breeder is a very delicate rose colour, but is rather scarce in that state. Broken it makes an exquisite feathered flower, the markings being scarlet and prettily pencilled. It is, however, wretchedly inconstant: a very small proportion come right, and when flamed it is worthless. The petal is flimsy, the base yellow and wants bleaching, and the whole flower soon flushes and loses character in heat or sunshine.

It should be grown in the poorest possible soil. 'Modesty' is one of the most exasperating of flowers; but good feathered Roses are so scarce that one must grow a lot of it on the chance of getting one really first-class bloom.

'*Rose Hill*' is a dark crimson breeder with a wide base, of excellent form and the largest size. In many respects this is the best Rose breeder in cultivation, but it rarely breaks at all well.

The Roses are much the weakest of the three classes; many others are grown and produce good flowers, but speaking generally they are inconstant and weak in shape; among them 'Alice' and 'Sarah Headly' are perhaps the most likely to yield a good feathered flower.

Cultivation.

The English Tulip is comparatively easy to grow, and is not very

Fig. 57.—Petals of Feathered Flowers.

particular either as to soil or climate; it is an excellent suburban flower, standing smoke well, even the smoke of the outskirts of the great manufacturing towns of Lancashire and Yorkshire, where but few trees survive. Any moderately rich well-worked soil will suffice, but it should be stiff rather than light; indeed it is quite a mistake to suppose the light alluvial sand of Holland is at all the natural medium for the Tulip. The great desiderata in the soil are free drainage and a fair proportion of carbonate of lime; in the absence of either of these disease is likely to set in. Many growers renew the soil of their beds every year, well-rotted maiden loam being sought after for this purpose, but I have not found the change necessary. To revive and enrich an old bed I have scattered over it a few handfuls of guano immediately after lifting the Tulip bulbs about the end of June, dug the bed over, and sown

Mustard on it. In four or five weeks' time the Mustard is eighteen inches or two feet high : it is beaten or chopped down and dug into the soil, which is then consolidated by trampling. The Mustard plant soon decays, and by the end of October the soil is in excellent condition and easy to work. In what follows I shall only describe my own routine of cultivation, not that there is anything special about it, but because a concrete case is most intelligible.

The beds are marked out by boards set on edge and projecting about two inches above the general soil level : they are dug over in the early autumn and covered up as planting time approaches, so as not to become too wet for that operation. Seedlings, offsets, and other small stuff I plant in October at latest ; about November 9 is the orthodox time for planting the general stock, but I generally leave it to the end of the month. The quickest plan of planting a large bed is first to throw out the soil to the depth of four inches from the top of the boards, get the bottom firm and level, and then set the bulbs out. Afterwards the soil may be sifted through a half-inch sieve on to the bulbs, or a handful of soil may be firmly placed on each, then the remaining earth thrown gently over the bed and finally raked level ; in any case there should be a depth of four to five inches of soil above the base of the bulb. My own beds measure 30 × 4 feet ; saw cuts on the edge of the boards every six inches mark out the "rows," in each of which seven bulbs are placed at intervals of six inches. Often two bulbs are planted near together in each "hole," for which there is ample room. It is impossible to keep a large collection true to name, or to get it planted and lifted with any expedition, except by the aid of a Tulip box and book. The box is a cabinet of drawers, each of which is divided into partitions measuring two inches each way, seven partitions in a row and ten rows to a drawer. As a row of the box thus corresponds to a row on the bed, six drawers will hold the bulbs of a 30-foot bed. The collection is arranged beforehand in the drawers ; at planting time each drawer is taken in turn to the bed and the bulbs removed to their corresponding places in the bed ; similarly when the bulbs are lifted they are placed straightway in their proper holes in the box. The Tulip book, for which any stout memorandum book will serve, is ruled to correspond with boxes and beds ; for example, on the left-hand page of my own come the names of three rows of bulbs, the corresponding lines on the opposite side being left for comments.

The following extract will explain the system :—

79.

1. 'E. Pegg' fr. 64/7 × × ×	lightly fld.
2. 'Heroine' [× × × fr. 1897] 30/2	bad—throw away
3. 'Dr. Hardy' fld.	2 fair.
4. 'Talisman' fld. 114/3 × × × ×	to S. heavy, to N. × × × ×
5. 'Dr. Hardy' fld. × × ×	× × ×
6. 'Annie McGregor' fr. × ×	indefinite
7. 'E. Pegg' fr. 64/7 × × ×	× × × fr. shown

No. 79 indicates the position of the row on the bed, the other numbers the position in the row ; fr. and fld. are contractions for feathered and flamed respectively: they and the × refer to the nature and degree of excellence attained by the flower in the previous season, and are extracted from the former "book" just as the comment on the right-hand side, inserted when the flowers bloom, will be transferred to the next book.

Thus 4 'Talisman' fld. 114/3 × × × × signifies that in the previous season this bulb of 'Talisman,' then planted third in row 114, gave a very superior flamed bloom. The further record shows that this season it had split into two bulbs, one of which, the northernmost of the two, was heavy in colour; whilst the one to the south maintained the excellent marking.

The old growers took the greatest pains to arrange their beds, so that the three classes came in regular succession, and the heights were

Fig. 58.—Petals of Flamed Flowers.

graduated to bring the tallest flowers in the centre of the bed. The effect of the whole bed is certainly richer on this plan, but I find it convenient to grow each variety in a block. This facilitates the selection of blooms to cut for exhibition, and makes it easier to arrange that certain sorts shall have poorer or richer soil, extra shade or sunshine, according to their constitution. After planting, the beds are left without shelter or protection of any kind until April. The shoots generally peep through early in February, and as soon as they can be seen and the state of the soil permits, the surface is stirred with a pointed stick, or a narrow hoe is worked carefully between the rows. I like to repeat this shallow cultivation whenever the surface gets at all caked by drying after rain; some growers also draw the earth up by hand round the stems of the Tulips in April. In very dry springs a good watering may be necessary in April or early in May.

In April, when the buds are well above the leaves, it becomes necessary to afford some protection, lest hail or heavy rain damage the bloom. The old growers stretched a light awning of canvas over the bed, but it is better to arrange a wooden framework above the bed to carry a series of garden lights sloping gently from four feet in the middle to three feet at the sides. As the buds get up and begin to open, light canvas is run round the side of the bed as a wind break, and if great heat sets in the glass will want whitening.

The Florist's Tulip is perfectly hardy, but it is only in exceptional seasons that one can hope to obtain a cup-like bloom, some three inches in diameter and standing two feet or so from the ground, in anything like perfection without shelter overhead. This last season (1902) I had nine degrees of frost following rain on May 14 ; every Tulip, even under the glass, was lying flat on the bed in the morning, and though they got up again, those which had been unprotected were covered with dead spots wherever a raindrop had frozen, and in many cases the rot spread and destroyed the whole bloom. Some growers give all the protection they can as soon as the shoot peeps through ; but in the south, at all events, this results in excess of vigour and gross blooms flushed with colour. I can only keep the flowers, especially the feathered sorts, in character by the freest exposure, even at the cost of a certain proportion of crippled blooms, where the bud has been nipped by frost just when it was in the axil of the leaf. In the south the Tulip must have poorish but well-worked and strong soil, and no coddling if the bloom is to retain its refinement. Rich soil and great care in sheltering and protecting result in huge bulbs and leaves, and blooms with eight petals and the like, flushed with colour—"dragons," as the old growers called them.

After the bloom the bulbs are allowed to ripen off, still under the lights to keep off rain, until the leaves have begun to shrivel and dry up. Many growers lift as soon as the stalk can be bent double without breaking, but in the south it is desirable to wait a little longer. The seed-pods should be broken off, as then the growth dies down more quickly. The bulbs are then lifted with a small hand-fork, and each, as it is removed from the ground, is placed in its appropriate hole in the drawer. The stalk should be cut off with a stout pair of scissors about two inches above the bulb ; it is not wise to attempt to detach the new bulb from the old growth until the whole is somewhat drier. The boxes containing the bulbs should then be kept in a dry shed, or covered over with newspaper and left under the lights for a few days ; in any case, it is dangerous to let the sun rest on the bulbs before they are dry. Finally, when completely dry, the old growth and dead skins can be broken off, the new bulb cleaned up, and the offsets detached. Some varieties, especially the breeders, increase freely, sometimes splitting into two or even more flowering bulbs, in addition to yielding several smaller offsets, which want feeding up for another season before they will reach flowering size. But many of the choicer sorts only yield an offset from time to time, and so cannot be multiplied rapidly. The offsets of all good sorts should be preserved and grown on in a separate bed of rather richer soil, planting them not so deep and earlier than the flowering bulbs. In this way not only is an increase of stock secured, but a reserve is created wherewith to fill the places of bulbs which have lost character, and become too full of colour or otherwise degenerated. When the drawers have been cleaned up and the offsets detached they should be stored in a cool dry place until the time comes round for rearrangement, when one can reject the unworthy and replace them with new stock preparatory to planting again. It will thus be seen that the routine of cultivation is not heavy, and even a large collection is well within the management of an amateur. The planting and lifting are rather tedious, and can rarely be done properly except by the amateur, for few working gardeners can be trusted to keep the bulbs in their proper places.

The Tulip has few enemies to contend with : wire-worm is capable of eating out the heart of a bulb, rats and mice sometimes destroy bulbs when out of the ground, and I have had a bed ravaged by an incursion of moles ; but in a general way there are no insect pests to fear. The Tulip disease one hears of sometimes, seems to be a common fungus which starts above ground, where a leaf has been wounded by hail or frost, and by spreading downward results in the decay of the bulb. A confined situation and wet undrained ground are the places where it is most in evidence ; it also seems to run more freely where there is a deficiency of lime in the soil. On cold and especially on sour soils a good dressing of lime or mortar rubbish should be incorporated with the soil before planting, and a dressing of basic slag at the rate of $\frac{1}{4}$ lb. per square yard will greatly benefit the health of the bulbs.

In conclusion, I should like to press the claims of the Florist's Tulip on the attention of the amateur : the fancy has fallen upon evil days and the old school of growers is sadly diminished, but with the new love of flowers that is springing up, there must be plenty of gardeners to revive so old and distinguished a cult. The days of fancy prices for bulbs are over, a good working collection is easily obtained, and I and the members of the Tulip Society will be only too glad to put intending growers in the way of making a start if a letter be addressed to me under cover of the Royal Horticultural Society. The growth of the Tulip even on a comparatively large scale does not demand too much space ; four beds, each 30 × 4 feet, will easily grow 2,000 bulbs, enough to furnish bloom for exhibition in any company ; nor is the flower fastidious about soil, or susceptible to a suburban or even a smoky atmosphere. The charm of the flower, with its traditions and its unique development, is a very special one that grows from year to year ; and if its inconstancy and the uncertainty of getting a perfect bloom from the same stock two years in succession are exasperating, yet there are always compensations in the unexpected return of other bulbs to good manners, which gives a touch of excitement to the unfolding of every flower. As to the beauty of a bed of Tulips in full bloom in the sunshine, the feast of colour and of form realised then rather than on the exhibition table, it has once been described by a master hand, and I cannot do better than transcribe the words of Steele, written two hundred years ago :—

"Sometimes I considered them with the eye of an ordinary spectator, as so many beautiful objects varnished over with a natural gloss and stained with such a variety of colours as are not to be equalled in any artificial dyes or tinctures. Sometimes I considered every leaf as an elaborate piece of tissue, in which the threads and fibres were woven together into different configurations, which gave a different colouring to the light as it glanced on the several parts of the surface. Sometimes I considered the whole bed of Tulips, according to the notion of the greatest mathematician and astronomer that ever lived, as a multitude of optic instruments, designed for the separating light into all the various colours of which it is composed."

WEEDS OF THE GARDEN.

By The Hon. Mrs. Boyle. (E.V.B.)

[Lecture delivered June 10, 1902.]

I fear that to say so may be thought a sign of poor gardening; yet, nevertheless, I have to acknowledge that I admire weeds. There are some indeed whom I love like old friends, whilst the grace and beauty of some never fail to delight me. I do not, of course, mean things like Shepherd's Purse—interesting as that really is—or Groundsel, or Chickweed; although even these have their charm, and Groundsel especially must not be too severely dealt with, since whenever one sees it—as Lord Rosebery pleasantly said at Edinburgh—"one thinks of one's canary!" Also when I confess to a love of weeds I do not refer to Stinging Nettles, who come up singly never, but always in tribes and families, always making one think of ruined homes and "dolelful haunts where satyrs dance." Nor do I love afflictions such as Summer Cress or Hound's-tongue and others which insist on reappearing summer after summer, in spite of our persistent efforts at discouragement; nor to Cornsow Thistle or Dandelion, each exquisitely leaved, but each a worry because they "come" too much. Also I have no regard for "The Bishop's-weed." Why "The Bishop's" it were hard to say. One detects in it nothing especially episcopal. By the confused description in Gerarde's "Herbal" it would seem to be Hone-wort. In Paxton's dictionary it is *Sison Ammi*, from the Celtic *sisum*, a running stream. This Sison one should call an evil weed were it not so harmless. Anyhow it is too tiresome for words. Paxton is good enough to inform the reader that "the seeds merely require sowing in common garden soil in spring." Who would be so rash as to sow it? It suffices to receive a parcel of any kind of plants from the north, and Bishop's-weed is pretty sure to be amongst the packing, and you are safe to stock your garden with it, without the faintest hope of ever getting rid of it, for the root runs far and deep.

The chief interest of garden weeds seems to rest with those that spring up naturally, of themselves; which as it were belong to the soil. They are more in number, I think, than those sown by birds, or in other ways imported. It is not easy, however, sometimes, to know for certain which are true natives of the place.

I would like to begin the list of garden weeds which may be supposed to belong naturally to my own little plot in South Bucks by naming my favourite of all the Greater Celandine (in Somerset called the Witches' Flower), *Chelidonium majus*. So pleasant to me is this lovely plant that every spring, when the young growth may not at once be visible, I suffer from fears lest the stock is lost; yet in the end there is no disappointment; soon or late the weed I love is sure to reappear.

Great Celandine, when it has attained its proper size, is full of grace.

It is satisfactory all round. It is an "elegant" plant in the old true meaning of the word—that is, "made with care and taste, excellent; highly wrought." Seldom is it seen in groups of more than three or four, oftener it comes singly, and shadowy places seem to be the most agreeable to it. There is just one drawback—the sinister-looking orange-drop that oozes from the end of a stalk when broken. Yet even that ugly drop is possessed of healing qualities. The leaf is boldly and exquisitely cut, and the whole plant bears a sort of stately presence, lowly in stature though it be; an aspect of strength and delicacy combined. Great Celandine is certainly my best-loved garden weed. He is said to be named "Chelidon," after the swallow, since it first appears with the swallow, and dries up when swallows depart. Our Celandines near the house—they seldom wander far—began to spring this year just as the first swallows arrived. As for the withering away, the plant knows his time, but I do not; since I am absent from the garden from July until autumn.

For the Lesser Celandine (*Ranunculus Ficaria*) I fear I have little fancy. Poets praise it and children love it; therefore not to care for it must surely be my own mistake. Just once or twice I have seen it in the garden nestling among the roots of a Rose-bush, with wide-open petals glistening in the sun, like gold; and then I have almost liked it. It then has somehow seemed to lose its perhaps rather "common" look.

Early in February or March, under the old trees of a Lime avenue just outside the garden wall, our little Celandine luxuriates. Suddenly, in April this spring, there appeared one day a purple glow—the purple of wild Sweet-violets, between the polished leaves and blossoms of the Celandine. The Violets made netted patchwork in the midst, and they seemed to redeem the almost vulgar boldness of the little yellow-flowered plant. A Violet leaned against every other green leaf-disc of Celandine!

Another favourite is a handsome weed that stays with us in beauty from about the first week of December until put an end to by the hot suns of summer. Gardening and botanical authorities have named it for me *Helleborus fœtidus*. Yet except for a kind of pungent odour in the leaf when crushed, I can discover nothing to warrant the unpleasant name. Had I had the luck to be its godmother, it should have been named something that meant green-flowered, or charming, or "the plant with sad-coloured leaf." As usual it is next to impossible clearly to make it out in the gardening books, at least in those I have been able to consult. Mostly these descriptions seem to read as though the authors had never beheld the plants they describe; and when there are illustrations the case is worse; they seem to be coloured to look pretty and—except when photographed—are unnaturally twisted about so as to fit the page.

Helleborus fœtidus, if thus it must be, seems to have been with us always, more or less. At least I cannot remember when it was not there. It grows only in one special bit of the garden, within the shady angle of an old brick wall. I do not know of the narrow boundary being ever overstepped in the course of these many years past, save once only when one individual seedling contrived to transfer itself from the shady to the sunny side of the old wall. Here it rejoices in the hot south, with equal zest as formerly in the cool shade. Hellebore seems to be not particular about either aspect or soil, thriving, as it does with us, both in deep garden mould and in gravel. Last December the abundant blossoms of our Hellebore weed were conspicuously attractive, and thus they remained unchanged until the first days of April. Even then the light green panicled cymes, in such good contrast with the dark foliage, retain their beauty, while the flower quietly seeds itself away. Long before the Hellebore has failed, Euphorbia (*E. Lathyris*, or Cape Spurge) begins to dot the borders here and there with the columnar grace of his tall stem. Euphorbia never comes in such numbers as to require much clearing away. It may not be a feeling of admiration that rivets attention to this curious weed; it is more perhaps the strange symmetry of the set of its leaves. An equal measure of parts is no unusual characteristic among plants, yet Euphorbia displays this exact symmetry in rather an uncommon degree. The leaves are said to point north, south, east, and west; and I believe it to be true—at least it is thus with the Euphorbias in my garden. They may make a mistake sometimes, but as a rule they know the points of the compass.

What mysterious magnetism is it that moves these strange leaves? What secret stirring of the slow white sap?

A fine plant of Euphorbia rises against one of our walls, and has attained already (May 13) a height of three and a half feet, with an exceedingly massive stem. Downwards from the budding summit, where are seven buds instead of the usual four, the colour of the stem is all pure lilac bloom fading palely into green. The leaves—blunted at the end, and each one's centre broadly veined in dull white—show a kind of careless vigour. This great Euphorbia king seems scarcely to know what to do with his own immense vitality; and before long the firm smooth pillar will be spoilt by the branching out—Brussels-sprout-wise—of little sprigs all the way down. The bud bears in some degree the semblance of a serpent's head, and so the plant has been called "Medusa" or "Medusa's Head." And also it is said that a dead plant will come to life again and bloom if placed in warm water. I have not tested the truth of this.

If we climb down from these grand incomprehensibles to the earth around them, which in March they have not yet begun to pierce, we find in that early month numbers of the little field Veronica (*Veronica agrestis*) about the garden, beginning to twinkle in the morning sun. It is not of much account, being so very small. Yet I have seen the furrows of a ploughed field just outside the garden literally blue with it as it lay there in countless multitudes. As the season ripens, *Veronica agrestis* goes its way and gives no trouble. After this come a few more weeds, both favourites and enemies. In their order of precedence they are these:—*Draba verna*, Robin-run-the-Hedge, Bryony, Black and White, Enchanter's Nightshade, Nettles (stinging, white, and yellow), Pimpernel, Fumitory, *Corydalis lutea*, Nightshade, Convolvulus, Crane's Bill, Mare's-tail, &c.

Draba verna is a sweet little thing, and even in childhood I had learnt its pretty name. When first it flowers in February, it is like a miniature, so exquisite is the finish of the tiny white flowers set on their slender stalk. *Draba verna* is very cheerful in itself, and loves best to make its home on some old mossy ledge, perhaps halfway up a western wall.

Such a position has been chosen in our place, and here a numerous family party are established and look the picture of happy well-being. At times, its fancy is to grow in a patch on some sunny bit of lawn where a big tree may keep the grass spare and dry. I have enjoyed the sight of our little plant on the wall all through March and part of April. But towards the end of that month it will have grown too tall and scraggy. It will look gigantic, towering above a new settlement of Forget-me-nots which have taken possession of the moss-grown ledge, crowding over every inch around the Draba roots. These Forget-me-nots are the most wonderful lilliputians imaginable. Each flower is almost smaller than the head of the very tiniest minikin pin ; yet the six square inches of them gathered together give a perceptible sense of blue to the bit of old wall. The sky-blue is as bright and the starry form as perfect in every detail, as in any of those finer forms of Forget-me-not that set with turquoise the wild margin of an English river.

Robin-run-the-hedge, or Goose-grass (*Galium Aparine*, Cleavers), is as tiresome as any of our most unbeloved garden weeds. It begins early, and if let alone would soon smother up everything. The Greeks, I believe, called Goose-grass *Philanthropon*, because they attributed to a love of mankind its tiresome clinging habit. If this were true, our remorseless pulling up of it would indeed seem hard. A much smaller, more refined Goose grass grows in one—and only in one—little bit of shrubbery amongst Ivy and *Kerria* and Bramble. This may be *Galium tricorne* (though it answers not in the least to Anne Pratt's description). It never wanders, and makes a pretty variety mixing with the dark-leaved Ivy.

White Bryony (*Bryonia dioica*) is springing fast in May, already seeking to support itself on Yew hedges, Box, or Laurel. The small green flower comes much later, with all its furnishment of most sentient, most intelligent tendrils. You may almost think you *see* them, stretching out like hands to clasp and hold a branch or stick or aught else likely to support the tender shoots. I do not know if ever the question has been decided whether these tendrils twist always from right to left or the other way. Once I made a series of observations ; but that is so long ago I forget the result, if any ; and it does not matter much. We give our White Bryony leave to clamber where it will ; nor is it torn down until the green round berry begins to redden, when, having lost self-control, the plant has lost its charm.

Black Bryony (*Tamus communis*) is rare in our countryside, and we have within the garden only two. These two plants are cared for and cherished, for Black Bryony is handsomer than White. The Black has no tendrils, yet it manages well enough without ; and as for its leaf, I know no other leaf so satisfying to the eye as this, in the plain sincerity of its pure outline.

Another climber which I think is native to all gardens in every place everywhere—the fatal Bindweed, or *withy-wind*—would strangle in an unrelenting weak embrace the entire pride of the garden. Only an unsparing vigilance will keep the beautiful destroyer in check. Yet, for me at least, what courage is needed to tear away a thing so utterly lovely as the snow-white Convolvulus-flower of it is ! Once I asked my gardener, "Was there *any* place at all where Bindweed might be in peace, and have leave to live?" His reply was curt and decisive: "There's NO place."

The prettiest weed of the garden, after all—and the sweetest, if you bruise the leaf of it—is the common Crane's-bill (*Geranium Robertianum*). I find in an old family herbal the remark that "very few know it by the name of Crane's-bill, but every one knows a Geranium." That was printed in the days when every Pelargonium was a Geranium! Now and then our Crane's-bill will make some shady garden-corner rosy, or it courts full sunshine hanging from the grey limestone of the rockery. The delicate markings of the small flowers seem as it were "put in" with a touch; and so elusive is the colour, one knows not if to call it pink or rose-lilac. No highly cultivated florist's flower could be more alluring in its beauty. How many such indeed are cultivated up to so huge a doubleness and machine-made regularity that a point is reached where all true distinction and character are lost! The flower of many a persecuted wild garden weed, in comparison, seems, as one might say, "hand-made"; bears still in the lovely painting and shaping of its corolla the mark of the hand of God.

Corydalis lutea flourishes abundantly on our old brick walls, clinging by preference to the western aspect. Few things of the kind please more than its sea-green Fern-like foliage, so delicately made yet richly full, as to give the idea of masses of green sea-foam. The little yellow flower-spike is muffled up to the chin in its foamy leaves. Such at least is the fashion of their growth with us.

Mixed with lutea is a bunch or two of the white variety. This is not native to the garden; it came from a nurseryman's packet of seed.

Ground Ivy (*Nepeta Glechoma*) is another chief favourite. The name Ground Ivy is often misleading, for we find visitors to the garden often call the Common Ivy that is kept low under our large trees "Ground Ivy." Alehoof is also its ungainly popular name, because formerly used in the refining of ale.

Ground Ivy has long been understood to have the freedom of one special spot in the garden. It is allowed to enring our ancient Sumach (*Rhus Cotinus*) with a broad band of palest sapphire blue. Before August has clothed the tree in beauty with its own glowing inflorescence, many things besides Ground Ivy are there to dress it or to creep around it. There are Wild Primroses in spring, and self-sown Berberis (*Mahonia*) decorates the bare stem with little yellow balls. Nightshade (*Solanum Dulcamara*), too, winding cautiously about the time-worn trunk and crooked branches, pushing out purple tassels all the way as it climbs, arrives at last, and looks out from the topmost leaves in a shower of purple tipped with gold. Our Nightshade is not, I believe, the deadly Dwale; yet since it has descended now to the lawn from the top of a high wall, where it had flourished formerly for years, there seem to be certain fears about the dangers of its tempting berries. It would be a disappointment if yellow Ladies'-bedstraw (*Galium verum*) came not in its season, year by year, among the stones around our sundial. The peculiar perfume of it refreshes greatly, more especially if mixed with Honeysuckle. It is only in Scotland, I believe, where Wild Honeysuckle blooms quite late within woodland shades, while Yellow Galium—with flowerstalks rising a foot or more—blooms upon the sunny banks outside, that one can breathe this sweetness. Galium is far less vigorous of growth here in the south, where, according to Gerarde, " it wanders hither and thither upon the ground, supporting its yellow spikes upon the herbage or stones near at hand." Red Lamium, always rather coarse-looking, is inclined to be a tiresome weed; though now and then it is impossible not to enjoy the dash of red given suddenly by a cluster of it at the edge of a border in the grass, or somewhere else where they ought not to be. A short-lived triumph, to be too quickly ended as soon as the gardeners " come round." Yellow Nettle, Weasel-snout, or, as in Oxfordshire, " Dumb Nettle " (*Lamium Galeobdolon*), steadfastly keeps its place in a little sunless grassy bit at the foot of a north wall under the stable clock. As a garden weed, I think the plant is rare.

I might not perhaps have cared much for our Yellow Nettle were it not that many years ago at Cliveden, one day when I was there, the late Duke of Argyll came in at tea time bringing in his hand a Yellow Nettle, which he showed with much satisfaction, having found it in his walk through Cliveden Woods. Knowing his botanical learning, I thought that it must be certainly a herb of note, and thereafter gave it welcome in its own chosen spot amongst a few Archangels (spared for their beauty) and rambling Potentilla. I know not why Dead Nettle is Archangel, except for the purity of its velvet whiteness. In the kitchen garden beside one of the gravel walks little red Pimpernels, or Shepherd's Clock, gaze up open-eyed at the sun in June. These are lovely and beloved; but never can I forget the joy and pride of one day finding at the edge of the turnip plot a solitary plant of the azure blue variety (*Anagallis cærulea*). The root was carefully marked with a stick, but never did it flower again.

Weeds belonging to that part of the garden which once was cornfield should not perhaps be reckoned among true garden weeds. Yet one of them, at least, must not be left out. Equisetum, or Mare's-tail (*E. arvense*), is possessed of rather a peculiar interest, if it be, as I am told, the only living British representative of the Carboniferous period. No mention of this can I find in any of the books consulted. It is not named by Gerarde or by Parkinson, nor do others say a word. Often have I watched with interest our forests of Equisetum growing up through the hard-rolled gravel, or thronging narrow edges at the foot of a paling that divides us from the field. Of late I observe our mimic Mare's-tail-forests have diminished, and to-day, at the end of May, the plant cannot be found at all. Last autumn we saw a patch of it, like a fairy Larch forest, near a field footpath in the Highlands. The habitats of Equisetum lie far apart indeed!

The common *Arum maculatum*, the " Lords and Ladies " of lanes and hedge banks, is another protected weed in my garden, although by Paxton's dictum " it is a very disagreeable flower," " and hence they are not favourites." The presence of it even in this garden of strict protection is often misunderstood, and I am often made sorry by seeing its ruined leaves in the weed barrow. I think it to be one of the most native of our wild garden friends. Among its many country names are Silly Loons, in Somerset, and Cuckoo Pint. Cuckoo " *quart* "! might well be named, the great species that grows under Olive trees, and in grassy places in the South of France, and whose giant spathe is like a cornucopia of tissue paper. Some that I once brought home and planted in the garden Apple-border waned away entirely after a few years, while plants of our smaller English species at about the same time became oftener seen. Arums do not get on very well either wild or in the garden. Never have I beheld in the garden a single one of their scarlet fruit-spikes, while in the lanes and hedge-banks rarely does a single spathe escape the busy hands of passing school-children.

An interesting little thing was, for I think it is now no more, a minute pale pink Geranium which used to come in dry hot summers on the hard gravel-walks. The height of it would be about half an inch, and the utmost spread of its foliage might almost cover a crown-piece. This mite has, I fear, yielded at last to the roller.

Most lovely and most native among all the natural *weeds* of my garden are the wild White Violets. Against these there is no law. In February and March the whole garden is white with them in every part, and in the grass at the north-east end and under the Apple-trees you would almost think there had been a hail storm, so white and thick the White Violets lie. But it is only Violets and Wood Strawberries that may spread and multiply at will like this. Without question the Violets are native to the place. Wood Strawberries were brought home for remembrance, from the old grey walls of a little church in Hampshire, about a quarter of a century ago. They seed now everywhere and are welcome ; and they forget not the old church walls whence came their parent plant, and will climb joyfully all among the *Linaria Cymballaria* or Mother of Thousands, or Wandering Sailor, to the top of our ivied buttresses, six feet high and more. A little Barren Strawberry, has been my pet for years. For many years it has lived close under the house-wall, creeping up supported by Wild Ivy, looking very pretty, with an embroidery of humble little blossoms. And only lately have I learnt that it is no Strawberry at all, but *Potentilla Fragariastrum.*

And so we come to wild things who have made the garden their home, and yet who do not seem to have naturally sprung there ; they may have been brought by birds, or have come in a hundred ways.

Once, all over the kitchen garden, the Thorn Apple (*Datura Stramonium*) ran wild. It used to be too plentiful, though now quite lost. I remember how beautiful it was, with its large pale purple blossom, giving place in season to the Prickly Fruit, in its turn opening to scatter abroad its little black seeds. Gradually, as years went on and care took the place of long neglect, it was weeded away off the face of the land, and now—I am sorry ! They say *Datura* was used in the incantations and unlawful practices of witches ; also, no doubt in some places, Thorn Apple is—as it is also said to be—a remnant of old ecclesiastical gardening, although introduced from Constantinople, Spain, or Italy, not earlier, I believe, than 1597.

Milk Thistle (*Carduus Marianus*) is another departed weed from our garden where it formerly used to flourish. This also, with its white streaked leaves,—made lovelier by a holy meaning that tradition gave,—was once a favourite in convent gardens. Wherever it now is found—when not recently introduced—we may be sure its origin in that place is in some way ecclesiastical. Our Milk Thistle has surely gone the way of

Datura, and it will be seen no more in the garden. These beautiful things are shy in their own way, seeming to understand when they are not much wanted. Tansy, with leafage "infinitely jagged and nicked and curled withal like feathers" (so described in Parkinson), has also for reasons of its own quitted the garden; and last June, a patch of it, avoided by the cows, gave the sole touch of fresh green in all our dried-up meadow. The day of a school feast, a party of white-frocked little girls sitting in the midst of this fresh and brilliant Tansy—busy tying up aromatic posies of its emerald sprigs—made a picture to be remembered long. On the east side of the house close under the drawing-room windows, in a sort of earth *hem* six inches wide, suddenly appeared one summer a single plant of *Claytonia perfoliata*, holding the flower-head upright in the middle of its strange little green saucer. Immediately it became a favourite weed. We have had difficulties in the matter of keeping it alive. There was an under-gardener who persisted in mowing it down. It did no harm in the position it had chosen; strict orders had been given not to meddle with the little plant; yet whenever this unlucky youth's turn came to tidy up, the *Claytonia* was sure to be annihilated. Once I hurried to stand guard over my weed—as "Baggs," looking dangerous, came near—and again forbade him to touch it. Yet next morning it was away, as usual. Nothing will cure an unskilled garden labourer's ardour for destroying the wrong thing. "Baggs" has long been a thing of the past, and *Claytonia perfoliata* lives and multiplies in peace. Close under an aged Apple espalier, for several years past, has flourished a splendid root of Wild Hyacinth (*Scilla nutans*). Somehow, although constantly increasing in size and in depth of colour, it has never lost the thin spare character of a true wild flower. Once on a time there came a plant of Tway-blade (*Listera ovata*). Dog Violets flower here and there like little amethyst gems; and a new variety, very pale in hue, has appeared. In the month of May Wild Hyacinth—blue and white and pink—adopts the garden for its own. In May, too, Woodruffe makes sweet the air in different parts of the garden. These last are weeds imported from elsewhere.

Late in June one becomes aware of the slender eager springing of Avens (*Geum urbanum*), wherever there is shade of shrubs or trees. I like to see it—in moderation—and it suits well its pretty names of 'Gold-star' and 'Erba Benedetta'; though certainly not unlike a tall mistaken Buttercup. With small petals and bunch of brown central stamens it makes but little show.

Then there are what may be called national weeds, weedy plants which are mostly only too inherent and native to the soil of every English garden. Of these are the hateful Summer Cress, and Shepherd's Purse with its little heart-shaped satchels, so neat and tidy-looking in its habit; and Enchanter's Nightshade—which for all its magic name is a pest and would fain, if we let it, annex the garden altogether—and pink-flowered Willow-weed, which we should make much of were it only rare; and Coltsfoot, which I love. And in our garden orchard—as indeed wherever deep Meadow Grass is growing all over the country in the spring time of the year, come those dear favourites of childhood, the innocent Cuckoo Flowers, or Lady's Smock (*Cardamine pratensis*). Besides these and many more, a host of indistinguishable green things, which, I suppose, have names.

I can think of no more garden weeds, either pets or enemies, native or imported, unless the various agarics that autumn brings may be so called. They come in shadowy places under trees or in the shrubberies. To me they are full of interest in their quiet way, endless in variety, and some of them marvellously made. We cannot boast any grandly coloured scarlet and orange species, but in their own varied shades of brown or lilac the beauty of our autumn Toadstools cannot be surpassed.

One, like a large dark brown or chocolate *Mushroom*, was found four years ago between the roots of a great Oak in a meadow near the garden fence. This curious growth seemed something of a mystery, and was despatched to me by post the day my gardener discovered it.

It was then, and still remains, as hard as a bit of mahogany. It is as if the spirit of the Oak and his substance had passed into the lowly fungus at his feet. One might almost fancy some occult affinity, in the broad Mushroom-like shape of the old Oak on which it grew. It is said of the various kinds of fungus arboreus, that they have a venomous faculty, and they of the Oak bring death.

It might certainly seem that the garden where we have been wandering is but "a dankish untoyled place," as old garden books would say, after this long enumeration of its weeds and fungi. Yet I think the Horticultural Society might find Huntercombe not so badly kept after all! It might even be a surprise to see there more flowers than Weeds.

DISEASED PELARGONIUMS FROM THE TRANSVAAL.

By Geo. Massee, F.L.S., V.M.H.

In February last the Secretary of the Royal Horticultural Society received from Mr. John Dowie, Fordsburg, Transvaal, specimens of diseased leaves of English and French varieties of Zonal Pelargoniums.

The only remark in the letter accompanying the specimens was to the

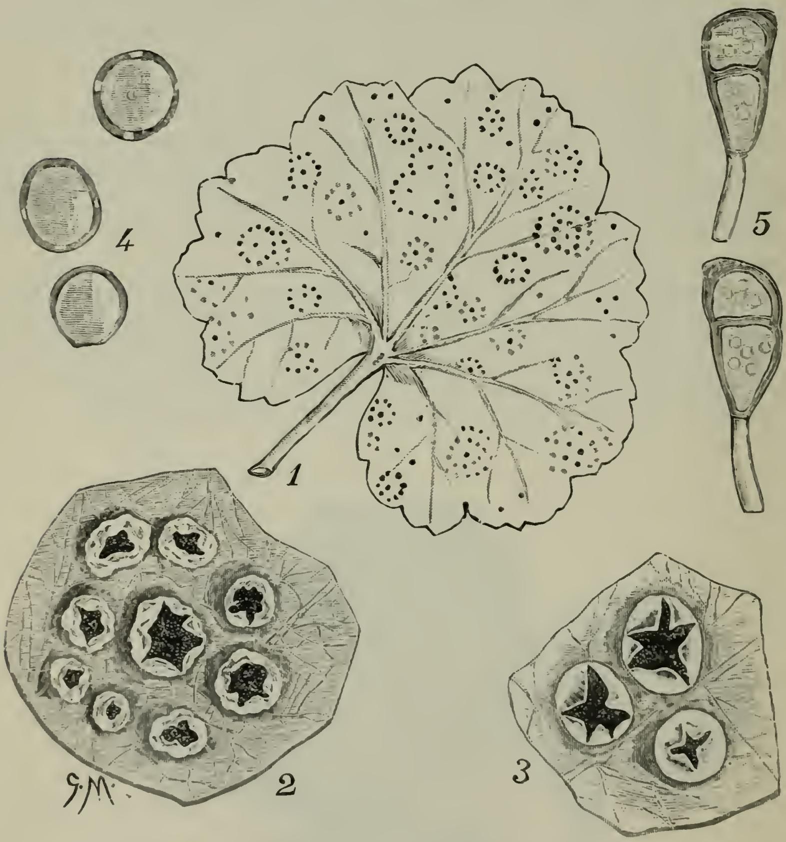


Fig. 59.—Diseased Pelargonium.

1. Leaf attacked by the uredo stage of *Puccinia granularis*. Nat. size.—2. Groups of uredospores bursting through the epidermis of the leaf. × 40.—3. Groups of teleutospores bursting through the epidermis of the leaf. × 40.—4. Uredospores. × 400.—5. Teleutospores. × 400.

effect that plants grown under glass were more susceptible to the disease than those grown in the open air.

Microscopic examination showed that the disease was caused by a minute parasitic fungus called *Puccinia granularis*, Kalch. and Cooke, a pest allied to the wheat mildew—*Puccinia graminis*, Pers., and, like the latter, producing different kinds of spores or reproductive bodies during different periods of its life-cycle. The first or uredo stage appears under the form of minute snuff-coloured groups of spores arranged in miniature fairy rings on the surface of the leaf. These uredospores are produced in immense numbers, and are carried from one leaf to another by wind, and thus enable the disease to spread with great rapidity.

Later in the season, just before the leaves begin to fade, the production of uredospores ceases, and a second kind of spore, called a teleutospore, is produced from the same mycelium which earlier in the season gave origin to uredospores. When the leaves decay, the teleutospores or resting-spores lie unchanged on the ground until the following spring, when they germinate and inoculate the young leaves, which in course of time again bear first uredo- then teleuto-spores.

Now *Puccinia granularis* is not uncommon on various kinds of wild plants belonging to the *Geraniaceæ*, as *Pelargonium aconitophyllum*, *P. alchemilloides*, &c., in Cape Colony, Transvaal, Natal, and Kaffraria, and in all probability the fungus passed from such indigenous species to the imported cultivated forms.

The statement that the disease is worse in the case of plants grown under glass than otherwise shows that such conditions of cultivation result in "soft" foliage in South Africa as elsewhere. Is it possible to grow plants under glass and yet retain the foliage as firm, crisp, and resistent to fungi as when the same species is grown in the open air? If so, then those who do so will be no more troubled with those destructive fungus epidemics peculiar to plants grown in hothouses, as all such are only rendered possible by the flabby, limp, non-resistent foliage. In other words, all such diseases are purely artificial creations called into being by a combination of conditions, which at one and the same time render the host very susceptible, and the fungus very aggressive.

The prime factors in bringing about this condition of things are too much moisture in the air and lack of proper ventilation.

SOME FLOWERS OF GIBRALTAR AND ALGECIRAS.

By Marion H. Mason.

We left England on February 1 amidst the gloom and mourning of the day before the Queen's funeral. A thick fog hid the Essex marshes from sight as we steamed from Liverpool Street to Tilbury, and detained us some hours in the river. So, after a tossing in the Bay of Biscay, it was a pleasant change and contrast indeed to be able to sit on deck in the mild warm air of the Portuguese coast. The voyage is by no means devoid of interest. There are many glimpses of the land, the views of course depending upon which places are passed by day. Cape St. Vincent is most striking, and nothing can be more wonderful than Cintra, with its old palace perched upon the very crest of the sharp ridge of rock, in outline against the sky, with precipices falling straight from it on both sides. Exposed as it is to the full gales of the Atlantic, it is not surprising that the King should have desired a more sheltered abode ; though the new palace, built at some distance north of Cintra, and well seen from the sea, might be more attractive. The huge building, looking like an asylum or kindred institution, stands alone, uncompromisingly straight and bare on the low hills facing the sea, without a tree near it.

It was like entering another world when on the fifth morning we woke in the Straits of Gibraltar in brilliant sunshine, with blue sea and hills dotted on the Spanish side with white cottages, and rich in colouring on the African side as well.

It seems to have been only recently discovered that Gibraltar is an excellent starting point for excursions into Spain as well as Morocco, and it is now much frequented for that purpose. But otherwise few people stay on the Rock who are not stationed there as officers in the army or navy or some other profession, or who do not come to visit friends or relations thus engaged. The very limited space of the Rock is not an attraction. Moreover a pass is required for all the more interesting parts of the jealously guarded Rock, and it is not a place where one may wander at will in search of flowers or come upon them accidentally in a casual ramble. Comparatively few persons therefore know how interesting it is from a botanical point of view. There are said to be over a hundred kinds of plants which are peculiar to the Rock and to grow nowhere else. As to whether this is so my experience is too limited to enable me to form an opinion ; but as far as it goes I have found the Gibraltar flora as a whole to be, as might be expected, midway between those of the south coast of Spain and the north coast of Africa, which are also not very generally well known.

Perhaps the most striking flower of the Rock is the huge light blue *Scilla peruviana*, which was in flower in March. The best and finest grow on the north side of the Rock, above the path to the Galleries. I found it also a little later at Tangier, but it was not yet in full blossom, and neither so fine nor so abundant as at Gibraltar. I afterwards—at the beginning of April—saw it again at Algiers, and there of all shades from light blue to dirty white. It is hardy enough to flower out of doors in the milder parts of England, and I have known it to blossom well in a South Welsh garden ; but there it did not, and was not likely to come up to the size and colour it attains in its native place. A splendid large pink and white Candy Tuft, *Iberis gibraltarica*, grows on the Rock of Gibraltar, a shrubby perennial like that common to English gardens, but larger and finer. It is peculiar to the Rock and found nowhere else. And though others may have seen it elsewhere, I have never elsewhere found such a pure white Periwinkle as in one spot at Gibraltar. A great part of the Rock as well as many places on the Spanish coast and that of Morocco are covered with periwinkles of the same kind as the pale-grey ones of the Riviera. They are rather smaller than the ordinary large blue Periwinkle (which also grows on the Riviera) and quite distinct from it as well as from the small variety indigenous in England and many other countries. This medium variety is very lovely and of various shades of blue and grey ; but I have only found it white this once, and most beautiful it was. Early in February the open ground and rocks at Gibraltar were literally purple with a large species of *Romulea*, like a big Crocus with an orange throat. On Europa Point it grew not singly, but in crowded clumps—even on the edge of the hard road. Mixed with it on the north front and neutral ground was a much smaller and less striking one, varying in colour from purple to pink. Later I found it near Tangier, but there it was larger and of an invariable bright lilac. These Romuleas are altogether distinct from the pale species which grows in Algeria, and are much handsomer. Early in the year the Rock of Gibraltar is covered with the white paper Narcissus, which is also found in the South of Spain ; but I was too late to see anything but its seed. There is the large pink Mint, common to the South of Spain, and many of the same sweet-smelling herbs, though there is certainly an absence of many of those abundant on the shores of Spain and Italy. There is very little, if any, Mediterranean Heath, either white or pink, though both of them grow plentifully in the cork woods of Algeciras just across the bay. Nor did I find much if any Myrtle at Gibraltar, though it grew near Algeciras.

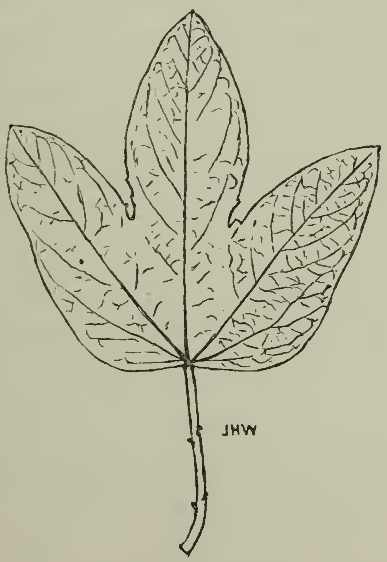
Although there seems to be very little "rock fever" now remaining at Gibraltar, thanks to modern drainage and strict rules as to cleansing of the streets, it cannot be a specially good health resort, considering its very limited area, its crowded town, and the draughts when the wind is in certain quarters. But Algeciras, just on the other side of the bay, and within half an hour by steamboat, seems to have a pure and healthy air. It is sheltered from the west wind by a wall of wooded hills which might almost be called mountains. Hitherto there has been no accommodation good enough to tempt any one to remain there more than the one night necessary for catching a most ill-timed and inconvenient Spanish train ; but a new and luxurious hotel has been lately built, and is shortly to be opened, on the shore outside the town, where those who wish to be near friends at Gibraltar will be within easy reach of them, and those who desire to catch trains without a preliminary ordeal of discomfort may rest in peace. Special provision has been made for those English people who must continue their national habits and pastimes wherever they go, and they may indulge in the monotony of golf, lawn tennis, or billiards as at home. But those who like variety in a foreign land will find it in the pretty country, cork woods, and southern flowers and birds. We made a charming expedition one day to some waterfalls in a mountain gorge. Five of us were mounted on donkeys with pack saddles, having cross-horns at both front and back as well as footboards, and seated on ordinary bed-pillows and pillow-cases. The donkeys had no bridles, only a cord round their heads, by which the men who accompanied them might seize them if need should arise. But the donkeys knew their own way and took it, and it would have been of very little use for any foreigner to contend with them. We took three men with us to look after them, and they selected and distributed us among the donkeys as they judged fit. They apportioned me to a little white one, which was evidently accustomed to act as leader, and I resigned myself to his care, the others following in single file. Along the rough track we went, up hill, over rocks and stones, through mud and streams, the men shouting "Arri, bourri!" "Get on, donkeys!" in a mixture of Spanish and Arabic. Heavy rain had lately fallen, and the streams were much swollen and the mud was deep and sticky. Donkeys very much dislike wetting their feet, and always jump a stream whenever they can rather than walk through it, and most beautifully they jump. I have ridden many in many countries, and always found that they jumped much more easily than a horse—so easily and without jerk that one hardly feels it. But wise as my donkey was, he did not know that the rains had converted a part of the track into a deep bog, and here I suddenly found myself stuck fast, unable to move. By dint of much shouting I at last called up one of the men who were attending to the tail of the procession, and by pulling the legs of my steed out one by one, and step by step, I was at last extricated and set on *terra firma*, but not before more than one of the train had followed me into the bog, and had to be extracted in like manner.

We then proceeded quietly for about another half-mile, when, soon after crossing a swollen and muddy stream, I heard shrieks behind me, and looking round beheld, to my horror, my maid and her donkey, to whom I had entrusted my cloak and sketch-book, apparently rolling together head over heels in the stream. The maid, however, managed to jump on to a boulder, but the donkey's hindquarters entirely disappeared. I thought he was, if not dead, permanently disabled; but the three men managed, by devoting their combined strength to one leg at a time, to pull him out, and having washed him set him on the further bank, where he continued his journey *minus* his rider, who could not be persuaded to adventure herself on his back again. Happily the cloak and sketch-book, having been tied to the front horns of the saddle, were not submerged, and escaped without damage.

The Waterfalls, which were our destination, are nothing more than a stream broken by rocks and boulders, but most picturesque is this stream, bordered by Oleanders and Wild Rhododendrons. They were of course not in blossom at this early time of year (February), but being evergreen were even then beautiful. The Cork trees are very fine, and the undergrowth chiefly consisted of white Mediterranean Heath in full bloom, and pink, a much earlier variety, of which only a few blossoms were remaining to show what it had been. Yellow Cytisus of several varieties grew in abundance, and besides the usual varieties of pink and white Cistus was the common small one, here yellow instead of white. I do not mean one of the small yellow Helianthemi, but the shrubby white Cistus, which I have never elsewhere found yellow. If it is a distinct species it is one hitherto unknown to me.

Later in the year—on March 29—I spent another day at Algeciras, and went out in the opposite direction to some Fir woods on the level and below the hills. Here I found the beautiful yellow *Anemone palmata* growing on the edge of the woods, and in a neighbouring field in quantities like Buttercups. There was also a pretty blue Squill, and outside the woods were numbers of Lupines, both blue and yellow. Along the dry road sides were numbers of the beautiful little blue *Iris Sisyrinchium*, which I had found in February on the other side of Algeciras. This Iris, one of the most delicate and beautiful of the tribe, seems to like hard, dry, trodden ground and great heat, and its distribution round the Mediterranean is interesting. I have found it also at Gibraltar, in the Algerian Atlas near Tangier, near Malaga, and in Malta and Sicily. It grows among the stretches of stone and ruins at Syracuse, and on what were once the seats of the Amphitheatre at Taormina. But I have never seen it anywhere like what it was near Hammam R'hira in the Atlas, either for beauty or abundance. I have never had the opportunity of looking for it in South Italy, but though well acquainted with the flowers of both French and Italian Rivieras I have never found it there. It seems to require more heat.

The flowers of Gibraltar and Algeciras are certainly both beautiful and interesting. I have mentioned only a few of them, but they deserve more notice than they generally receive.



THE KHEDIVIAL HORTICULTURAL SHOW AT CAIRO.

By Geo. L. Morgan, F.R.H.S.

The Annual Exhibition held by the Khedivial Horticultural Society took place in the Society's grounds at Ghezireh on Friday, Saturday, and Sunday, March 7, 8, 9, 1902, and, as on all similar occasions, was the "rendezvous" of all Cairo. The Exhibition was opened by the Khedive himself, who greeted those invited to meet him with his usual courtesy and then proceeded to inspect the Exhibition. The flowers and plants were displayed in the Society's buildings, whilst the fruit and vegetables were arranged under a large tent. The prizes were afterwards distributed in a special tent most beautifully furnished. The bands of the English Army of Occupation and the Egyptian Army played during the afternoon. A short account of the Exhibition is given, as it may interest friends in England to know what we are doing for Horticulture in Egypt.

Comparisons are odious, but it will, of course, be well understood that whilst certain classes of plants which grow so well in England do not thrive well in Egypt, others, especially Palms, Ferns, and the more delicate kinds requiring a more genial climate, do far better than in England. Thus one never sees any good garden Daisies in Egypt, Primroses may be said to be unknown, whilst a bunch of Sweet Peas would be a greater delight to most English residents than a handful of pink Arum Lilies. The finest show of flowers was made by H.H. Prince Hussein Pasha Kamel, the President of the Khedivial Horticultural Society, but they were not for competition. Arranged in a circular group centred by lovely tree Ferns and Palms, they presented a splendid sight, and included fine specimens of Cyclamen, *Ranunculus asiaticus*, Crotons in variety, *Rhododendron ponticum*, excellent pots of *Caladium Leopoldii*, and flowers so endearing to the "exiles from home," as Lilac, Lilies of the Valley, Violets, and Hyacinths, all grouped in a charming way with Maidenhair Ferns. Among the best of the other exhibits were pots of Cinerarias and of Crotons, which were also shown by a native notable; a group of Cacti, Roses, Geraniums, and Pelargoniums successfully shown by Dr. Keatinge, and Banksia Roses and Lupins by Dr. Sandwith (both of these medical men take a very great interest in horticulture), and the Lady Cromer Prize of 1902, presented by H.H. Prince Hussein Pasha Kamel, value £30, for the amateur who obtained the greatest number of points in the classes for Decorative Plants, Flowers in Pots, and Cut Flowers at the three shows held by the Society, viz. the Chrysanthemum Show, Rose Show, and Horticultural Show, was awarded to Dr. Keatinge. S. Puccetti, a Cairo nurseryman, took several prizes for Carnations and groups of flowers in pots. The Mignonette shown was rather disappointing, being mostly too tall with the flowers not in contact. The Gilliflower also evidently does best in England. Plenty of it was shown, but it was deficient in perfume, and altogether delicate. Phloxes were very numerous and the colours very pretty. Nasturtiums were poor and ragged. Garden

Daisies rarely do well in Egypt, and present very little difference, except perhaps in size, from ordinary field Daisies. One would expect the Coleus to do well here, but the climate is probably too dry. Those exhibited were not nearly up to the standard either in stamina or variety of colour. The baskets of Roses showed that at least that flower can be successfully grown. Indeed, in the Fayoum many square miles are grown with Roses for the preparation of costly essences. Rose-growers have to be careful, however, for the trees are so prolific and, above all, the flowers are so quick in developing and opening that Roses with hard centres are rare. The table decorations were very fair, the first prize being awarded for a display of Lilies of the Valley and Maidenhair Ferns, the lamp shades being green. The second prize was awarded for pink Roses, tied with pink satin bows, the lamp shades also being pink. A table decorated with Nasturtiums also took a prize. Amongst miscellaneous side exhibits were manures, organic and inorganic; basket work done by prisoners, comprising all kinds of articles, from a big strong sentry box to delicate gilded five-o'clock tea-tables. One enterprising horticulturist showed Beetroots growing in pearl-glass, supported only by water and a certain fertiliser advertised.

With regard to the fruit and vegetables, the exhibits differed considerably from those usually shown in England, and one cannot do better than name them. The fruits were :—

Bananas.—These were not nearly up to the Egyptian standard, and there was only one exhibit.

Cedratos, sweet and bitter Citrons, Limes, and Oranges.—These were without doubt very fine. Some of the Cedratos were eight inches in diameter. The Oranges included Jaffa, Blood, Mandarins, and Narings. One of the Jaffas was 16 in. in circumference, with peel nearly ½ in. thick.

Indian Figs, or Prickly Pears, Naphoches, Kista, *Carica Papaya*, and Aigle Marmelos.—These were generally, except the Figs, little known.

Strawberries, Cape Gooseberries, and Medlars might have been better.

Guavas were very poor, but probably it was too early in the year for them, as they appear in Cairo in the summer months at the same time as the Mango. No Mangos were shown. In summer they are rather abundant, costing from 1*d*. to 2½*d*. each, and weighing about ½ lb., whilst Guavas usually fetch about 1*d*. a lb.

One good Melon was 18 in. in diameter. Of all fruits Melons can be said to be the best for Egypt. They are in season from May to the end of August, whilst the Nile banks allow of their being grown. The Water Melon, with pink middle and black seeds, grows to an enormous size and costs about 2*d*. The other smaller variety is delicious and is about as large as an English Vegetable Marrow and costs about 1*d*.

The vegetables included—

Spinach, Herbs, and Salads.—Under these heads several varieties of plants were shown. Arabs live chiefly on vegetables, and almost all kinds of leaves and plants found to be edible are included under the term "Spinach" or "salad." Of herbs probably Parsley is commonest, but it is not nearly so compact as in England. Bammias were not good, being out of season.

Radishes, Turnips, Parsnips, Beets, Carrots, though much under size, were very good exhibits. The tendency of the Egyptian climate is to make them fibrous and hot to the taste.

Artichokes were very numerous and excellent. They were just in season at the time of the show, and the exhibits were more numerous than in any other class.

Tomatos in Egypt, although growing so profusely, are not well looked after. The better varieties are entirely absent. The fruit ripens very quickly, but is gathered very indiscriminately. Those shown were disappointing, considering how suitable the climate is. Dr. Sandwith alone showed Plum-shaped fruit.

Peas.—The exhibits were numerous, but very poor. Most of the pods were almost empty, and shelling was quite out of the question even in the prize winners. This is no doubt the result of the dryness of the climate.

Beans.—French Beans were poor, but the Broad Beans were plentiful and very fair. The latter form a staple food of the natives.

Leeks.—In this class the home societies could learn something. Egypt is the land of the Leek, and some splendid ones were to be seen. The Society of Agriculture showed some three inches in diameter.

Celery as here grown is only fit for flavouring soup. That shown was very small and very green, and though very fair for Egypt could not have been eaten.

Salsify, Selq, were very good. Pumpkins and Asparagus not very good.

Potatos.—These are not supposed to do well in this country, but those shown were very good, and made one wish that such could be obtained in the markets. Sutton's 'Satisfaction' took second prize. This was the only intimation throughout the Show of the origin of any of the things shown.

Brussel Sprouts, Cabbage, Cauliflowers.—Over the first-named one felt inclined to drop a tear, but the sight of lovely Cabbages (one $1\frac{3}{4}$ foot across, with a beautifully solid heart) and some fine Cauliflowers soon dispelled the sadness.

Fennel was excellent for quantity, but for quality only a second prize was awarded.

Egg Plants, so very common in Egypt, and so popular as a food owing to their cheapness, were shown in both black and white varieties. They seem to be little relished, however, by English residents, in spite of the fact that, according to Arabic tradition, the water in which these vegetables have been boiled taken persistently as a medicine will cure any disease except the sickness of death.

After the distribution of prizes by H.H. the Khedive the Secretaries, Mr. Wilfred Carey and Mr. G. P. Foaden, were respectively decorated by his Highness with the third and fourth Orders of the Medjinet.

THE NARCISSUS- OR DAFFODIL-FLY (*Merodon equestris*).

By Rev. W. Wilks, Sec. R.H.S.

A discussion of intense interest to Daffodil-growers was initiated by Mr. Percy Williams, of Lanarth, at the meeting of the Daffodil Committee on Tuesday, March 25, 1902.

A note on this pest will be found in our Journal, vol. xxvi. p. 249, which summarises practically all that was known about *Merodon equestris* up to the present. Mr. Williams was led to make his interesting observations by a conviction that the grub makes its entrance through the base of the bulb, and not, as hitherto imagined, by way of the crown. The first introduction Mr. Williams had to the pest was in February 1901. When noticing that some bulbs in one Daffodil bed had weaker crowns than their fellows, he dug down and examined them, and found that the grub of *Merodon* had bored into the centre of each of the weaker-crowned bulbs. Without disturbing the roots he found he could distinguish the infested bulbs, from the fact that wherever the grub was present the stumps of the last year's flower and leaf-stalks remained inactive, instead of being replaced by new growth, the weakly growth which had attracted his attention coming, it was found, from the sides instead of from the centre of the bulb.

The grub was generally found near the crown of the bulb, apparently making its way towards the surface, and could frequently be extracted with a pair of small pincers without any disturbance of the bulb. In one or two cases the grub had eaten its way into the neighbouring bulb, but as a rule, if the partly eaten bulb was found empty, it was inferred that the grub was in the surrounding earth waiting to hatch into a fly, and in several cases it was actually found resting just under the surface.

In March two dead grubs were found which had apparently been caught by the frost on the surface.

Some bulbs were found where the grub had apparently died young, or had early moved on into another bulb, the base of such bulbs showing a nasty wound, but without freshly decomposed matter and in process of healing up instead. This fact strengthened Mr. Williams's opinion that the grub enters a bulb from the base and works upwards. Mr. Williams is also of opinion that by examining the base of each bulb and following up any rotten or dark spot the small grubs may be detected. The dark or rotten spot may, of course, be "basal rot," but he is confident that it is often the result of the presence of *Merodon*.

For some time Mr. Williams seems to have failed to identify the fly of *Merodon*. He therefore sent up a specimen of what he thought was it for identification to the British Museum, and received from Mr. E. E. Austen the following interesting note in reply:—

> The fly you have sent is not a *Merodon*, but a specimen of the common drone-fly (*Eristalis tenax*). *Merodon* and *Eristalis* are not very similar in appearance, and their respective life-histories and

habits are altogether different. If you compare specimens you will notice many points of difference in structure. *Merodon* is a distinctly smaller fly, with a noticeably smaller head; the basal joint (femur) of the hind leg is strongly swollen, and the middle joint (tibia) of the same leg has a stout spine at the tip, which is very useful as a means of identification. The differences in the veining of the wings are no less marked, though perhaps less easily detected by an untrained eye. The drone-fly is perfectly harmless; its larvæ (well known as "rat-tailed maggots") live in dirty ditches and similar places.—*E. E. A.*

A question then arose as to how and when the female fly laid its eggs, and it was suggested that as she hovered over the beds she dropped them on the foliage of the Daffodils, and that the grub, when hatched, followed the tissue of the leaves down to the neck of the bulb, and then skirted round and down it so as to enter at the base. It is known that *Bombylius*, the larvæ of which are parasitic in the nests of solitary bees, and *Cephenomyia*, the grubs of which infest the nasal passages and throat of deer, lay their eggs whilst hovering, and Mr. Williams thought he had seen *Merodon* dropping them in like manner.

In order to test practically whether the bulbs which showed only a small black spot at the base were infected with *Merodon* or not, Mr. Williams, in the autumn of 1901, sent a dozen such bulbs to me at Shirley, and although I have had many hundreds of thousands of Daffodil bulbs and not a few *Merodon* through my hands during the last fifteen years, I am bound to confess that when I received these particular bulbs from Mr. Williams I did not consider they had any *Merodon* about them; they showed only a small black spot on the base no bigger than a small pin's head. They were potted and kept in a cold greenhouse and grew, but very weakly, and when they were examined at this meeting on March 25 eleven out of the twelve were found to have three-quarter grown *Merodon* grubs in them. After the meeting I repotted them, and in May and June the perfect insects appeared. The general appearance of the fly, unscientifically described, is that of a small black humble-bee, for which I think any one would mistake it when flying. It has, however, very often, but not always, some bright brown markings on the back and tail, which shine like orange-brown velvet when the sunlight catches it rightly on an insect at rest. But the greatest peculiarity of the fly is the noise which it makes when flying about. I can only describe it as something between a shriek and a whistle; it is, of course, a small sound in itself, but great in comparison with the size of its author, and you can often hear it at a distance at which the fly itself is unperceived. The common drone-fly (*Eristalis*) makes no noise when flying, at least so far as my ear can appreciate, but the sound of *Merodon* betrays it to me before my eye catches sight of it.

The fly when it settles is very easily caught in an ordinary butterfly net, but not so when on the wing. It hides amongst the leaves of the Daffodils, rises on the least disturbance, but as a rule only goes a few yards and then settles again, when the net can be easily thrown over it. The most provoking part of it is the long time it covers; *e.g.*, I caught the first specimen out of doors this year (1902) on May 17, and the last on

July 12, when all my bulbs were dug up; but on examining the bulbs carefully I have since found *Merodon* grubs of all ages, some minute little white specks, others full-grown, and all sizes between; I am entirely at a loss to understand the very great difference in size and presumably in age of the grubs found in the harvested bulbs in the end of July. The full-grown grub is white or cream colour (turning dingy black when at rest), with a very round black noticeable hard spot for a head. It is about three-quarters of an inch long and exceedingly fat, like a miniature roly-poly pudding. In fig. 60 the fly is an exact and lifelike representation,

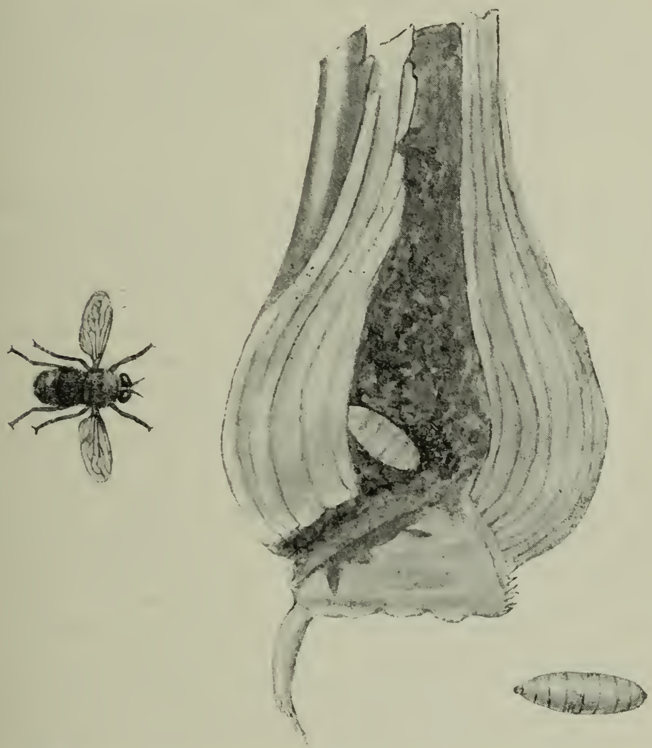


Fig. 60.—Merodon equestris—Fly and Grub. (*Gardening Illustrated.*)

but the grub is not so oval-shaped nor the chrysalis so pointed as represented; they are both much more flat-ended.

From my own observation I am convinced that in the majority of cases, if not in all, the grubs work their way down through the neck of the bulb and eat their way straight down the very centre of the heart of the bulb to the base where they seem *generally* to make a small hole through, possibly to act as a cloaca, and then they turn upwards to finish their course, emerging again by the same road they entered. I have found young grubs embedded in the centre of the bulb-neck, and on cutting open the bulbs they have been as yet perfectly sound and uninjured below. I am therefore strongly of opinion that Mr. Williams is mistaken in thinking the grub generally enters the bulb from below.

In my opinion Mr. Williams is also mistaken as to the method of the female laying its eggs. For in the first place the insect has a very long ovipositor, which one would imagine to be useless for laying eggs whilst flying; and secondly, I on July 7 saw a female sitting on the edge of a hole, left by the decaying Daffodil leaves, and stretching her ovipositor downwards. From which I infer that the egg is deposited as low down as she can reach amongst the shrinking and dying foliage, and that the grub, hatching quickly, follows the foliage to the neck of the bulb, and then works its way down the inside of the bulb towards the base. This, however, is inference and not observation.

I have noticed that when bulbs have been dug up and are stored in quantity a grub will often eat its way out of the side of one bulb and into the side or top or any part of the next bulb that touches it, so that little dependence can be placed on observation of stored bulbs. I have caught a grub with its head buried in the side of one bulb and its tail in the neck of another.

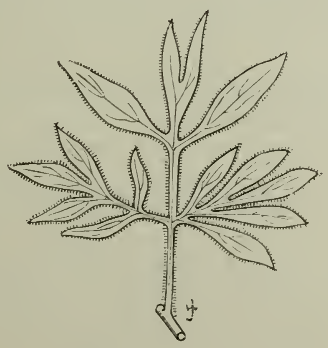
There is no doubt whatever but that the fly is very abundant in England now, and there is very little doubt that it was first imported from Holland about thirty years back. Growers of Daffodils do not like to admit they have got it, but I do not believe any garden exists in this country where 1,000 bulbs are grown where you could not find *Merodon equestris* among them. Whilst the discussion (of which this paper is an outcome) was going on, a great Dutch grower was heard to say that "he didn't know what we were talking about. They hadn't got any *Merodon* in Holland." At which one of the chief Daffodil growers in England was heard to remark *sotto voce*, "Then they must have been doing a wonderful export trade in them lately." And so, as a fact, we have all got *Merodon*, English and Dutch, amateurs and trade growers alike, some more and some less abundantly, and we should all for our own and each other's sake strive hard to keep the pest under by catching the flies and keeping a sharp look-out for the grubs when we are cleaning our harvested bulbs.

Mr. George S. Saunders, a member of our Scientific Committee and a well-known authority on all forms of insect life, writes to me thus:—

> The grub of the Narcissus-fly, *Merodon equestris*, or *M. narcissi*, as it is called by some authors, is much better known than the parent fly, but it is very essential to growers of bulbs that they should be able to recognise this fly, for one of the best means at our disposal for destroying this pest is by killing the flies. By the casual observer who is not an entomologist in any way, these flies may be mistaken for small "bumble-bees," just as their near relatives the common drone-flies are mistaken for honey-bees, for they are very hairy, and banded with various colours just as the bumble-bees are; but they may easily be distinguished from them by their narrower form, and by only having two pairs of wings, and their antennæ or feelers are much shorter. The Narcissus-fly varies very much in colour—so much, indeed, that differently coloured specimens have been described as different species. The head is dark brown or black; the thorax or fore-body is sometimes entirely black, sometimes has a reddish yellow or greyish band in front and behind, and is thickly covered with hairs. The body is also covered

with hairs, those on the front portion being black, and those at the tip being grey or reddish yellow. The legs are of moderate length, and are black and hairy. This insect is scarcely half an inch in length, and measures about an inch across the wings when they are spread open. The grubs are about half an inch long; they are of an oval shape and smooth, but the joints of the body are well marked; they are of a dirty yellowish-white colour. The pupa or chrysalis very much resembles the grub; it is much wrinkled, but there are no definite divisions of the body. Bulbs that are imported are occasionally infested with these grubs, but they may generally be detected by pinching them at the neck, when, if they contain a grub, they will feel soft and spongy. A friend of mine some years ago reported in the *Garden* newspaper that he purchased an apparently promising lot of 200 Narcissi at a sale, but he found no less than eighty grubs in them. The flies may be found flying about and settling on the bulbs in May and June; * when this is noticed every effort should be made to catch them. Many may be caught in a butterfly net after a little practice; it has been suggested that they may be caught by placing plates filled with treacle, and the edges smeared with honey, near the bulbs. The flies will be attracted by the smell of the honey and get caught in the treacle. It is obvious that nothing can be done to kill the grubs without destroying the bulbs; that, however, would not matter, for if the grub has so far destroyed the bulb as to make its presence known the bulb is sure to die. Dr. R. Bos, the celebrated Dutch naturalist, suggests as a precaution that all bulbs that are at all likely to be infested should be immersed in water for at least eight days, so as to drown the grubs. I feel rather doubtful of the utility of this measure, as I do not think the water would soak in far enough, and there would probably be sufficient air in the bulb for the requirements of the grub, and at the time when the bulbs are planted the grubs would be so small that they would not have done much damage to the bulbs. If the water in which the bulbs were placed could be kept at a temperature of about 115° Fahr. for twenty minutes or half an hour, the heat would probably kill the grubs without injuring the bulbs.—*G. S. S.*

* This year (1902) they were abundant in the early part of July.—W. W.



A NOTE ON THE WORK OF THE NARCISSUS AND TULIP COMMITTEE.

By C. Scrase-Dickins, Hon. Sec.

[Read at a Meeting of the Members on May 20, 1902.]

Probably it is not known to most of the present members of the Committee that originally we were formed as a Sub-committee of the Scientific Committee and not of the Floral, but this is the way in which it came about that we were called into existence:—In the year 1884 a Conference on Daffodils was held at South Kensington, under the presidency of Professor Michael Foster, F.R.S., when a resolution proposed by Mr. H. J. Elwes, F.R.S., seconded by Mr. J. G. Baker, F.R.S., was adopted as follows:—

> "That in the opinion of this Conference uniformity of nomenclature is most desirable, and that garden varieties of Narcissi, whether known hybrids or natural seedlings, should be named or numbered in the manner adopted by florists, and not in the manner adopted by botanists."

In order to carry this into effect a "Revising Committee" was appointed who should draw up a list of all the varieties then known, substituting popular names for the Latin or Latinised ones, except in the case of typical forms previously described. The Scientific Committee had had under consideration the question of the alleged doubling of Daffodils in gardens or modern reversions from single to double, and in February 1885 a circular was sent out to a large number of ladies and gentlemen likely to be interested in the subject asking them to become members of "a Sub-committee, which for brevity we will call the 'Narcissus Committee,' . . . formed under the auspices of the Scientific Committee of the Royal Horticultural Society," and to undertake work on the following suggested lines:—

1. Collect and sift the evidence offered by various observers as to the "doubling" or "going single" in their gardens.

2. If any cases seem to afford *primâ facie* evidence of "doubling" or "singling" in this or that garden, take these as "experimental stations."

3. Draw up a List of Regulations for carrying out an experiment, such as—

(*a*) Bulbs *in flower this spring* to be marked for experiment this summer as single, double, &c.

(*b*) The ground experimented on must be assured to be free from Daffodil bulbs.

(*c*) Precautions for securing that the labels do not get separate from bulbs, &c.

4. It will be as well that the character of the bulbs experimented on, and the result, should be attested by more than one Member of Committee. Possibly it will be desirable that some of the Committee should go down and plant the bulbs in the experimental stations.

5. Besides the operations carried on at experimental stations in localities said to have the power of doubling, &c., some sets of marked bulbs should be planted at Chiswick, under experimental conditions, and possibly in other places, where they can be watched by the Committee.

A meeting was held, and experiments were instituted at Chiswick, bulbs being planted in a variety of soils, local and brought from elsewhere, mixed and unmixed, manured and unmanured, under the observation of Mr. J. G. Baker, F.R.S.

On April 14, a meeting of the newly formed Committee was held at South Kensington, Mr. H. J. Elwes, F.R.S., in the Chair, when the list was submitted which had been drawn up by the Conference Committee with popular names substituted for the Latinised ones, including also the names of the older described species. Objection was taken to some division of Triandrus and Calathinus which proved fatal, and this list was never accepted, though the revision of names in compliance with the Conference resolution was taken up and continued by us, and up to the present time the rule has been adhered to in all strictness.

In 1886 a preliminary meeting was held to make arrangements for the season, and at the suggestion of Professor Foster, F.R.S., a notice was drawn up and a routine of business arranged as follows:—"The Committee will meet at 11 o'clock, when a list of the specimens sent in for examination and of questions for discussion will be presented. The Committee will first determine what specimens and questions it will take into consideration, and thereupon be adjourned in order that the members may conveniently and deliberately examine the specimens. At 1.30 P.M. the Committee will reassemble and proceed to the discussion of the specimens, &c., according to the list previously agreed upon. . . . The Committee will be glad to receive communications or inquiries relating to the natural history and culture of Narcissus, also suggestions for investigation, in order that the work may be made as broad and useful as possible." The circular also contained directions as to sending flowers and general instructions to be followed. A very liberal response was made to this invitation, and so plentiful was the material sent for investigation that four or five o'clock would arrive with the work unfinished. Consequently it was found necessary to dispense with the midday adjournment and work steadily from the start.

It must be remembered that in 1886, though Daffodils were advancing fast in popular favour, not only were the newer seedling varieties little known, but even the type forms were not familiar to the majority of nurserymen and amateurs. Such names as Princeps and Maximus were doing duty for a number of relatives besides their own individual selves, and one of the chief points to which the Committee applied itself was the reduction of the confusion in existing names. Moreover, in the case of many garden Daffodils, such as Moschatus, which had been in cultivation for centuries in Holland and in this country, it was not known how far they might be wild varieties, and if so, what were their native habitats. Diligent search made through many portions of Europe by such men as Mr. G. Maw, Mr. Tait, Mr. Wolley Dod, Mr. Barr, and others did much to settle this point, and also resulted in the introduction of new forms for the first time—Cyclamineus, Johnstoni, &c., information being communicated with great eagerness to the Narcissus Committee, who in turn gave attention to clearing up the natural history of the species, as well as to recognising the merits of new garden varieties.

The Committee also undertook to identify any flowers sent for that purpose, and the number received, not only from all parts of the United Kingdom, but also from Holland, France, Italy, Spain, and Portugal, was at times considerable ; there would be piles of boxes, some of them containing as many as thirty or forty supposed different forms. As our authority and our decisions seem to have been accepted by the senders of these flowers in nearly every instance, the result was that a great deal of confusion was removed, and the same name stood for the same thing in all these different countries. The number of expressions of gratitude which reached me as Honorary Secretary from those whose flowers had been named showed clearly that this privilege was much appreciated.

As regards the new garden or seedling forms, a plan was adopted of selecting carefully only the best, which were "registered" as standard varieties under a name appropriated so that it should not be used elsewhere, and all possible information concerning origin or history was asked for and noted. Unless the information had already been communicated, a special form was sent to be filled up by the exhibitor, and in some cases the history had to be traced back to the raiser or introducer, and it was the intention to have a coloured drawing made of each "registered" variety had not the number of seedling forms increased so rapidly.

The work, therefore, fell under three heads :—

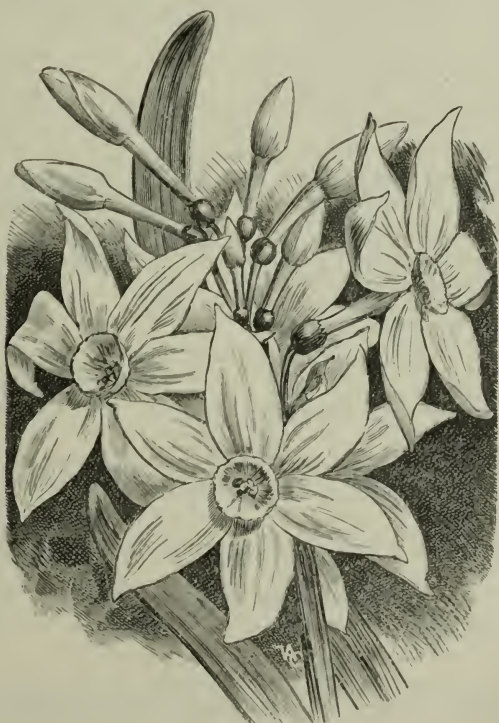
1. Information as to natural history ;
2. Clearing up the confusion of nomenclature ;
3. Selecting and registering standard varieties.

During the next few years the market industry in Daffodils as cut flowers was beginning to assume large proportions, hence a special importance of the flower which we had in our charge. I do not think it is too much to say that, had it not been for the stimulus given by this Committee, some of the raisers of new varieties who have been the most successful, would not have attempted or persevered in their labours as they have done. The unexpected manner also in which the very diversely formed types of Narcissus—Ajax, Corbularia, Cyclamineus, Triandrus, Jonquilla, Poeticus—have been found capable of being crossed or hybridised, has opened up a wider field of refined beauty than one could have dared to hope for.

To return to the history of the Committee. In 1887 a trial was started at Kew, the soil at Chiswick not being considered suitable, of all the white Ajax that could be obtained, in order to test the question how far distinctions which under certain conditions were observable would remain constant when those conditions of climate or soil were assimilated, altered, or removed. It has always been the ambition of the Committee to have the varieties submitted for judgment grown and tested side by side in a similar way, and examples kept for future reference and comparison, but the inflated money value of bulbs of the finer varieties—which were the chief ones required for the purpose—has rendered this impossible in practice.

In the year 1889 the Council granted us power to recommend First-class Certificates and Awards of Merit, as some difficulty was likely to arise from flowers being brought first before the Floral Committee and dealt with by them without being submitted to us.

In 1890 a Conference on Daffodils was held at Chiswick, which marked a great advance in knowledge during the five years, and of which all can read in the JOURNAL of the Society, vol. xii. page 288 *et seq.* The number of varieties registered up to that time was thirty-nine. With the exception of the year 1895 the meetings of the Committee have been held regularly each spring, and though the nature of the work is changed somewhat (Tulips having been added to our care this year, 1902), the functions now exercised do not differ largely from those of the Fruit and Floral Committees, except perhaps when we make a quasi-scientific excursion into the domains of the *Merodon*, as was done the other day; and I feel that there is no longer any need of a special Honorary Secretary or Correspondent. During my fifteen years of office the work has been a source of great pleasure to me, I have made many friendships which I value highly, and I have to thank the Members of the Committee most gratefully for all their loyal assistance. In his letter asking me to act as Secretary Professor Foster wrote: "The Daffodil Committee is in great want of a Secretary who will *drive* it with a firm hand," and if under a variety of Chairmen I may have seemed at times to "drive" unasked, it should be remembered that such were the terms of my appointment, and that I have been striving throughout for a uniformity both of policy and method.



EXAMINATION IN HORTICULTURE.

1. The Council of The Royal Horticultural Society, sympathising with the efforts of various County Councils, Technical Institutes, Schools, Gardeners' Mutual Improvement Societies, and other bodies to promote instruction in Practical Horticulture by means of Lectures, Demonstrations, &c., and in the hope of rendering such teaching more definite and effective, have consented to hold an Examination in Horticulture on April 23, 1903.

2. The following is an Outline Syllabus showing the nature of the subjects to which it is considered desirable that the attention of Students should be drawn:—

ELEMENTARY PRINCIPLES

On which Horticultural Practice is based.

(1) Soils, good and bad: their Mineral Composition; Chemical Nature of Fertilisers and their respective values.

(2) The Physiological Values of Water, Heat, and Air in Plant Growth.

(3) The Structure of Seeds and their Modes of Germination; the Chemical Phenomena of Germination; the Movements of Seedlings and the Uses of them.

(4) The Functions of Roots; their Anatomical Structure; Hindrances to Healthy Root-action and their remedies.

(5) The Uses of Stems and Branches; the Anatomical Structure of ordinary Dicotyledonous and of a Monocotyledonous Stem.

(6) The Physiological Functions of Leaves, and the Action of Light upon them.

(7) The Structure of Tubers and other Subterranean Stems; the Structure of Bulbs and Buds; the General Phenomena of Vegetative Multiplication.

(8) The Physiological Processes undergone in Growth and Development; the Structure of an Active Cell, and the process of Cell-division and the formation of Tissues.

(9) The Structure of Flower-buds and of Flowers; the Methods of Pollination, Natural and Artificial.

(10) The Process of Impregnation of the Ovule, and the Formation of Embryo and Endosperm.

(11) The Classification and Description of Fruits; the Changes and Development during Ripening.

(12) The General Characters of the Commoner Families of Plants in Cultivation.

(13) The Origin of Species.

HORTICULTURAL OPERATIONS AND PRACTICE.

(1) Surveying and Landscape Gardening, Elements of.

(2) Choice of Site for Garden.

(3) Description and use of Implements under each head.

(4) Operations connected with the Cultivation of the Land, with explanations and illustrations of good and bad methods; Digging and Trenching; Draining; Hoeing, Stirring the Soil, and Weeding; Watering; Preparation of Seed

Beds; Rolling and Raking, Sowing, Transplanting and Thinning; Potting, Planting; Aspects, Positions and Shelter; Staking; Earthing and Blanching, &c.

(5) Propagation, Elementary Principles: Cuttings, Buddings and Grafting, Stocks used, Layering, Division, Branch Pruning, Root Pruning; Old and Young Trees and Bushes. Training.

(6) Fruit Culture: Open Air and under Glass; Small Fruits; Apples and Pears; Stone Fruits; Gathering and Storing; Packing and Marketing. General Knowledge of Fruits, and Selection of Varieties.

(7) Vegetable Culture: Tubers and Roots; Green Vegetables; Fruits and Seeds; Rotation of Crops and Selection of Varieties.

(8) Flower Culture, Outside and Under Glass.

(9) Manures and their Application.

(10) Improvement of Plants by Cross-breeding, Hybridisation and Selection.

(11) Arboriculture: Trees and Shrubs and their Culture.

(12) Insect and Fungus Pests; Prevention and Treatment.

3. Students and young gardeners not having had the advantage of attending Lectures, but wishing to present themselves at some one of the Centres for Examination, might with advantage consult some of the following works:—

"Primer of Botany," by Sir J. D. Hooker, K.C.S.I. (Macmillan & Co., 30 Bedford Street, W.C.) 1*s*.

"Elementary Botany," by Prof. Percy Groom (Bell & Sons, Covent Garden). 3*s*. 6*d*.

"Elementary Botany," by J. W. Oliver. (Blackie & Sons, 50 Old Bailey, E.C.) 2*s*.

"Botany for Beginners," by Professor Henslow. (Stanford.) 2*s*. 6*d*.

"Floral Dissections," by Prof. Henslow. (Stanford.) 4*s*.

"How to Study Wild Flowers," by Prof. Henslow. (R.T.S.) 2*s*. 6*d*.

"Structural Botany" (Flowering Plants), by Dr. D. H. Scott. (A. & C. Black, Soho Square, W.C.) 3*s*. 6*d*.

"Plant Life," by Dr. M. T. Masters, F.R.S. (Vinton & Co., 9 New Bridge Street, E.C.) 2*s*. 6*d*.

"Elements of Agriculture," by W. Fream, LL.D. (J. Murray, Albemarle Street, W.) 3*s*. 6*d*.

"Plant Breeding," by L. H. Bailey. Macmillan & Co.) 4*s*.

"Primer of Horticulture," by J. Wright, V.M.H. (Macmillan & Co.) 1*s*.

"Physiology of Plants," by Dr. Paul Sorauer. Longmans, Green & Co., 39 Paternoster Row, E.C.) 9*s*.

"Chemistry of the Garden," by H. Cousins. (Macmillan & Co.) 1*s*.

"Diseases of Plants," by H. Marshall Ward. (S.P.C.K., Northumberland Avenue, W.C.) 2*s*. 6*d*.

"Profitable Fruit Growing," by J. Wright, V.M.H. (Journal of Horticulture, 12 Mitre Court Chambers, E.C.) 1*s*. 3*d*.

"Art of Budding and Grafting," by C. Baltet. (Crosby Lockwood, Stationers' Hall Court, E.C.) 2*s*. 6*d*.

"Pruning," by L. H. Bailey. (Macmillan & Co.) 5*s*.

"Natural History of Plants." 2 vols. By Kerner and Oliver. (Blackie & Son.) 50*s*.

4. The Examination will be held simultaneously in as many different centres in Great Britain and Ireland as circumstances may demand. The time allowed for the Examination is 2½ hours, the hour fixed being generally from 7 to 9.30 P.M.

5. The Examination will for the most part be based on the above Outline Syllabus of "Elementary Principles of Horticultural Operations and Practice."

6. Three hundred Marks will be given as a maximum. Candidates gaining 200 Marks and over will be placed in the First Class. Those

gaining 150 to 200 Marks will be placed in the SECOND CLASS, and those gaining between 100 and 150 will be placed in the THIRD CLASS. Candidates failing to obtain 100 Marks will not be classed.

7. The Royal Horticultural Society will award a Silver Gilt Medal to the Candidate gaining the highest number of Marks, and will also send to the Candidates Certificates of the Class in which they shall have passed.

8. County Councils, Lecturers, &c., must send in to the Society the actual number of Candidates at each proposed centre at **least ten days** before the examination takes place.

9. Gardeners and Students wishing to sit for the Examination, who have not attended any particular series of Lectures, must send in their name and address, and also the name and address of some responsible person willing to conduct the Examination (see par. 13), to the Secretary, R.H.S., 117 Victoria Street, Westminster, at least three weeks before the date of Examination.

10. Every Student wishing to be examined must, as far as possible, give all the information asked for by filling up a form, which will be supplied on application to the Secretary.*

11. A capitation fee of 3*s.* will be charged for every Student, in order to partially defray the expenses of the Examination.

12. County Councils, Lecturers, and others desiring to have an Examination held in their neighbourhood must also send in the full name and address (with designation or occupation) of one responsible person for each proposed centre, who will undertake to supervise the Examination in accordance with the Society's rules.

13. N.B.—The Society is willing to hold an Examination wherever a magistrate, clergyman, schoolmaster, or other responsible person accustomed to Examinations will consent to supervise one on the Society's behalf, and in accordance with the rules laid down for its conduct.

THE DUTIES OF A SUPERVISOR.

(*a*) To satisfy himself that the room proposed for the Examination is a suitable one for the purpose, and to see that a sufficient quantity of foolscap paper, *all of one size*, is provided for the use of candidates.

(*b*) To satisfy himself that all candidates belonging to his centre have been duly acquainted with the place, day, and hour of Examination. This may be done by communicating with the Lecturer, or with the Secretary of the County Council &c.

* A stamped and directed envelope must be enclosed with all communications requiring a reply. Copies of the Questions set at the Examinations 1893–1902 (price 1*s.*, or 5*s.* a dozen) may be obtained at 117 Victoria Street.

(*c*) To receive the sealed parcel of papers which will be posted to him from London two clear days before the Examination. N.B.—If the papers do not arrive by the first post on the day of Examination, he should *immediately* telegraph to the Secretary of the Society, 117 Victoria Street, S.W. Telegraphic Address: 'Hortensia, London."

(*d*) To preserve the seals of the parcel *unbroken* until he opens it *in the presence of the candidates*, at the hour fixed for the Examination to commence.

(*e*) To distribute one copy of the Examination Paper to each candidate. It is better that the candidates should be seated not too closely together.

(*f*) The Supervisor will then *immediately* read aloud the directions printed at the head of the papers, make a note of the exact time, and inform students distinctly of the exact hour at which all papers must be handed in.

(*g*) To see that the following rules are strictly observed:—

1. Two and a half hours are allowed for the paper.

2. Students are not allowed to bring any books, paper, notes, &c., into the Examination Room; nor to ask any questions whatever, save of the Supervisor, who must exercise his judgment as to whether such question is one he should answer or not.

3. Students are not allowed to leave the Examination Room on any pretext whatsoever after the papers have been distributed. In case of unavoidable illness the Student must be content either to hand in what he has already done, or to wait till another Examination takes place.

4. Any Student leaving the room before the full time allowed has expired must first give up to the Supervisor his written papers.

5. The papers of any Students breaking these rules, or found copying, should at once be destroyed.

(*h*) The allotted time having expired, the Supervisor will call on the Students to fold up and hand in their papers, which should then be *at once* (before leaving the room) tied together securely with string. They should be posted to the Secretary, R.H.S., 117 Victoria Street, Westminster, S.W., by the earliest possible post.

(*i*) The Supervisor will, of course, not himself leave the room during the time of Examination.

(*k*) The Supervisor is requested to sign the following form and return it with the Students' papers to the Secretary, R.H.S., 117 Victoria Street, London, S.W.

I hereby certify that the Examination in Horticulture held at

....

has been conducted strictly according to the rules and regulations of the Royal Horticultural Society.

Supervisor's Signature ....

Date ....

*** The Council of the Royal Horticultural Society reserve to themselves the right to modify the application of these regulations as they may consider necessary, and all disputed questions of interpretation and procedure must be referred to them for final decision.

SCHOLARSHIPS.

Sir Trevor Lawrence, Bart., President of the Society, and Master of the Worshipful Company of Gardeners, very kindly offered a Scholarship of £25 a year for two years, to be awarded after the examination of the Royal Horticultural Society in 1894, to the Student who should pass highest, if he were willing to accept the conditions attaching thereto. The main outline of these conditions is that the holder must be of the male sex, and between the ages of 18 and 22 years, and that he will study gardening for one year at least at the Royal Horticultural Society's Gardens at Chiswick, conforming to the general rules laid down there for Students. In the second year of the Scholarship he may, if he likes, continue his studies at some other place at home or abroad which shall be approved by the Master of the Worshipful Company of Gardeners, and by the Council of the Royal Horticultural Society.

A similar Scholarship was presented by Baron Schröder, V.M.H., after the 1895 examination.

The Worshipful Company of Gardeners continued this Scholarship to the end of 1896.

Another similar Scholarship was given after the 1897 examination by N. N. Sherwood, Esq., V.M.H., Master of the Worshipful Company of Gardeners.

Another was given for 1898–9 by G. W. Burrows, Esq., a Member of the Court of the same Worshipful Company of Gardeners.

Another was given for 1899–1900 by the Right Hon. the Lord Amherst, who presents it also through the Gardeners' Company.

Another was given for 1901 by Henry Wood, Esq., and

Another by F. G. Ivey, Esq., Member of the Court of the Worshipful Company.

SCHOLARS :—

1894–5–6	Mr. W. N. Sands.
1895–6–7	Mr. G. F. Tinley.
1897–8–9	Mr. H. S. Langford.
1898–9	Miss Harrison.
1899–1900 . . .	Mr. C. J. Gleed.
1900–1	Mr. B. Smith.
1901	Mr. Charles H. Buck.

If the Student who is at the head of the examination is for any reason unable or unwilling to accept the Scholarship, it is then offered to the next highest on the list. In case of two or more eligible Students being adjudged equal marks, the Council reserve to themselves the right to decide which of them shall be presented to the Scholarship.

RESULT OF THE EXAMINATION IN HORTICULTURE, 1902.

The Annual Examination in the Principles and Practice of Horticulture was held on April 23, 1902, when 229 papers were sent in.

Three hundred marks were allotted as a maximum, and all candidates who obtained 200 marks and upwards were placed in the First Class. The total number was 97, or about 42·3 per cent.

The highest number of marks, 285, was awarded to Miss W. M. Buttenshaw, of the Horticultural College, Swanley, Kent.

Those who secured 150 and less than 200 marks were placed in the Second Class. The number was 98, or about 42·7 per cent.

Those who obtained 100 marks and upwards were ranked in the Third Class. The number was 28, or about 12 per cent.

Six candidates obtaining less than 100 marks were not placed.

A slight increase in the number of entries has occurred, 225 being that of 1901; but still it falls considerably short of that in 1900, viz., 236.

The percentage of the First Class was 48 in 1901, so that it has somewhat fallen; while that of the Second Class has risen from about 38 to 42.

The percentage of the Third Class is nearly stationary, having only slightly improved from 11 to 12.

The lowering of the percentage of the First Class, as well as only two candidates obtaining more marks than 275, is attributable to the somewhat higher standard in the character of the questions. Some students had evidently prepared themselves for meeting such questions as might be asked upon the revised "Requirements."

In the "Principles" there were no serious mistakes, but merely varying degrees of knowledge upon the matter treated of in the replies. The answers as a whole were well expressed, showing considerable care in preparation.

In the Horticultural practice department the candidates kept well to the questions they had to deal with, except in the one relating to landscape gardening; on this subject there is considerable room for improvement. It is a subject that might be dealt with in various phases, and some of the candidates were fully alive to the main points they were asked to deal with. Some of the other questions were not so much dealt with in detail as they ought to have been; owing to this very few obtained the full number of marks. Upon the whole the answers were very satisfactory, and, as the questions were rather more difficult than on previous occasions, the result is quite as good as we expected.

Examiners { GEORGE HENSLOW.
JAMES DOUGLAS. }

First Class.

		No. of Marks gained.
1.	Buttenshaw, W. M., Swanley College	285
2.	Moore, Harold, 17 Mundania Road, Honor Oak, S.E.	280
3.	Crabtree, G. H., Kirklees Park Gardens, Brighouse	275
4.	Bowden, M. A., Reading College and Lady Warwick Hostel	270
	Brown, W. R., Cally Gardens, Gatehouse, Kirkcudbrightshire	270
	English, M., Swanley College	270
	Huckle, M. J., 53 Birkenhead Avenue, Kingston	270
	Humphrey, L. J., Essex County School of Horticulture	270
	Smith, S. P., Benson School, nr. Wallingford	270
	Turner, J. S., The Gardens, Dochfour, Inverness-shire	270
	Warner, J., The School, Burleydam, Whitchurch	270
12.	Bebbington, L., The School, Pulford, Wrexham	265
	Butler, E. W., Swanley College	265
	Turner, F., The School, Eccleston, Chester	265
15.	Ardington, M., Swanley College	260
	Hicks, George, Ardington, Wantage	260
17.	Selden, G. P., Woodhatch House Gardens, Reigate	255
18.	Donoghue, J., Tranby Croft Gardens, Hull	250
	Learoyd, T. W., The School, Rostherne, Knutsford	250
	Swift, J. W., County Technical School, Stafford	250
21.	Darby, T. W., C.C. Farm School, Old Basing, Basingstoke	245
	Day, William, Long Wittenham, Abingdon	245
	Driver, J., School House, Crowton, Northwich	245
	Lloyd, G. E., The School, Tattenhall, Cheshire	245
	Lowe, J. L., The School, Disley, Stockport	245
	Nicholls, H. R., School House, Warborough, Wallingford	245
	Oddie, E. M., County Oak, Crawley, Sussex	245
	Pollard, G. E., Swanley College	245
	Powell, E. H., Swanley College	245
	Smith, F., The School, Worleston, Nantwich	245
	Wimpress, H., Swanley College	245
32.	Clewley, C. H., County Technical School, Stafford	240
	Langmore, E., Reading College and Lady Warwick Hostel	240
	Ross, E., The School, Hale Barns, Altrincham	240
35.	Humphreys, F. W., County Technical School, Stafford	235
36.	Bourne, E. B., Swanley College	230
	Brown, Stanton, Edwinstowe, Newark, Notts	230
	Cleeves, Vincent, 6 Garth Hill, Bassaleg, Mon.	230
	Schneider, E., Swanley College	230
	Silvers, A. J., County Technical School, Stafford	230
	Trollope, T., Middleton Park Gardens, Bicester	230
42.	Anson, W. H., Churchill, Chipping Norton, Oxon	225
	Bidwell, L. S., Reading College and Lady Warwick Hostel	225
	Bull, H. M., Essex County School of Horticulture	225
	Butler, R., Reading College and Lady Warwick Hostel	225
	Dobbie, H. B., Pine Banks, Thorpe St. Andrews, Norwich	225
	Draper, M., Swanley College	225
	Duguid, M., F.R.H.S., Swanley College	225

		No. of Marks gained.
	Emlyn, E. S., Swanley College	225
	Heald, C. W., Weaverham, near Northwich	225
	Johns, E. L. M., Reading College and Lady Warwick Hostel	225
	Mallinson, J. W., 9 Waterloo Place, Kew Green, Surrey	225
42.	Millard, M., Reading College and Lady Warwick Hostel	225
	Pickerill, J., The School, Broom Hall, Nantwich	225
	Rendle, A., Essex County School of Horticulture	225
	Robb, A., Essex County School of Horticulture	225
	Scott, Kenneth, Essex County School of Horticulture	225
	Yeates, T., Sutton Courtenay, Abingdon	225
	Dutton, C. D., Springhall, Sawbridgeworth	220
	Hathaway, J., County Technical School, Stafford	220
59.	McKechnie, W. C., The Gardens, Ffrwdgrech, Brecon	220
	Mitchell, J., The School, Haslington, Crewe	220
	Williams, A., The School, Hassall Green, Sandbach	220
	Bennitt, W. E., County Technical School, Stafford	215
	Dines, J., Essex County School of Horticulture	215
	Dutton, G. F., Aldersey School, Bunbury, Tarporley	215
	Graves, W. B., County Technical School, Stafford	215
	Longmire, F., 77 Earlsfield Road, Wandsworth, S.W.	215
	McDonald, A. J., King's Meadows Gardens, Peebles	215
64.	Nixon, W., Whitley Park Farm, Reading	215
	Perry, A. M., Reading College and Lady Warwick Hostel	215
	Schofield, S. H., The School, Dean Row, Wilmslow	215
	Scourfield, G., Ty-Gwyn Gardens, Neath, Glam.	215
	Swaine, R., F.R.H.S., Swanley College	215
	Walters, J., County Technical School, Stafford	215
	Whetham, V. S., Swanley College	215
	Bartley, J., County Technical School, Stafford	210
	Forster, Y. I., F.R.H.S., Swanley College	210
77.	Moore, H., The School, Wheelock, Sandbach	210
	Poyer, F. T. P., Swanley College	210
	Baldwin, W., Horticultural School, Holmes Chapel	205
	Colvin, J. S., Hampton Hall Gardens, Balbriggan, co. Dublin	205
	Cowley, H., Swanley College	205
	Creasy, B., Essex County School of Horticulture	205
	Hodgkinson, W., The School, Cranage, Holmes Chapel	205
	Hotten, A. P., Swanley College	205
81.	Ingles, M. G., Essex County School of Horticulture	205
	Thomas, G., Coedmore Gardens, Cardigan	205
	Tobin, L., Reading College and Lady Warwick Hostel	205
	Townend, J. W., The Cottage, Clevelands, Birkdale, Southport	205
	Will, H., Reading College and Lady Warwick Hostel	205
	Worsfold, H. G., Paddockhurst Gardens, Crawley	205
	Young, W. H., Swanley College	205
	Leighton, F., School House, Lydiard Tregoze, Wootton Bassett	200
	Masson, G., 8 Dunrobin Place, Edinburgh	200
94.	Mordaunt, G., Swanley College	200
	Willoughby, J. B., Bennie Cottage, Causewayside, Tollcross	200

Second Class.

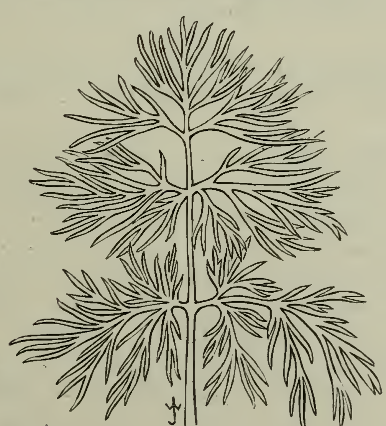
		No. of Marks gained.
	Cameron, John, Essex County School of Horticulture	195
	Dent, Thomas, Howbery Park, Walingford	195
	Harding, P., Horticultural School, Holmes Chapel	195
	Herman, W., Ewelme National School, Wallingford	195
	Hine, T., Coombe Ridge, Kingston Hill	195
	Hirst, S. R., The School, Broken Cross, Macclesfield	195
	Hodgson, G. H., 1 Mayfield Terrace, Gateshead-on-Tyne	195
	Hulme, H., Horticultural School, Holmes Chapel	195
	Judson, H. R., Castle Hill Gardens, Rotherfield	195
98.	Keene, C. E., County Technical School, Stafford	195
	Little, H., Essex County School of Horticulture	195
	Manning, S., Horticultural School, Holmes Chapel	195
	Masterton, D., 32 Hay Terrace, Edinburgh	195
	Parker, R. W., Horticultural School, Holmes Chapel	195
	Percival, C. P., Astbury School, Congleton	195
	Reed, H. T., Cromer Villa, Clifton Road, Kingston Hill	195
	Walkden, C. H., The Gardens, Virginia Water, Surrey	195
	Ward, H., Essex County School of Horticulture	195
	Willan, G., Ivy Cottage, Lymm, Cheshire	195
	Williamson, T., Horticultural School, Holmes Chapel	195
	Bayliss, I., Spelsbury National School, Charlbury, Oxon	190
	Clarkson, J., Hook Norton, Banbury	190
	Davies, M., Essex County School of Horticulture	190
	Dolman, E. G., Tredegar Park, Newport, Mon.	190
	Durham E., King's End, Bicester	190
	Fayers, M. A., Upper School Abinger, Dorking	190
	Grundy, S., Swanley College	190
	Hancock, T., British School, Wheelock, Sandbach	190
	Head, G. H., Poltimore Park Gardens, Exeter	190
	Hodgson, J. T., The School, Elworth, Sandbach	190
	Hulbert, W. C., The Hermitage, Jarvis Brook, Tunbridge Wells	190
118.	Jolley, E., Jubilee Road, Waterloo Ville, Cosham	190
	Jones, D. G., Horticultural School, Holmes Chapel	190
	Lane, F. G., School House, Kingston Bagpuze	190
	Laugher, H., County Technical School, Stafford	190
	Lester, Thos. J., Horticultural School, Holmes Chapel	190
	Martins, A. V., Essex County School of Horticulture	190
	Mitchell, F., School House, Culham, Abingdon	190
	Oulton, R., Horticultural School, Holmes Chapel	190
	Parker, J. C., County Technical School, Stafford	190
	Pearce, A. J., Milton C. E. School, Milton, Steventon, R.S.O.	190
	Smart, A., The Gardens, Lesmurdie, Elgin, N.B.	190
	Smith, W. H., 33 Lancaster Street, Barnsley, Yorks	190
	Williams, M. A., Wesley Cottage, Bicester	190
	Lee, James, The Gardens, Woolton Wood, Woolton	185
142.	Russ, H. D., Whitmore Lodge, Worplesdon, near Guildford	185
	Warburton, W., 45, Cranworth Street, C.-on-M., Manchester	185
	Wilks, Alf., County Technical School, Stafford	185

		No. of Marks gained.
	Biddle, J. L., Charlton Lodge, Surbiton Road, Kingston	180
	Bishop, R., 262 Burrage Road, Plumstead, Kent	180
	Chapelow, H. D., Essex County School of Horticulture	180
	Edwards, A., Park Hall, Spink Hill, Chesterfield	180
	Hart, F. W., County Technical School, Stafford	180
	Hogan, D. C., 75 Leyton Road, N.W.	180
146.	Humphrey, H. P., F.R.H.S., 11 Marlboro' Buildings, Bath	180
	Nock, T., The School, Brereton, Sandbach	180
	Sanderson, W., Ardtornish, Morvern, Argyllshire	180
	Smith, B., F.R.H.S., Swanley College	180
	Tunstill, F., The School, Henbury, Macclesfield	180
	Willans, E. F., Reading College and Lady Warwick Hostel	180
158.	Jeffery, F. W., Moor Court Gardens, Oakamoor, N. Staffs	175
	Blair, J. S., Toravon Lodge, Polmont Station, Stirlingshire	170
	Blanche, E., 26 St. Paul's Street, Ramsbottom, Lancs	170
	Cassels, E. M., Glencairn, 6 Belsize Road, Worthing	170
	Drummond, D. H., Crowmarsh Gifford, near Wallingford	170
	Henderson, A., Essex County School of Horticulture	170
159.	Hoyes, W., 8 Gower Street, Sheffield	170
	Lee, Joseph, 328 Atherton Road, Hindley Green, near Wigan	170
	Pawlett, M., Swanley College	170
	Sibley, J., The Grove, College Road, Dulwich Common	170
	Simmonds, A. E., Ormond Road, Wantage, Berks	170
	Stayner, F. J., The Lilies, Epsom Road, Croydon	170
	Hunter, J., 52 Castle Street, Woolton	165
	Mallabar, W., Heathfield Gardens, Gateshead-on-Tyne	165
170.	Painton, A., Winterbrook, Wallingford	165
	Smith, W. S., Swanley College	165
	Taylor, T., County Technical School, Stafford	165
	Barwell, F., 73 King's Road, Kingston-on-Thames	160
	Braggins, Saml. W., Edith Villas, Tatchbrook Road, Feltham	160
	Campbell, D. M., Wells Gardens, Hawick, N.B.	160
	Dennis, E., 11 Carter's Cottages, St. John's, Redhill	160
175.	Hay, James D., F.R.H.S., Culverlands, Woking	160
	Hunter, T., The Gardens, Coombe Cottage, Kingston	160
	Parker, C. H., Swanley College	160
	Selsby, J. S., Laxfield, Framlingham	160
	Walker, J. H., County Technical School, Stafford	160
184.	Godwin, E., 39 Courtenay Street, Cheltenham	155
	Shaw, J., Stormerhill Cottage, Tottington, near Bury	155
	Burgess, E., The Laurels, Benson, Oxford	150
	Carr, E. B., The School, Eaton, Congleton	150
	Coward, H. V., 21 Merton Hall Road, Wimbledon	150
	Grieve, S. G., The School, Bridgmere, Nantwich	150
186.	Hoyle, G., Nuffield Board School, Henley-on-Thames	150
	Overton, E. A., 5 Crawborough, Charlbury	150
	Polkinghorne, F. J., The Gardens, Polgwin, Bodmin	150
	Scott, E. H., 22 Gladstone Villas, Wallingford	150
	Simms, L., 3 Plantation Road, Oxford	150

		No. of Marks gained.
186.	Watson, J. W., F.R.H.S., Upper Sleigh Lea Gardens, Fulwood, Sheffield	150

Third Class.

196.	Black, W., The Gardens, Ashton Hall, Lancaster	140
	Blackshaw, W. R., Horticultural School, Holmes Chapel	140
	Cairns, W. J., Heatherwick, Otterburn, Northumberland	140
	Gammon, V., The Gardens, Middleton Park, Bicester	140
	Manning, H. P., Essex County School of Horticulture	140
201.	Yates, H., 37 Cemetery Road, Tonge, Bolton, Lancs	135
202.	Bedwell, W., 1 Loughborough Villas, Carshalton	130
	Byrom, W., 11 Cam Street, Woolton	130
	Martin, T., The Gardens, Woolton Wood, Woolton	130
	Salway, W. H., 33 Stopford Road, St. Heliers, Jersey	130
206.	Woodnutt, W. E., Orchardleigh, Catisfield	125
207.	Blackshaw, A., George Street, Altrincham	120
	Bowell, E. C., Blenheim Gardens, Woodstock	120
	Butt, T., Bournecroft Cottage, Whyteleaf, Surrey	120
	Goble, W. E., Kingswood Warren Gardens, Epsom	120
	Gray, R., Horticultural School, Holmes Chapel	120
	Turner, C., Blenheim Gardens, Woodstock	120
	Worthington, J. B., Horticultural School, Holmes Chapel	120
214.	Wright, J., The Gardens, Talbot House, Edinburgh	115
215.	Dent, W. J., Swyncombe National School, Henley	110
	Fergusson, R. F., 25 Borough Road, Kingston	110
	Price, J., East Lodge, Strathbraan, Shillingford, Wallingford	110
	Robson, H. F., R.H.S. Gardens, Chiswick, W.	110
219.	Chapman, G. M., Cornwall House, Leopold Road, Wimbledon	105
	James, R. H., Gorphwysfa, Dinas Powis, Cardiff	105
	Kneller, P. C., Laureldean, Petersfield, Hants	105
	Spencer, J., 40 Lower Church Street, Warwick	105
223.	Luxford, C., 3 James Street, Iffley Road, Oxford	100



REPORT ON LETTUCE GROWN AT CHISWICK, 1902.

Twenty-seven stocks of Lettuce were received for trial in the Gardens, all being sown in gentle heat, and after hardening off were planted out on a warm, well-manured border on May 16. All the stocks made good growth, and were remarkably well selected and true. The Committee examined the collection on two occasions, viz. on July 11 and 18.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.

1. All the Year Round (R. Dean).—Foliage pale green, small, compact; hearts small, firm, crisp, and of good flavour. Ran quickly to seed. Ready July 1. Cabbage.

2. Big Ben (R. Veitch).—Foliage large, pale green, lightly suffused with red; hearts large, firm, crisp, and of pleasant flavour. Stood well without running to seed. Ready July 10. Cabbage.

3. Big Boston (Masters), **A.M.** June 20, 1901.—See Vol. xxvi. p. 866. Ready July 9.

4. Bloomdale Reliable (Masters).—See Vol. xxvi. p. 866. Ready July 14.

5. Bossen's Giant (R. Dean).—Foliage very large and spreading, deep green suffused with red; hearts large, moderately firm, crisp, and of good flavour. Stood well without running to seed. Ready July 17. Cabbage. A very late variety.

6. Blonde de Berlin (R. Dean).—Foliage small, very pale green; hearts small, firm, crisp, and of excellent flavour. Ran to seed very quickly. Ready July 1. Cabbage. Very similar to No. 1.

7. Carter's Perpetual (Carter), **A.M.** July 18, 1902.—Foliage large and spreading, pale green; hearts large, firm, crisp, and of excellent flavour. Stood well without running to seed. Ready July 14. Cabbage. 'Harbinger Forcing' is synonymous with this variety.

8. Continuity (R. Dean), **A.M.** June 20, 1901.—See Vol. xxvi. p. 866. Ready July 2.

9. Early Gem (R. Veitch).—Foliage small, pale green; hearts small, firm, crisp, and of fair flavour. Quickly ran to seed. Ready July 1. Cabbage.

10. Emperor William (R. Dean).—Foliage large, pale green, suffused with red at the margins; hearts large, firm, crisp, and of good flavour. Stood well without running to seed. Ready July 3. Cabbage.

11. Fearnought (R. Dean).—Very similar to No. 1.

12. Giant Glacier (Atlee Burpee).—Foliage very large and spreading, deep green; hearts large and loose, and of fair flavour. Stood well without running to seed. Ready July 17. Cabbage.

13. Grand Rapids (Masters).—See Vol. xxvi. p. 867. Ready July 14.

14. Green Unctuous (R. Dean), **F.C.C.** July 24, 1883.—Foliage small, dark green; hearts of medium size, firm, crisp, excellent flavour. Stood moderately well without running to seed. Ready July 4. Cabbage.

15, 16. Iceberg (J. Veitch, Atlee Burpee).—Foliage very large, deep green, slightly flushed with red; hearts of great size, firm, crisp, and of fair flavour. Stood well without running to seed. Ready July 8. Cabbage.

17. Largest of All (Masters).—See Vol. xxvi. p. 867. Ready July 9.

18. Leyden White Dutch (R. Dean).—A very good selection of the well-known White Dutch. Ready July 1. Cabbage.

19. Pioneer (R. Veitch).—Foliage of medium size, very dark green; hearts of moderate size, firm, crisp, and of good flavour. Ready July 10. Stood well without running to seed. Cos. Requires a little more selection.

20. Satisfaction (R. Dean).—Same as No. 18.

21. San Francisco Market (Atlee Burpee).—Foliage very large and spreading, pale green; hearts large, firm, crisp, and of very good flavour. Stood well without running to seed. Ready July 7. Cabbage.

22. Solid Heart (R. Veitch).—Foliage small, dark green; hearts rather small, very firm, crisp, and of excellent flavour. Quickly ran to seed. Ready July 1. Cabbage.

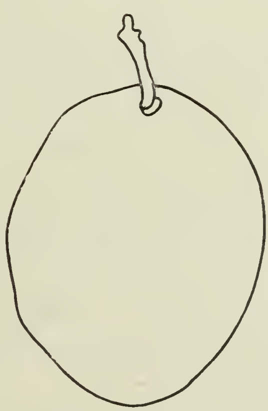
23. The Empire (R. Veitch).—Foliage large and spreading, deep green; hearts large, firm, crisp, and of good flavour. Ready July 8. Stood remarkably well without running to seed. Cabbage.

24. Virginia Solid-head (Masters).—See Vol. xxvi. p. 868. Ready July 16. Cabbage. This variety stood longer than any other without running to seed.

25. Welstead's Selected (Welstead).—Foliage large, dark green; hearts of great size, firm, crisp, and of good flavour. Stood well without running to seed. Ready July 11. Cos. A very promising variety.

26. Winter Passion (J. Veitch).—Of no value for spring sowing, as all the plants ran to seed without hearting.

27. Wrench's Mammoth Self-folding (Wrench).—Foliage of moderate size, very dark green; hearts of medium size, self-folding, firm, crisp, and of good flavour. Stood well without running to seed. Ready July 6. Cos.



REPORT ON PEAS AT CHISWICK, 1902.

Eighty-three stocks of Peas were received for trial in the Gardens, and all were sown on March 14 on ground that had been ridge-trenched and heavily manured the previous autumn. All the stocks were thinly sown and germinated well, followed by a strong sturdy growth, free from any fungoid pests. The Committee met on two occasions to examine the stocks, viz. July 11 and 18; and on the latter date they passed the following resolution unanimously: "The members of the Fruit and Vegetable Committee desire to express their high appreciation of the very admirable and excellent trial of edible Peas seen by them this year in the Society's Gardens, which reflects much credit on the Superintendent and his staff."

F.C.C. = First-class Certificate.
A.M. = Award of Merit.

1. Acme, **A.M.** July 5, 1898 (J. Veitch).—Haulm and pods dark green; pods in pairs, averaging seven large sweet peas in straight pods. Heavy crop. Ready for use July 3. Height 3½ feet. Seeds wrinkled.

2. Alderman, **F.C.C.** July 10, 1900 (Sutton).—Haulm and pods dark green; pods in pairs, long, straight, handsome, averaging nine large sweet peas in a pod. Heavy crop. Height 6 feet. Ready for use July 11. Seeds wrinkled.

3. Alderman Selected (J. Veitch).—Same as No. 2.

4. Autocrat, **F.C.C.** July 10, 1885 (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

5. Battleship (Carter).—Haulm and pods dark green; pods in pairs, short, broad, straight, averaging four large deep green sweet peas in a pod. Heavy crop. Ready for use July 5. Height 4 feet. Seeds wrinkled.

6. Best of All (Sutton).—See Vol. XXVI., page 278. Ready for use July 11.

7. Brydon's King (Kent & Brydon).—Haulm and pods dark green; pods in pairs, long, straight, handsome, averaging seven large deep green peas in a pod. Heavy crop. Ready for use July 15. Height 4½ feet. Seeds wrinkled.

8. Centenary, **A.M.** July 5, 1901 (Sutton).—See Vol. XXVI., page 278. Ready for use July 11.

9. Champion Marrowfat, **A.M.** July 18, 1902 (Dicksons).—Haulm and pods very dark green; pods in pairs, long, straight, handsome, averaging eight large deep green and very sweet peas in a pod. Very heavy crop. Ready for use July 18. Height 4 feet. Seeds wrinkled. A very fine late variety.

10. Chelsea Gem, **F.C.C.** July 1, 1887 (J. Veitch).—See Vol. XXVI., page 276. Ready for use July 4.

11. Compactum (Laxton).—Haulm and pods dark green; pods in pairs, long, broad, slightly curved, handsome, averaging seven large deep

green peas in a pod. Good crop. Ready for use July 10. Height 3 feet. Seeds wrinkled.

12. Commonwealth (Carter).—Haulm and pods dark green; pods in pairs, of moderate length and breadth, straight, blunt, averaging six large pale green sweet peas in a pod. Good crop. Ready for use July 10. Height $2\frac{1}{2}$ feet. Seeds wrinkled.

13. Conqueror (Sutton).—See Vol. XXVI., page 279. Ready for use July 11.

14. Conquest (Dicksons).—Haulm and pods dark green; pods in pairs, moderate length, thick, straight, averaging five large deep green sweet peas in a pod. Heavy crop. Ready for use July 10. Height 6 feet. Seeds wrinkled.

15. Continuity, **A.M.** July 9, 1898 (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

16. Daisy, **F.C.C.** July 11, 1902 (Sutton).—See Vol. XXVI., page 277. Ready for use July 5.

17. Dicksons' Harbinger (Dicksons).—Haulm and pods deep green; pods in pairs, moderate length, straight, averaging six pale green peas in a pod. Very heavy crop. Ready for use July 3. Height 4 feet. Seeds wrinkled. A very productive variety.

18. Duke of Albany, **A.M.** July 5, 1901 (Sutton).—See Vol. XXVI., page 278 Ready for use July 11.

19. Duchess of York, **A.M.** June 20, 1901 (Sutton).—See Vol. XXVI., page 276. Ready for use July 7.

20. Dr. McLean, **A.M.** July 18, 1902 (Sutton).—See Vol. XXVI., p. 278. Ready for use July 11. A very fine selection of this excellent old variety.

21. Dwarf Defiance, **A.M.** July 5, 1901 (Sutton).—See Vol. XXVI., p. 277. Ready for use July 10.

22. Dwarf Mammoth (Sutton).—Haulm and pods deep green; pods in pairs, long, broad, straight, averaging six medium-sized pale green sweet peas in a pod. Heavy crop. Ready for use July 18. Height 3 feet. Seeds wrinkled.

23. Dwarf Gradus (Laxton).—See Vol. XXVI., page 273. Ready for use July 5.

24. Early Giant, **A.M.** July 11, 1902 (Sutton).—Haulm and pods deep green; pods in pairs, long, broad, straight, handsome, averaging nine large deep green peas in a pod. Very heavy crop. Ready for use July 9. Height $4\frac{1}{2}$ feet. Seeds wrinkled.

25. Empress of India (Sutton).—See Vol. XXVI., page 276. Ready for use July 9.

26. Ensign (Dicksons).—Haulm and pods very dark green; pods in pairs, long, broad, straight, averaging six large sweet peas in a pod. Great crop. Ready for use July 18. Height $4\frac{1}{2}$ feet. Seeds wrinkled. A very promising variety.

27. Edwin Beckett, **F.C.C.** July 3, 1900 (Beckett).—Haulm and pods dark green; pods in pairs, long, broad, pointed, averaging eight large deep green and very sweet peas in a pod. Very heavy crop. Ready for use July 9. Height $4\frac{1}{2}$ feet. Seeds wrinkled.

28. Eureka (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

29. Exhibition (Sutton).—See Vol. XXVI., page 279. Ready for use July 16.

30. Excelsior (Sutton).—See Vol. XXVI., page 276. Ready for use July 5.

31. Favourite (J. Veitch).—Haulm and pods dark green ; pods in pairs, moderate length, broad, straight, blunt, averaging five large deep green peas in a pod. Heavy crop. Ready for use July 17. Height 4 feet. Seeds wrinkled. A good late variety.

32, 33. Fertility (Dicksons, Watkins & Simpson).—Haulm and pods dark green ; pods in pairs, long, narrow, straight, averaging eight medium-sized green sweet peas in a pod. Very heavy crop. Ready for use July 8. Height 5 feet. Seeds wrinkled. This should prove a good field pea.

34, 35. General French (J. Veitch, Steward).—Haulm and pods deep green ; pods in pairs, moderate length, broad, straight, averaging six large green peas in a pod. Very heavy crop. Ready for use July 7. Height $4\frac{1}{2}$ feet. Seeds wrinkled. Requires further selection.

36. Glory of Devon, **A.M.** July 11, 1899 (R. Veitch).—Haulm and pods deep green ; pods in pairs, long, straight, broad, averaging eight large pale green peas in a pod. Very heavy crop. Ready for use July 15. Height 4 feet. Seeds wrinkled.

37. Gradus, **F.C.C.** July 1, 1887 (J. Veitch).—Same as No. 23.

38. Green Gem (Sutton).—See Vol. XXVI., page 275. Ready for use July 4.

39. Harbinger, **A.M.** June 20, 1901 (Sutton).—See Vol. XXVI., page 276. Ready for use July 1. The earliest Pea in the collection, and is also one of the best Peas for forcing.

40. Ideal, **A.M.** June 20, 1901 (Sutton).—See Vol. XXVI., page 276. Ready for use July 5.

41. Late Prolific (J. Veitch).—This variety had **A.M.** July 5, 1901, under the name of 'Prolific Late Marrow.' See Vol. XXVI., page 274. Ready for use July 11.

42. Late Queen, **A.M.** July 10, 1900 (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

43. Little Marvel, **A.M.** July 11, 1902 (Sutton).—See Vol. XXVI., page 275. Ready for use July 4.

44. Lord Roberts, **A.M.** July 18, 1902 (Sutton).—Haulm and pods dark green ; pods in pairs, long, broad, straight, averaging six large deep green and very sweet peas in a pod. Very heavy crop. Ready for use July 17. Height 2 feet. Seeds wrinkled.

45, 46. Lord Rosebery, **A.M.** July 18, 1902 (J. Veitch, Steward).—Haulm and pods deep green ; pods in pairs, long, slightly curved, averaging six large green peas, exceptionally sweet in flavour, in a pod. Extraordinary crop. Ready for use July 18. Height 5 feet. Seeds wrinkled. A very good late variety.

47. Magnum Bonum (Sutton).—See Vol. XXVI., page 279. Ready for use July 11.

48. Masterpiece (Sutton).—See Vol. XXVI., page 278. Ready for use July 12.

49. Matchless (Sutton).—See Vol. XXVI., page 279. Ready for use July 11.

50. May Queen (Sutton).—See Vol. XXVI., page 276. Ready for use July 4.

51. Ne Plus Ultra (Sutton).—A very good selection of this well-known and excellent late Pea. Ready for use July 18.

52. Nonpareil (Sutton).—See Vol. XXVI., page 277. Ready for use July 10.

53. Nonsuch (Sutton).—Haulm and pods dark green; pods in pairs, long, broad, straight, averaging six large deep green and very sweet peas in a pod. Heavy crop. Ready for use July 17. Height 20 inches. Seeds wrinkled.

54. Peerless, **A.M.** July 10, 1900 (Sutton).—See Vol. XXVI., page 278. Ready for use July 11.

55. Perfect Gem, **A.M.** July 5, 1901 (Sutton).—See Vol. XXVI., page 277. Ready for use July 10.

56, 57. Perfection, **A.M.** July 14, 1897 (R. Veitch, Sutton).—Haulm and pods dark green; pods in pairs, averaging six very large and sweet deep green peas in a pod. Heavy crop. Ready for use July 8. Height 3½ feet. Seeds wrinkled.

58. Prince of Wales (Sutton).—See Vol. XXVI., page 277. Ready for use July 9.

59. Prince of Wales (Stoward).—This is quite distinct from No. 58. Haulm and pods deep green; pods in pairs, long, broad, straight, averaging six pale green sweet peas in a pod. Good crop. Ready for use July 18. Height 4 feet. Seeds wrinkled.

60. Princess of Wales (Stoward).—Very similar to No. 59.

61. Prize-winner, **F.C.C.** July 5, 1901 (Sutton).—See Vol. XXVI., page 277. Ready for use July 10.

62. Productive (Sutton).—See Vol. XXVI., page 277. Ready for use July 11.

63. Prolific, **A.M.** July 18, 1902 (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

64. Royal Jubilee, **A.M.** July 18, 1902 (Sutton).—See Vol. XXVI., page 279. Ready for use July 15.

65. Royal Salute (Nutting).—Haulm and pods dark green; pods in pairs, long, broad, straight, handsome, averaging seven large deep green peas in a pod. Very heavy crop. Ready for use July 11. Height 4 feet. Seeds wrinkled.

66. Royal Warrant (Dicksons).—Haulm and pods dark green; pods in pairs, long, broad, curved, averaging seven large deep green peas in a pod. Heavy crop. Ready for use July 9. Height 5 feet. Seeds wrinkled.

67. Satisfaction (Sutton).—Haulm and pods deep green; pods in pairs, long, broad, straight, blunt, averaging eight large pale green and very sweet peas in a pod. Heavy crop. Ready for use July 18. Height 3 feet. Seeds wrinkled.

68. Senator, **F.C.C.** July 11, 1902 (Dean).—Haulm and pods dark green; pods in pairs, long, pointed, slightly curved, averaging seven large sweet pale green peas in a pod. Enormous crop. Ready for use July 7. Height 3½ feet. Seeds wrinkled.

69. Stratagem, **F.C.C.** July 7, 1882 (Sutton).—See Vol. XXVI., page 277. Ready for use July 11.

70. Sutton's Perpetual (Sutton).—See Vol. XXVI., page 279. Ready for use July 15.

71. Sutton's Seedling (Sutton).—See Vol. XXVI., page 275. Ready for use July 5.

72. The Cropper (Watkins & Simpson).—Haulm and pods dark green; pods in pairs, short, thick, blunt, averaging five large deep green and very sweet peas in a pod. Heavy crop. Ready for use July 10. Height 3 feet. Seeds wrinkled.

73. The Gladstone, **F.C.C.** July 18, 1902 (A. Dickson).—Haulm and pods very dark green; pods in pairs, very long, nearly straight, handsome, averaging ten large deep green sweet peas in a pod. Very heavy crop. Ready for use July 15. Height 4 feet. Seeds wrinkled.

74. The Starter (A. Dickson).—Haulm and pods dark green; pods single, short, thick, slightly curved; averaging seven large deep green and very sweet peas in a pod. Heavy crop. Ready for use July 5. Height 4 feet. Seeds wrinkled.

75. Tit Bits (A. Dickson).—Haulm and pods pale green; pods in pairs, short, thick, straight, averaging five large whitish peas in a pod. Heavy crop. Ready for use July 5. Height 4 feet. Seeds wrinkled.

76. Thomas Laxton Selected, **A.M.** July, 5, 1898 (J. Veitch).—Haulm and pods dark green; pods in pairs, long, broad, straight, averaging six large deep green peas in a pod. Heavy crop. Ready for use July 3. Height 4½ feet. Seeds wrinkled. A very fine early tall variety.

77. Torpedo (Carter).—Haulm and pods deep green; pods in pairs, short, thick, straight, averaging five very large green peas in a pod. Ready for use July 4. Height 4½ feet. Seeds wrinkled.

78. Utility (Dicksons).—Haulm and pods deep green; pods in pairs, long, straight, handsome, averaging seven large green peas in a pod. Heavy crop. Ready for use July 10. Seeds wrinkled.

79. Veitch's Perfection (Watkins & Simpson).—See Nos. 56 and 57.

80. Walker's Perpetual, **F.C.C.** August 9, 1881 (Sutton).—See Vol. XXVI., page 279. Ready for use July 18.

81. Western Express, **A.M.** July 11, 1902 (R. Veitch).—Haulm and pods deep green; pods in pairs, long, broad, nearly straight, averaging seven large green peas of excellent flavour in a pod. Heavy crop. Height 4 feet. Ready for use July 7. Seeds wrinkled.

82. Windsor Castle (Sutton).—Haulm and pods dark green; pods long, broad, straight, averaging six large deep green peas in a pod. Heavy crop. Ready for use July 18. Height 3½ feet. Seeds wrinkled.

83. Yorkshire Hero (Sutton).—See Vol. XXVI., page 278. Ready for use July 11.

COMMONPLACE NOTES.

By The Secretary and Superintendent.

Saxifragas from Seed.

A Fellow says he has had great trouble in raising Saxifragas from seed. Possibly the seed was very old, or possibly he did not treat them rightly, for we always find them germinate both quickly and well. First of all (as with everything else) the pots must be clean. It is astonishing how many people calling themselves gardeners are content to use dirty pots. The soil used should be about half leaf-mould and half loam, with a little silver sand, and it should be all well mixed and passed through a fine sieve. Plenty of clean sharp crocks should be used for drainage. The surface of the soil in the pots should be made both firm and level; then sow the seeds thinly and add a very little fine sand—not enough to cover or for the purpose of covering the seeds, but to keep them from moving about and all floating to one spot when they are watered, which should be done very carefully and gently. The pots should then be placed in a gentle heat with a piece of glass over each pot to prevent undue evaporation. Shade should be given whenever the sun is out. As soon as the seeds have come up the pots should be moved at once into a cold frame, continuing to shade lightly, and when large enough to handle they should without delay be potted separately, kept close for a couple of days, and shaded until established, when they may be hardened off for outdoor planting.

Sulphur on Hot Pipes.

"Is any harm done to Grapes by putting sulphur on the pipes during and after flowering?" How hard it is to make folk understand that what may be excellent at one time may be execrable at another, and *vice versa*! Much harm is often done by putting sulphur on the hot-water pipes while the vines are in blossom; indeed, it is not safe to use it for some time afterwards whilst the skin of the berries is still tender. If used when the vines are in bloom it causes them to set very sparsely, and if used whilst the skin is tender it will often make the bunches rusty. Sulphur on the pipes is at the proper season a good thing, but it should not be used until the berries are half-grown.

Hybridisation and Selection.

In a former issue we urged the desirability of everybody interested in gardening taking up some one plant or other and endeavouring to improve it or get it to vary, and then selecting the best variety over a series of generations until it had become "fixed." Numerous inquiries have been sent to us since as to what plants can be suggested for the purpose. The question is only difficult to answer from the fact that there is hardly a plant in cultivation which might not yield rich fruit if thus treated. We suggested as an example crossing our common white Wood Anemone with the scarlet and blue forms of *Anemone coronaria*, and with the scarlet *Anemone fulgens*, making the Wood Anemone the seed parent, so as to endeavour to obtain a plant with all the hardiness and freedom of the

Wood Anemone with the brilliant colour if possible of its more pretentious southern relatives. But let no one mistake. We by no means think that a scarlet or a blue Wood Anemone would be more beautiful or as beautiful as our present white one; we should only like an occasional bunch of scarlet and of blue planted amongst broad sheets of white. Any other plants might be experimented with. For example, why does not some one cross the Red Currant with a Gooseberry so as to make the former sweet, and reverse the cross so as to give a briskness to the ripe Gooseberry? Why not cross the white form of our wild *Fritillaria Meleagris* with the yellow 'Crown Imperial,' or with *Fritillaria Moggridgei* or *F. aurea*, or any of the beautiful golden species which are somewhat delicate, so as to give us a really hardy and free yellow one? What young man will set to work on Grapes and see if he cannot puzzle out a combination of parents or series of combinations which should eventually present all northern people with an outdoor Grape with good-sized berry and with Muscat flavour which would ripen in September not only in an exceptional but in any ordinary English summer? Or who will give us a hardy yellow Rhododendron by crossing a white variety of the *R. ponticum* group with a deep yellow variety of *Azalea mollis*? Or who will take up and carry on in a slightly different direction the inestimable work which Mr. Fenn has done amongst Potatos? He has given us large mealy and disease-resisting tubers; now let some one give us a series of delicious small yellow-fleshed waxy ones lasting from the earliest 'Ashleaf Kidneys' well into the following spring, and equally disease-resisting. Some greenhouse worker should cross *Amaryllis* (*Hippeastrum*) with both *Clivia* and *Pancratium* and *vice versa.* By the way, in crossing hardy plants it would as a rule be best to make the hardier of the two the seed parent, but with greenhouse plants it is comparatively immaterial. A lady we know of is endeavouring to cross a white Poppy with *Meconopsis Wallichi.* She will probably fail; but all honour to those who try, and if now and then they should succeed, happy indeed will they be and will they make others also.

Grass or Cultivated Land under Fruit Trees.

We are frequently being asked by intending planters of orchards whether it is better to have the land cultivated, or Grass, under the trees. And, again, a correspondent writes that he finds the expense of constantly cultivating the ground amongst his fruit trees so great compared with what it would be under grass, he would therefore like to have our opinion as to whether it would not be better to sow fine Grass seeds over the whole, and thus save the expense of hoeing &c. The answer is a very emphatic No! All fruit growers who have tried the two methods have found that hardy fruit trees on cultivated land are far more vigorous and healthy and prolific; they produce larger and better fruit, and are also more free from insect attacks, than trees growing on Grass land. When trees are on cultivated ground they get the benefit of all the rainfall; and the constant moving of the surface soil during the summer months lessens the drying power of the sun on the land, as will be seen if the loose surface soil is moved, a more or less moist soil being found just below owing to evaporation having been arrested. Further, the constant stirring of the soil exposes insects and their larvæ to the keen eyes of birds, toads, and suchlike, and the attack of such pests must naturally be greatly reduced. On the other hand, with Grass a very large proportion of the rainfall never reaches the roots of the fruit trees at all, and it would be difficult to estimate how much plant food is absorbed by the roots of the Grass; the consequence is that the roots of the trees are driven downwards in search of food and moisture, and if they come in contact with some unsuitable layer of soil—as they frequently do—canker follows, or stunted unhealthy growth with correspondingly inferior crops. Grass also affords a splendid harbour for insects and their larvæ, which only wait for a favourable opportunity to attack the trees in legions and play havoc with the fruit and foliage. Many other arguments could be brought forward in favour of cultivated ground, but enough has been stated to show that Grass land is not the most economical for modern fruit culture.

Wasps.

All fruit growers are only too well acquainted with the ravages of wasps amongst fruit, the damage seldom ending with the wasp, as flies and other insects follow and feed through the holes in the fruit made in the first instance by the wasps, until little is left save the outside skin or husk. There are many methods of keeping down the number of wasps, all more or less unsatisfactory, and there is no doubt that the best means of minimising their evil effects is to destroy all the nests. When the wasp has visited the fruit, and secured all it requires, it always flies in a straight line for its nest, and a sharp-eyed boy will quickly locate all the nests in the neighbourhood by following this line of flight. Having discovered the nests, it is a very simple matter to take some cyanide of potassium and put a little—say half a teaspoonful—into the mouth of the hole leading down to the nest. Most of the wasps that are really troublesome are *Vespa vulgaris*, and build their nests in the ground, so that there is no difficulty about destroying the nests, as every wasp that passes over the cyanide of potassium is killed by the fumes as it passes in or out of the nest. For this reason we prefer to place the cyanide in the mouth of the hole during the daytime, for when placed there at night when the wasps are at rest much of its strength has evaporated, and is lost before the wasps are active in the morning. There is no danger of being stung if the person destroying the nests walks quietly up to the hole and places the cyanide of potassium carefully in, and moves away again quietly without beating at any wasps that may be buzzing about him. We have destroyed hundreds of nests in this way without once getting stung. Cyanide of potassium is a deadly poison, and should only be used by a careful person, nor should it be left about where children could get at it. It is far more effective and expeditious than tar, gunpowder, or any other means for destroying wasp nests.

Vines Scalded.

"I enclose some berries of 'Muscat of Alexandria' and 'Lady Downes' which always go in this way, whereas 'Mrs. Pince's Black Muscat' and 'Gros Colmar' in the same house look perfectly healthy. Can you tell me what the disease is?"—The disease was no disease at all. The berries were simply scalded through faulty ventilation. Either the vinery had not a sufficient number of ventilators or else they were not opened *early enough* in the morning. 'Muscat of Alexandria' and 'Lady Downes' are both thin-skinned varieties, and scald very easily and quickly. Ten times more harm, we think, is done by undue coddling and shutting plants and houses up too closely than by the opposite treatment. Fruit cannot be well grown, of good flavour, or good colour, without abundance of air, but at the same time a draught is no more good for plant life than for human.

Lawns and Golf Grounds.

"This season we have been greatly troubled by the abnormal increase of Clover. Is it due to the wet spring, or have the manures we have been using favoured its growth at the expense of the Grass? We have used basic slag, bone-meal, sea-sand, soot, Clay's fertiliser, nitrate of soda, and sulphate of ammonia."—We think that all the manures mentioned, excepting the last two, would decidedly encourage the growth of Clover. Any one interested in the subject will find some useful remarks on page 852 of our last volume, XXVI. In making lawns &c. care should be taken to get seed free from Clover. All the best seedsmen make special mixtures of such Grass seeds as will be suitable for different purposes and different soils. It is well worth the slight delay entailed by sowing these rather than laying down turf full of all manner of weeds. Many people think April the best time to sow Grass seed, but we like August or early September, as then a really fair lawn may be obtained by the following summer.

The Asparagus Beetle.

In some parts of the country this always too common pest has this year been still commoner than usual, and in places the whole greenness of the foliage has been devoured. The best remedy we know of is to give the beds a good dressing of 2 oz. of kainit and 1 oz. of nitrate of soda to the square yard once a month while the plants are growing, and to syringe the foliage of the Asparagus once a week with a wineglass of paraffin in a gallon of water, taking care to keep it thoroughly well shaken up and mixed together whilst it is being used. It is also better not to mulch the beds with manure in autumn, as this protects the chrysalids and keeps them from the frost in winter; but mulch with well-rotted stuff in spring just before the growth commences.

Sweepings of Poultry-houses.

A Fellow writes to know how best to utilise the sweepings of poultry-houses. It is of course a most valuable fertiliser, and may be used as a surface dressing for indoor or outdoor fruit trees or vegetables. About a pound to the square yard sprinkled over the ground, then lightly raked and watered in the ordinary course of watering, suffices. It is also excellent for mixing with the compost for potting soft-wooded plants. A 7-inch pot full to a barrow load of compost and well mixed up with it will stimulate growth and produce good dark-coloured healthy foliage. Nothing, again, is better for making liquid manure. Two bushels tied up in a sack and allowed to soak for two or three days in 100 gallons of water will make a splendid stimulant for pot plants or growing crops.

Heating by Steam.

Enquiry has reached us lately as to whether steam could not be used advantageously instead of hot water for heating greenhouses, and on making enquiry ourselves we find that a special boiler for the purpose has been introduced by Mr. Richardson, of Altrincham. The chief point claimed for the system is that the temperature can be regulated to a nicety and also maintained at an almost absolutely constant point so as to avoid fluctuations both above and below the particular temperature desired. A second point claimed for it is that it is very economical cf fuel; and, further, that it is a particularly clean system. A gentleman who has tried it says that in a large Orchid house the temperature was maintained night and day during a very cold spell of frost at sixty degrees regularly and constantly. We cannot speak from our own experience; we have not yet seen the system working.

Beech-tree Pest.

In Volume XXVI., at page 851, we asked for information of cases where *Cryptococcus fagi* had been known to attack *Copper* Beeches, as there was an erroneous idea abroad that Copper-leafed Beeches were exempt from the pest. A Fellow, writing from Loughborough, says: "I have three Copper Beeches nearly fifty feet high, and they have all had the pest, but they (as well as the Common Beeches) have been cured by scrubbing them well with Gishurst compound made into a gocd lather. Sometimes a little patch of the pest appears again, but it is instantly got rid of by one scrubbing. I think every Beech tree on the place has had the pest, and all have been cured in this way, as also have some of the finest Beeches I ever saw on an estate in Wiltshire, whose owner was almost in despair about them; in fact, I have never known it fail if taken in time before the pest gets to the branches, for it *generally* begins at the bottom and moves upwards." Another correspondent writes: "Having noticed that a very fine Copper Beech was badly attacked by this insect, which was destroying so many Beech trees in the neighbourhood, I determined to try and save the tree, if possible to do so. I made a paraffin emulsion by boiling two pounds of soft soap in a gallon of water until dissolved: this I poured into a glazed pan in which I had put one quart of paraffin. I then beat up the mixture with a handful of twigs from a birch-broom until all the oil was thoroughly mixed up. I then poured in twelve gallons of boiling water. A man was then sent up to the top of the tree with the emulsion and a scrubbing-brush, and the stem and the branches near the stem were thoroughly scrubbed down. For five years after this was done the tree, to my knowledge, remained perfectly clean and free from the pest, and, I believe, has remained so ever since."

Distribution of Surplus Plants.

Fellows should bear in mind that the Society has never pretended to distribute very rare and valuable plants amongst the Fellows. How could it be done for the subscription paid? All the Society professes to do is to distribute by ballot all *surplus* plants instead of throwing them on the rubbish heap. Any one knows that if you want to raise a few plants of any kind from seed and sow a pan with them you probably get a vast number more than you require for yourself, and in all private gardens they are either given away or thrown on the waste heap. It is exactly the same with the Society. We must either throw all surplus plants on the rubbish heap, or we must distribute them amongst those Fellows who care to have any of them. Some few years ago the rubbish heap had them, but when the Society was reorganised it was determined to distribute them by ballot to any who cared for them. Admit that from the point of view of a really first-class garden these plants are rubbish; but is that any reason why those who care to have some of them should not be allowed to have them? What is rubbish to one is by no means so to another. Suppose you grow a large collection of Chinese Pæonies, or of Phloxes, or of German Irises, or of perennial Sunflowers or Asters, &c. After a few years the clumps get too crowded and must be taken up and divided. In all such cases probably not one-twentieth part of the old stool is replanted, and the other nineteen-twentieths must be either given away or thrown on the waste heap. Generally we find abundance of neighbours and friends only too glad of a part of such waste. Waste rubbish it is to ourselves, but not so to them. Exactly the same with the Society, only that as a rule its stock is far larger than in a private garden, and we are sure that the mass of the Fellows would far rather have a share in such "rubbish" than that it should be burnt on the waste heap, and Fellows who grumble that they do not get valuable plants worth ten times the subscription they pay are manifestly unreasonable.

Variation.

A correspondent sends us the following interesting note: "Seeing the interesting discussion on seedling Red Tankard Turnips at the Scientific Committee (pages l and li) reminded me of an experience of my own. I had one plant of Broccoli come quite distinct from any other I had at the time, or have indeed ever met with. It was both whiter and later. I saved it for seed and marked it 'Not to be cut,' but the latter precaution proved unavailing. However, the stem was left, and from it I eventually secured a few seeds. Being well aware how easily the Brassica tribe are intercrossed by insects, before the flowers opened I enclosed the whole plant in lace netting, through which not even a greenfly could pass. As soon as ever the seeds were ripened and gathered I had my misgivings, as they were larger than Broccoli seed usually is, and when they germinated the seed leaves were abnormally large, and the resultant plants were of the most nondescript character and totally unlike a Broccoli. It is highly improbable that the flowers had been cross-fertilised by insects or even by wind-blown pollen, for no insect as big as an aphis could reach them, and the garden being very isolated and having no other Brassicas flowering in it, the pollen would have had at the least a half-mile to journey on the wind, and that through or over the woods which intervene between us and the nearest garden. It was probably a reversion to some very ancient form, and this might have been induced by the fact of the flowering shoots having come from the stem growths and not from the central head of the Broccoli. The comparative freedom of all the garden varieties of the Cabbage tribe from similar reversion is, I think, very remarkable, considering the frequency with which reversion to type-forms takes place among many popular flowers."

Gaslime for Clubbing.

Here is the gist of a letter from a gentleman who once had great faith in gaslime as a preventive of clubbing, and who has used upwards of 400 tons of it in that belief. He now says: "My experience with gas-lime is that it is of very little value as a manure, and utterly useless to prevent clubbing. I have used it in quantity, but am now convinced that it is not worth the labour bill of carting and spreading. In theory it ought perhaps to stop clubbing, but practical experience is against it, and I have never heard an opinion worth noticing in its favour. Year after year, for five or six years, have I used it, but still there is club root." We should be very glad if any one who has in any way found a means of stopping "clubbing" in gardens would communicate his experience, as lamentations concerning its prevalence reach us from all sides.

BOOKS RECEIVED.

"The Book of the Rose." By the Rev. A. Foster Melliar, M.A. (Macmillan, London.) 6*s*. 8vo.

A second and enlarged edition of Mr. Foster Melliar's well-known and delightful "Book of the Rose." No Rose grower should be without it, for it is not only charmingly written and a pleasure simply to read, but it gives full particulars on all Rose subjects, treating of all the various soils and situations, of the methods of planting, of manuring and pruning for various different purposes, of the stocks on which to bud and how to raise them, of insect and fungus pests and diseases. Roses under glass are treated of as well as in the open air; advice and directions for exhibiting &c. Then all the principal and best sorts in existence are admirably described, and all their peculiarities of needs or conduct noted. The book ends with selected lists for various purposes, and a calendar of all the months, and what should be done in each to secure a really lovely and perpetual Rose garden.

"European Fungus Flora—Agaricaceæ." By George Massee, F.L.S., V.M.H. (Duckworth & Co., London.) 6*s*. 8vo.

The mycologists (students of fungi) of every European country will have cause to thank Mr. Massee for providing them with what is practically a dictionary of all known European Agarics, of which no less than 2,750 species are here described, 1,553 of them being British. The labour of compiling such a book must have been enormous, and for many years to come it will doubtless form the authoritative text-book of the Agaricaceæ, and will be a necessary volume of reference to all students of mycology. It should be understood that it is not a book to take up for half an hour's light reading, but is essentially a book for reference and study.

"The Gardener's Assistant." By the late Robert Thompson. Revised and edited by William Watson. (The Gresham Publishing Company, Southampton Street.) Vol. VI. Imperial 8vo. 8*s*.

This is the concluding volume of one of the best books ever issued for the use of a working gardener or an amateur. It was a first-rate book when it first issued from the pen of Mr. Robert Thompson, head gardener to the Royal Horticultural Society; and now that it is revised after a lapse of so many years and brought up to date it has, under the editorship of Mr. Watson, of Kew, approached as nearly to perfection as any such work can do. It should be in every bothy and in every gardener's house, for there are few (if any) such "all-round" men as not to benefit by a study of one part of it or another. The present volume is concerned chiefly with the vegetable garden, concluding with a most valuable calendar of operations in the fruit and vegetable departments. It is in every way equal to its predecessors, and higher praise could not be accorded.

"Roses for English Gardens." By Gertrude Jekyll, V.M.H., and Edward Mawley. (*Country Life* Office, 20 Tavistock Street.) 12*s.* 6*d.* 8vo.

Like everything that issues from *Country Life*, this book is magnificently got up, printed with delightful type and on excellent paper, and illustrated with upwards of 200 full-page illustrations, which are in themselves a perfect feast of delight; and being all reproductions from actual photographs, they should inspire beholders not only with enthusiasm but with the determination to make their own porticos, verandahs, pillars, Rose gardens, or Rose arches as beautiful as those depicted. There is a chapter on arranging cut flowers which is greatly to be commended to the ladies; in fact, we strongly recommend every "mere man" to buy a copy of this volume and present it to that lady of the household who undertakes the arrangement of the flowers. The fact that Mr. Mawley is Hon. Secretary of the National Rose Society is guarantee that the best possible advice is given as to selecting, planting, and pruning Roses outdoors and also under glass.

"Gardening for Beginners." Second edition. By E. T. Cook. (George Newnes, Ltd., London.) 12*s.* 6*d.* 8vo.

This work contains 550 pages of instruction and information which we can thoroughly recommend to beginners and "others." It is eminently practical, and just the sort of book that a young gardener should keep by him; in fact, when in doubt consult "Gardening for Beginners," and you are almost certain to find the advice and direction you require. Lovers of flowers who live in towns will find words to encourage them to try again if at first they don't succeed; and with such a list of hardy perennials to select from as that given on page 392 they must be hard to please if they cannot find plenty to their taste. Amateurs frequently fail in fruit culture, just as even professional gardeners will sometimes do in the management of Ferns. The careful following of Mr. Cook's instructions in either case is sufficient to insure success. The woodcuts and illustrations are excellent.

"Agricultural Botany, Theoretical and Practical." By John Percival, M.A., F.L.S. (Duckworth & Co., Covent Garden, W.C.)

In this work Professor Percival has supplied a much-felt want in providing agricultural students with a text-book on botany suited to their particular branch of study, and omitting all such details as interest only the scientific botanist. It is divided into eight parts, which treat of General External Morphology, Anatomy, Physiology of Plants, Classification and Special Botany of Farm Crops, Weeds of the Farm, Farm Seeds, Fungi, and Bacteria. A great part of the book is just as applicable to gardeners as to farmers, and invaluable to either. One novel element in a book of such serious purpose is the introduction of a great mass of examples or suggestions for experiments, which shall themselves illustrate or prove the thesis under discussion. These we consider would be to the student of the greatest possible assistance if carefully carried out. The cordial thanks of horticultural students, as well as of agricultural, are due to Professor Percival for his book.

"Garden and Grounds—how to lay out and arrange." By T. W. Sanders, F.L.S., F.R.H.S. (Dawbarn & Ward, Farringdon Avenue, E.C.) 6*d.*

In No. 2 of the Country House Series of Practical Handbooks Mr. Sanders has produced a little book which will be useful to those who desire to tastefully lay out or improve their gardens, "whether it be the small plot in the city or the suburbs or the country house and grounds of several acres." Plan 2 shows how the most may be made of half-an-acre plot; while plan 7, consisting of ten acres, is more ambitious and describes a garden of parklike character. In suggesting evergreen and flowering creepers for the house we cordially agree with the author in thinking "it is of no use spending money and time in laying out beautiful grounds if base and ugly walls meet the eye at every turn."

"First Steps in Photo-micrography." By F. Martin Duncan, F.R.H.S. (Hazell, Watson, & Viney, Long Acre, London.) 1*s.*

This volume is No. 23 in the "Amateur Photographer" Library. Mr. Duncan is an enthusiast on his subject, and amateurs intending to take up this interesting branch of photography could not do better than consult the little book before us. All apparatus necessary for obtaining exact photographs of specimens, from the "baby spider" to the "foot of the bee parasite," will be found fully described, and when the amateur has "successfully mastered the first steps and gained some amount of experience and facility," then the author modestly says "he may with advantage consult the more exhaustive and technical works."

"The Book of Vegetables." By George Wythes, V.M.H. (John Lane, London and New York.) 2*s.* 6*d.*

This is vol. vii. of the "Handbooks of Practical Gardening," and is a welcome addition to those already published. A careful selection of the best varieties is suggested, and the cultural directions are given with no uncertain sound. Should this volume fall into the hands of cooks, they will find in it much valuable information, and it may perhaps teach them to take a little more care than is customary in the cooking of such common vegetables as Cabbages, Brussels Sprouts, and the like. Illustrations of vegetables are nearly always more or less unsatisfactory, and we should feel rather sorry for the gardener who could not grow better Peas than those represented in the frontispiece. But the book is distinctly helpful.

"A Handy Book of Horticulture." By F. C. Hayes, M.A. (John Murray, Albemarle Street, London.) 2*s*. 6*d*.

A book which should prove very useful to young gardeners. It is written in plain, simple language which beginners can understand, and contains much information necessary to successful flower and vegetable culture. The chapter on hot beds and cold frames, though short, is helpful, while the advice on the best method to make the most of small gardens will be valued by many amateurs. The monthly calendar at the end of the book is excellent. Besides some useful woodcuts, there are several full-page illustrations, among which many will be pleased to see one of the garden at Edge Hall, Cheshire, the home of that veteran hardy plant grower, the Rev. C. Wolley Dod, V.M.H.

"Orchard and Bush Fruit Pests, and How to combat them." By Cecil Warburton, M.A., F.Z.S. (John Murray, Albemarle Street, London.) 6*d*.

This pamphlet gives the life-history and describes the ravages on fruit trees of such insect pests as the winter moth, slugworms, red spider, codlin moth, Apple sawfly, gall mite, the Raspberry beetle, and others. The method of fighting and destroying these enemies of orchards and bush fruit is clearly described and will be found effective.

NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

JUDGING by the number of appreciative letters received, the endeavour, commenced in our last volume, to enlarge the usefulness of the Society's Journal, by giving an abstract of current Horticultural and Botanical periodical literature, has met with success. It has certainly entailed vastly more labour than was anticipated, and should therefore make the Fellows' thanks to all who have helped in the work all the more hearty.

That anything approaching perfection either in method or execution should have been achieved as yet is not to be expected, but the Editor desires to express his most grateful thanks to all who co-operate in this work for the very large measure of success already attained, and he ventures to express the hope that they will all strictly adhere to the general order and scheme of working, as the observance of an identical *order* can alone enable the Editor to continue to cope with the work. The order agreed on was as follows :—

1. To place first the name of the plant, disease, pest, &c., being noticed ; and in this, the prominent governing or index word should always have precedence.

2. To place next the name, when given, of the author of the original article.

3. Then, the abbreviated form of the name of the journal, &c., in which the original article appears, taking care to use the abbreviation which will be found on pp. 222, 223.

4. After this, a reference to the number, date, and page of the journal in question.

5. If an illustration be given, to note the fact next, as "fig.," "tab.," or "plate."

6. After these preliminary necessities for making reference to the original possible for the reader, the abstract or digest should follow, ending up with the initials of the contributor affixed at the close of each Abstract or Note.

Names of those who have kindly consented to help in this work.

Boulger, Professor G. S., F.L.S., F.R.H.S.
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Ward, Professor Marshall, Sc.D., F.R.S., F.R.H.S.
Wilks, Rev. W., M.A., F.R.H.S.
Worsdell, W. C., F.R.H.S.

JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales de la Soc. Nantaise	Ann. Soc. Nant.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Hort. de Loiret	Bull. Soc. Hort. Loiret.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletin of Bot. Dep. Trinidad	Bull. Bot. Dep. Trin.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt für Bacteriologie	Cent. f. Bact.
Chronique Orchidéenne	Chron. Orch.
Comptes Rendus	Comp. Rend.
Contributions from the Botanical Laboratory, University of Pennsylvania, Philadelphia	Contr. Bot. Lab. Phil.
Department of Agriculture, Victoria	Dep. Agr. Vict.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Dictionnaire Iconographique des Orchidées	Dict. Icon. Orch.
Die Gartenwelt	Die Gart.
Engler's Botanische Jahrbücher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Hamburger Garten- und Blumenzeitung	Hamb. Gart. Blum.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal Dep. Agricult. Victoria	Jour. Dep. Agr. Vict.
Journal Imperial Department Agriculture, West Indies	Jour. Imp. Dep. Agr. W.I.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R.A.S.
Journal S.E. Agricultural College, Wye	Jour. S.E. Agr. Coll.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundheitsamte	Kais. Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Notizblatt des Königl. Bot. Gart. und Museums zu Berlin	Not. König. Bot. Berlin.
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Queensland Agricultural Journal	Qu. Agr. Journ.

Journals, &c.	Abbreviated title.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gén. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions Bot. Soc. Edinburgh	Trans. Bot. Soc. Edin.
Transactions of the British Mycological Soc.	Trans. Brit. Myc. Soc.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.*
U.S.A. Experimental Station Reports	U.S.A. Exp. Stn.†
U.S.A. Horticultural Societies' publications	U.S.A. Hort. Soc.†
U.S.A. State Boards of Agriculture and Horticulture	U.S.A. St. Bd.†
Wiener Illustrirte Garten-Zeitung	Wien. Ill. Gart.-Zeit.
Woburn Experiment Farm Report	Woburn.
Zeitschrift für Pflanzenkrankheiten	Zeit. f. Pflanz.

* The divisions in which the U.S.A. Government publish Bulletins will be added when necessary.
† The name of the Station or State will in each case be added in full or in its abbreviated form.

NOTES ON RECENT RESEARCH.

Effect of Alkali on Roots.

Alkali Soils, Effects upon Seedlings of certain Components of. By Thos. H. Kearney and Frank K. Cameron (Some Mutual Relations between Alkali Salts and Vegetation. *Report* No. 71, *U.S.A. Dep. Agr.* p. 7 ; 1902).—In many of the arid districts of the Western United States the soil contains various salts collectively termed "alkali" by the people of the district. The salts most commonly met with are sodium chloride, sodium sulphate, sodium carbonate, sodium bicarbonate, magnesium chloride, magnesium sulphate, and calcium chloride. Frequently they form thin efflorescent crusts on the surface of the ground. Soils containing moderate amounts of some of these—notably sodium carbonate or "black alkali"—support little or no useful vegetation. The authors endeavoured to determine the relative harmfulness of each of the commonly occurring salts of alkali lands. Experiments were made with pure salts singly and in mixture with each other, the plants utilised for the work being White Lupin and Lucerne.

The primary roots of well-developed plants germinated on damp sphagnum were allowed to dip for twenty-four hours into solutions of various strengths of the different salts, and the limits of concentration of each solution which would just permit the roots to live during that time were determined.

The following results were obtained with White Lupins :—

Magnesium sulphate . . .	7 parts in 100,000.
Magnesium chloride . . .	12 ,, ,,
Sodium carbonate . . .	26 ,, ,,
Sodium sulphate . . .	53 ,, ,,
Sodium chloride . . .	116 ,, ,,
Sodium bicarbonate . . .	167 ,, ,,
Calcium chloride . . .	1,377 ,, ,,

From this table it is clear that the basic radicles or kathions of the salts are more active upon plant tissues than the acid radicles or anions.

Comparison of the same salts was made in regard to the concentration of each which would prevent any elongation of the roots to take place during twenty-four hours. The following results were obtained :—

	Concentration preventing growth.
Sodium carbonate . . .	260 parts in 100,000.
Sodium bicarbonate . . .	417 ,, ,,
Magnesium chloride . . .	960 ,, ,,
Sodium chloride . . .	1,160 ,, ,,
Sodium sulphate . . .	1,410 ,, ,,
Calcium chloride . . .	1,652 ,, ,,
Magnesium sulphate . . .	1,680 ,, ,,

That the injurious or toxic effect of solutions of these salts is not merely a function of their osmotic pressures is obvious from a comparison of the two sets of results given. Marked toxic effects appear long before turgor is reduced or growth checked.

By experiments upon the influence of mixtures of the salts it was found that the toxic effect of one salt can be diminished by addition of another to the solution, and the diminution is much greater when a different kind of kathion is added than when a new anion only is introduced. The addition of sodium ions to a solution containing magnesium ions generally reduces the poisonous effects of the latter, and calcium ions added to solutions containing sodium or magnesium ions have an extraordinarily beneficial influence, especially when the calcium is added as sulphate.

The authors also show that plasmolysis, which is so generally supposed to be due to a reaction to physical stimuli only, can apparently be prevented by altering the chemical nature of a solution without materially reducing its osmotic pressure.

The authors conclude that the effect of one kind of ion in neutralising the physiological action of another kind cannot be entirely explained by a consideration of the chemical changes within the solution itself; some of the effects must be in part referred to changes in the protoplasm of the organisms.

When the concentration of the solution of the salts already mentioned was reduced to a certain point the toxic effect disappeared. In solutions diluted still further a stimulating effect was observed, the roots of the plants growing more vigorously than those of control plants grown in distilled water.—*J. P.*

Plant Anatomy.

Anatomy of Leaf and Axis (Genisteæ) (*Beih. Bot. Cent.* bd. xi. ht. 6, pp. 368–417).—Herr Alfred Schroeder (aus Danzig) describes the minute anatomy of the *Liparieæ* and *Bossiææ* in a very detailed and complete manner. They exhibit very marked xerophilous characters. A few possess epidermal papillæ, deeply sunk stomata, or centric leaf structure. As the details of some sixty-four species are fully given in the paper, it is scarcely possible to make a satisfactory abstract. It seems from the anatomy as if *Goodia* should be withdrawn from the *Genisteæ*.
G. F. S.-E.

Structure of Aphyllon.

Aphyllon uniflorum, Structure and Parasitism of. By Amelia C. Smith, B.S. (*Contr. Bot. Lab. Phil.*, vol. ii., No. 2, 1901, p. 111; pls. 13–15).—The naked Broomrape is typically a North American species, parasitic on *Aster corymbosus*. The degeneration attendant upon its parasitic habit is expressed by (*a*) absence of chlorophyll, (*b*) degeneration of bract leaves, (*c*) loss of root-hairs, (*d*) reduction of the bundle system, and the greater relative development of phloëm than of xylem, (*e*) small size of seed and primitive embryo, and development of this embryo within a mass of precocious endosperm, which completely surrounds the embryo and suspensor.

Parasitic roots form intimate connections with host-roots, but the host-roots are not entirely starved beyond the point of attachment.

Stomata are present on bract-leaves, flower-stalk, calyx, and corolla.

A well-developed ovarian nectar gland is present.

Starch is present in great quantities in roots, stems, leaves, and carpellary tissue.—*M. C. C.*

FUNGI ATTACKING THE APPLE FRUITS.

1. Apple Scab. 2. Apple Rots in Illinois. By G. P. Clinton (*U.S.A. Exp. Stn., Urbana, Bull.* 67, *Dec.* 1901, *and Bull.* 69, *February* 1902).—In the first of these pamphlets the author describes the results of botanical studies carried out during 1898, 1899, and 1900 on the disease of Apples known as "Apple scab," caused by the parasitic fungus *Fusicladium dendriticum.* Goethe in 1887 suggested that this fungus was a stage in the life-history of a fungus which had its later stage on the dead leaves, and Aderhold in 1894 connected it with a species of *Venturia* on the dead leaves. The investigations of the author confirm the view that Apple scab is merely a parasitic summer stage of a permanent saprophytic fungus occurring on the fallen leaves.

The *Fusicladium* stage occurs on the leaves and fruits, forming distinct small circular olive patches, and in time causing puckering of the leaves and sometimes death of the cells beneath. Young leaves attacked often turn yellow and drop, but the leaves usually remain attached to the tree until autumn.

On the fruit roundish olive rough areas or "scabs" are produced, sometimes spreading over a considerable surface. When very young fruit is badly attacked, distortion and interference with normal development occur, and sometimes the little fruits fall.

The severity of the attack depends largely upon the weather conditions. In years having wet springs, especially when damp cold weather prevails during the opening of the leaf buds, the disease does most injury.

Bordeaux mixture (4 lb. copper sulphate, 4 lb. fresh lime, 50 gallons water) sprayed on the trees soon after the leaves begin to unfold, again soon after the petals fall, and if the season has been favourable to the development of the fungus about two weeks later, has been found an effective means of preventing the disease. The second spraying may be done with a mixture of Paris green and Bordeaux mixture if codlin moth is troublesome (1 lb. of Paris green to 200 gallons Bordeaux mixture).

The *Fusicladium* stage appears soon after the leaves begin to unfold, and may be found until the leaves fall. It can more easily attack the young leaves and fruits than older ones. It is more abundant on the lower than on the upper surface of the leaves, and especially near the midrib. It attacked the lower leaves more frequently than the upper. On the leaves the mycelium grows between the epidermis and the cuticle, and sometimes between the epidermal cells. It sends up conidiophores which penetrate the cuticle, and from which lanceolate, acute, reddish olive-coloured spores are successively abstricted. Sooner or later the complete collapse of the epidermal cells is caused. In the fruit the mycelium often forms a pseudo-tissue several cells deep before the spores are produced.

The fungus was in only one case found on twigs, and that on a tree very badly infected, but all trace had disappeared before the spring.

This stage was cultivated artificially on Apple leaf agar and other nutrient media.

The *Venturia* stage appears on the old leaves which have been infected with scab. The perithecia usually originate in the spongy tissue of the leaf from the mycelial threads which have by this time penetrated more deeply into the dead tissues of the leaf. They appear as small black pustules, scattered as a rule, but frequently in the vicinity of the veins. The author has never found the perithecia on the old fruit and only once on the twigs. In the latter case it is probable that the perithecium had blown into the position taken up.

The ascospores from the perithecia were cultivated, and produced characteristic *Fusicladium* colonies and spores on Apple corn meal.

The *Venturia* stage is identical with *V. inæqualis* (Cke.), Ad.: it is considered distinct from the form on the Pear, which was included by Cooke in his *Sphærella inæqualis* (see *Seem. Journ. Bot.* iv. 1866, pp. 248, 249, illus.). The author notes also another ascogenous fungus having perithecia chiefly on the upper surface of the fallen leaves (*Sphærella pirina*, E. & E.)

The synonymy and bibliography of the fungus are given in full (pp. 124–137).

In the second pamphlet the author enumerates the various "rots" to which Apples are subject in Illinois. "Fruit burn," due to sun heat, mostly attacking fallen Apples; "brown rot," due to *Monilia fructigena*, Pers.; "soft rot," due to *Rhizopus nigricans*, Ehr., like "brown rot," attacking fallen or mature Apples only as a rule; "fruit blotch," due to *Phyllosticta* sp., apparently a new disease which the author hopes to investigate next year; "black rot," due to *Sphæropsis malorum*, Berk.; and "bitter rot," which forms the chief subject for consideration in this pamphlet. Other rots due to various causes are incidentally referred to. The bitter-rot fungus attacks both green and ripe fruit, and is widely distributed over the world. It is much more frequent in some seasons than in others, and has been known to cause the destruction of an entire crop. The means of prevention suggested are the thorough removal of all infected fruit and spraying at frequent intervals after the disease appears, but experiments along these lines are in progress.

The rot may spread from many starting points, but generally from one or a few places, and forms a brown rotten area $\frac{1}{4}$ inch or $\frac{1}{2}$ inch in diameter. After a time blackish pustules appear at the centre, which under favourable weather conditions burst and set free the pinkish masses of spores. One characteristic feature of this rot is the shrinkage of the tissues, so that a depression is formed, and another is the peculiar bitter flavour of the rotten part.

Experiments proved that moisture was a necessary condition for the bursting of the pustules and the liberation of the spores. The rot usually appears in July (in Illinois), and the spores, which when moist form a somewhat sticky mass, are carried from tree to tree by small pomaceous flies belonging to the genus *Drosophila*: they never become so dry as to be blown about by the wind. The spore develops into the *Glæosporium* stage of the fungus which produces the rot, but during the autumn and the succeeding spring another form of the same fungus develops as a saprophyte on the mummy Apples. These mummy Apples are covered by the growth of the fungus with a matted mycelium, protected by which perithecia containing asci are gradually developed in a stroma. These perithecia mature the next summer when the ascospores are shed out of the asci. The ascospores are no doubt carried by the pomaceous flies before mentioned, and germinating on the green Apples start the disease again for another year.

The author gives an account of artificial cultures on Apple agar, &c., upon which both the *Glœosporium* stage and the permanent stage developed, while the disease was induced in Apples by artificial infection.

The parasitic form was described under the name *Glœosporium fructigenum* by M. J. Berkeley (see *Gard. Chron.* 1856, p. 245), while the permanent stage is now technically described by the author for the first time under the name *Gnomoniopsis fructigena*, Berk., who has slightly modified the characters of the genus *Gnomoniopsis*, Stoneman, in order that this species may be included.

Both papers are freely illustrated, figures being given of the diseases and the fungi producing them.—*F. J. C.*

The Black Currant Mite.

Black Currant Gall Mite, Eriophyes (Phytoptis) ribis, Westwood, The Life History of the. By Cecil Warburton and Alice L. Embleton (*Linn. Soc. Jour.* vol. xxviii. pp. 366-378; plates 33, 34; 1902).—An exceedingly interesting and instructive account of this destructive pest. The *new* and *important* facts concerning the life-history of the mite are taken from the summary as follows:—

"3. Distribution is effected by (1) crawling, (2) adhering to insects, (3) leaping.

"5. The mites are unable to maintain life in the ground, nor do they attack the roots."

As to the distribution of the mites by adhering to insects &c. the writers (*l.c.* p. 369) say that when the mites were first observed on the outside of the abortive buds one curious point in their behaviour attracted attention, even under the slight magnification of a pocket lens. Though some were actively crawling about, others appeared to be standing on end and motionless, except for the waving of their legs. A series of observations and experiments were undertaken with a view to ascertaining the precise nature and purpose of this phenomenon, with the following results.

A migrating mite, after crawling for a short distance in the manner already described, would obtain a firmer hold upon the surface of the bud with its tail-disc and assume an upright attitude (pl. 33, figs. 5, 6, 9; pl. 34, figs. 14, 15). The necessary hold was not always gained in the first attempt, the disc sometimes slipping, and here again the tail-bristles came into play, serving to anchor the animal to the bud and to give a certain amount of prop-like support to its rigid body. The position was not necessarily vertical, but at right angles to the supporting surface, and frequently oblique or even horizontal, and it was remarkable how the vermiform soft-bodied mite would maintain for several minutes an attitude apparently so ill adapted to its structure. All the time its four short legs would be waving wildly in the air. A number of mites standing up in this way bore a remarkable resemblance to diminutive hydras with greatly retracted tentacles.

After indulging in this performance for a period varying from one to five minutes, the mite would generally relax its rigid attitude, bring down its feet to the surface again, and continue its progress by crawling, only to resume its upright position and grotesque waving of legs a little farther on.

This behaviour was highly suggestive of a desire, on the part of the mite, to attach itself to any passing object, and its readiness to do so was easily proved in the most conclusive manner. If touched with a needle-point, it immediately let go its hold on the bud and was carried off on the needle. A camel's-hair brush or a feather applied to an infested bud was found to be swarming with mites on subsequent examination. In nature the most likely carriers of the mites would, of course, be insects or arachnids. Accordingly spiders and insects of various kinds were either induced to run over infested buds or examined after having been observed to come into contact with them spontaneously, and in almost every instance mites were found attached to their bodies or appendages. The fact was recorded of four different species of spider, of the larva of the Currant moth (*Abraxas grossulariata*), of the Currant aphis, of the larva of the two-spotted ladybird (*Coccinella bipunctata*), of the black ant (*Lasius niger*), and of various insects. So uniform was the result that the investigation into the various creatures capable of distributing the mite was presently discontinued, as it was clear that almost any insect might perform that function, though those which wander widely and especially affect Currant bushes would necessarily be most efficient. It is probable that the Currant aphis is specially instrumental in spreading the disease. It crawls slowly along, feeling its way with its antennæ to which the mites readily attach themselves, and the winged individuals would be extremely likely to convey the pest direct to another Currant bush.

With regard to the other sections of the summary similar information has already been given in the Society's JOURNAL,* which was apparently overlooked by the authors, as no mention is made of the work in the bibliography.

The writers further state that if the results thus obtained are trustworthy certain inferences follow with regard to the treatment of the disease. The most important are these :—

"1. Any treatment of the ground under the infested bushes is unnecessary, as the mites do not live in the soil."

"2. Spraying in the early spring is only calculated to destroy mites which would perish in any case.

"3. The only time when spraying would be likely to prove beneficial is at the end of May and the beginning of June, when it is undesirable on account of the blossoms.

"4. The removal of all the new shoots from infested buds at the end of June, if practicable, would apparently clear the plants of the disease.

* Newstead, JOURNAL R.H.S., vol. xxv. Pt. III.

It is at all events important to remember that at this time the pest is reduced to a minimum."

So far, spraying has been found of no avail against this pest. It is hoped, however, that the treatment suggested under 4 may be carried out, but it seems scarcely possible that this method could clear the plants of mites when the complete cutting down of extensive plots of infested bushes has so completely failed even to check the increase of the mites.

R. N.

Branches.

Branching in Tropical Woody Plants. "Ueber die Verzweigung." By M. Raciborski (*Ann. Jard. Bot. Buit.* vol. xvii. p. 1; 31 woodcuts; 1900).—Concerning the growth and branching of woody plants in Java Raciborski has brought together a number of interesting facts, some new and some already known. He discusses in greater detail the periodicity shown in the production of branches, the angular divergence and length of successive branches.

In many respects woody plants growing in the perpetually humid tropical climate display in their growth likenesses to our own trees and shrubs; and in no case is this more marked than in the arrangement of the leaves along the stems, the leaves formed at the commencement and conclusion of the period of growth often being closer together than those formed in the middle of the same period. Other examples show further analogy in the production of foliage-leaves and scale-leaves; but most interesting are the cases described in which the close of the period of growth is heralded by the production of smaller opposite foliage-leaves (not scales) in place of the normal alternate foliage-leaves.

In reference to the periodicity in the production of branches it is pointed out that three types occur: (1) that in which the branches are less numerous than the leaves on the same stem, because some buds remain dormant; (2) that in which the number of branches is equal to the number of branches on the same stem, because one axillary bud shoots out from the axil of every leaf (*e.g.* shoots of coffee and mangosteen); (3) that in which the branches on a stem are more numerous than the leaves, because accessory buds shoot forth from the leaf-axils.

The exceeding regularity of the arrangement of the successive branches in reference to one another and to the leaves is illustrated by various examples. For instance, in the jujube tree on certain shoots one leaf subtending a branch is succeeded by two leaves without axillary branches, upon which follows another leaf with an axillary branch, then two without, and so on. A similar arrangement occurs in the rubiaceous *Randia longispina*, which however has opposite leaves, in that one branch-bearing node is succeeded by two branchless nodes; on the horizontal long shoots foliaged branches are replaced by axillary spines. The climbing *Randia scandens* has decussate leaves, spineless long shoots, and spine-bearing dwarf shoots; on it two successive branch-bearing nodes are regularly succeeded by two branchless nodes.

In the last two sections of the paper it is shown that various types of cymose inflorescence are simulated by racemose monopodial or cymose sympodial systems of vegetative branches. For instance, in a species of

Casuarina with four leaves at each node only one branch arises at the node, and the successive branches form a $\frac{3}{8}$ spiral. In *Strobilanthes Wallichii* the two leaves at each node are unequal, and a branch is emitted solely from the axil of the large leaf; the larger leaves and the branches form racemose "cicinni."

In addition to modes of branching simulating those of inflorescences others of an original kind are found. The buds on the under surface (hypotrophic), on the upper surface (epitrophic), on the flanks (laterotrophic), may be favoured in their development, or combinations of these systems of branching may occur. For example, in a species of *Uncaria* that climbs by means of irritable hooks, which are dwarf branches, the leaves are opposite and decussate; but the hooks arise only in the axils of the leaves on the flanks and lower (outer) face of the long shoots, whereas the leaves on the upper (inner) face subtend no buds. [The eminent utility to the plant of this arrangement is obvious.]

The origin of the tier-like arrangement of the branches in *Eriodendron anfractuosum* (Silk Cotton tree) and other plants is described. As an instructive example of this, and as an example of the familiar grouping of the leaves of tropical woody plants at the tips of the branches, *Alstonia scholaris* serves. In this plant during each period of growth only a single whorl of foliage-leaves is produced, and this falls when the succeeding whorl is completed; and very remarkable is the stated fact that each lateral stem produces only two (rarely one or three) of such whorls of leaves, then ceases to grow, the increase in length being continued by axillary buds, which very commonly sprout forth from the tip of the shoot.

Doubtless many interesting new observations on the branching of hothouse plants in Great Britain could be made by persons interested in the subject.—*P. G.*

Anatomy of Ceratopteris.

Ceratopteris thalictroides, Anatomy of. By Sibille O. Ford, Bathurst Student, Newnham College, Cambridge (*Ann. Bot.* vol. xvi., No. lxi., p. 95; March 1902).—This plant is an annual aquatic Fern, widely spread throughout the tropics and not uncommon in botanic gardens. It grows very readily from spores and also increases freely by means of vegetative buds, found not only on the sterile, but also on the fertile fronds. It is not without claim to beauty. The authoress in this paper, while gathering together the previously known facts, provides an excellent account, from her own observations, illustrating the most important points by means of fifteen figures in a plate and eight illustrations in the text. Interesting facts, apart from the main subject, are sometimes alluded to, as, for instance, that the plant is cooked and eaten as a vegetable by the natives of the Indian Archipelago. Thomae, it appears, had given a description and figure of a petiole containing a single median vascular bundle, while the investigations of the authoress confirm Engler and Prantl, that the number of bundles varies considerably with age and development. Even in small petioles measuring only 2–3 mm. in diameter a fairly regular ring of bundles was found towards the periphery. The single large median bundle described by Thomae is certainly not a constant feature. An interesting circumstance is shown with regard to the stomata, viz. that the guard-cells have a curious beaked projection on the side facing the other guard-cell. As in *Salvinia* and *Azolla* the guard-cells are but feebly cuticularised, but in regard to their shape and beak-shaped projection there is a strong resemblance to those figured and described by Haberlandt in *Lemna*. The lateral roots which arise from the adventitious roots are arranged in two rows, each root arising from a single endodermal cell. According to Poirault these rootlets do not always reach the exterior at once; for, having made their way as far as one of the air spaces of the mother root, they grow for some time obliquely downwards before passing through the cortical parenchyma to the exterior. The authoress, however, did not find any of these in her material. The stem of *Ceratopteris* differs distinctly from that of *Pteris aquilina*, *Trichomanes alatum*, *Osmunda regalis*, and *Angiopteris evecta*, though up to a certain stage they are the same. "In *Ceratopteris* the solid stele divides directly into two, whilst in the Ferns described by Leclerc du Sablon (those just mentioned) a ring of xylem is formed by the appearance of pith or phloëm in the centre of the solid xylem-strand. No such ring can be detected in *Ceratopteris*, for the xylem is always present in a central solid mass, and the parenchymatous cells, which may or may not be scattered irregularly amongst the tracheids, can hardly be regarded in the light of phloëm or medullary tissue." It is interesting to note that the vegetative buds arise, according to Heinricher, from a single epidermal cell. He has shown also that the bulbils of some of the *Polypodiaceæ* (*Asplenium bulbiferum*) arise in the same way. King's view of the origin of the Monocotyledons and Dicotyledons is here quoted in this connection. He pointed out that in the embryo of *Ceratopteris* both the two anterior quadrants form the first leaf, and that from this the stem arises laterally at a later stage. The above groups have in his opinion originated independently of each other from the vascular cryptogams, and he laid stress upon this point which he brings forward as a resemblance between Monocotyledons and the *Filicineæ*. In summarising, the authoress points out that the steles in the stem and leaves are markedly bi-collateral. "In the stem an outer circle of large steles is found, within which small feebly developed steles are scattered irregularly. The stem of the young plant is monostelic, at a later stage the monostele divides directly into two, and further division of the two resulting steles gives rise to the polystelic condition of the older stem." This paper is of special value from the fact that it deals with a Fern necessarily much modified in correlation with its exceptional aquatic habit. It takes a definite place in our rapidly increasing knowledge of special Fern structure.—*R. I. L.*

Circumnutation.

Circumnutation of some Flowering Plants: Comparative Studies. By Elizabeth A. Simons (*Contr. Bot. Lab. Phil.* ii., No. 1, 1898, p. 66).—Experiments undertaken to continue and extend those made by Darwin, on *Convolvulus sepium*, *Phaseolus vulgaris*, *Lonicera brachypoda*, *Wistaria chinensis*, and *Humulus Lupulus*. Undertaken to ascertain whether under a comparatively bright sky and warmer temperature, as contrasted with the atmospheric surroundings of England, circumnutations might be performed more rapidly than in the shortest time limits given by Darwin. Tables devoted to each species record the results, with comparisons of the periods recorded by Darwin. Universally the time was much shorter.—*M. C. C.*

Oak Leaves and Climate.

Climate and Leaf in the genus Quercus. By Wilh. Brenner (*Flora*, vol. xc. 1902, pp. 114–160; 21 woodcuts).—The genus presents leaves of several types: (1) entire, rounded elliptical, or lanceolate; (1*a*) serrate or serrate pungent; (2) filiform-lobate; (3) sinuate-lobate. Different types of texture occur, from papery to leathery, and of anatomical structure: (1) with aquiferous cells occurring in the spongy parenchyma; (2) with great development of the spongy parenchyma; (3) with great development of the epiderm. Branched hairs frequently occur on the underside. The stomates are always simple, and rarely either sunk or prominent. The venation may be: (1) *Camptodromal*, each rib tapering as it runs arching in towards the next; (2) *Craspedodromal*, nearly straight, running into a tooth or lobe; (3) *Brochedodromal*, losing itself by branching before reaching the periphery.

Experiments on seedlings of *Q. sessilis*, *pedunculata*, and *Suber* raised in dry air, in moist air, and under alternating conditions showed an increase of palisade tissue, a tougher, thicker leaf, more branching ribs, and a more entire margin as the dryness increased.

Comparison of leaves of given species show differences in form, venation, and anatomy, as they grow in sun or in shade, and these are repeated in specimens from different stations; notably pungent serrate species tend to become simply serrate, and simply serrate and entire leaves to become lobed when transferred to more temperate stations. A detailed comparison follows between the species represented in Grisebach's geographical regions. The author infers that the results point clearly to the conclusion that the specific variations must be due to the hereditary transmission of characters originally acquired in adaptation to the climatic conditions of growth.—*M. H.*

Oak Parasite.

Conopholis americana, Observations on. By Lucy L. W. Wilson, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii. No. 1, p. 3; 1898; 6 plates). Showing that this plant, resembling *Orobanche*, is parasitic on the Oak, and may form a fringe of growth round the trunk at a distance of ten or more feet; that it is perennial for at least eight or ten years, and first affects young roots, usually starving the portion beyond the point of infection; that the union between parasite and host is a very intimate one, the parasite being developed endogenously within its host, which rises up and encloses it after its germination. Resembles *Balanophora* and *Rafflesia* in this respect, rather than *Orobancheæ*, that the irritant action of the parasite causes swelling up of the host root and great multiplication of its sclerenchyma patches.

Each parasitic tubercle consists of bark, sclerenchyma masses, and some cellular tissue belonging to the host, and cellular tissue and bundle tissue, chiefly developed in flower stalks, of the parasite. Stomata present over the flowering shoots, but absent from the leaves, which latter are brownish-leathery when mature, and devoid of palisade tissue. Cells of leaves and young shoots contain refractive bodies, which may be of a glucoside character. The flowers show a small ovarian nectar gland.

M. C. C.

Effects of Copper on Fungi.

Copper Compounds, Toxic Properties of, with special reference to Bordeaux Mixture. By J. F. Clark (*Bot. Gaz.* xxxiii. No. 1, p. 26; with 7 figs.).—The object was to determine more exactly the concentration of the various copper compounds required to inhibit germination, or to kill the spores of a fairly large and quite representative selection of fungi. Copper is surpassed in toxic properties by several other substances, but its superiority lies in its cheapness, its adherence to foliage, and its solubility by substances of cell sap, especially that of the parasite. The tables show the results of the toxic effect of sulphate of copper on fifteen fungi, with and without additional substances.

With regard to Bordeaux mixture Swingle's suggestion that the good effect resulted from the fact that the fungi themselves, by secretions or excretions, might be able to aid in the solution of the copper has been proved to be correct. This power is particularly noticeable in fungi. An infusion of *Agaricus campestris* and infusions and decoctions of various parasitic fungi dissolve copper hydroxid very quickly, and in sufficient quantity to inhibit the germination of any fungus tested. The rapidity with which fungus spores are thus killed varies with the character of the contents and coverings of the spores.

The host-plant is also active in dissolving the $Cu(OH)_2$. This results from osmosis between the latter when sprayed on the foliage and the juices of the cell sap within the leaf. An important point is that the solution of the copper, whether effected by the host or the fungus spore itself, is possible in the presence of an excess of lime. This excess is apparently somewhat detrimental to the solvent action of the copper, and in this way doubtless serves a very valuable purpose in preventing a too rapid solution. It also protects the $Cu(OH)_2$ from the solvent action of the ammonia, nitrites, and nitrates of the atmosphere. The amount of copper necessary for the destruction of the spores of parasitic fungi is probably not more than one part of soluble metallic copper to 80,000 parts water (dew).

As the host-plant has a greater or less power of dissolving the $Cu(OH)_2$ it may injure them, as in the case of Japanese Plums, Peach, &c., when sprayed with Bordeaux.—*G. H.*

Fungi in Manures.

Coprophilous Fungi, Researches on. By George Massee, F.L.S., and Ernest S. Salmon, F.L.S. (*Ann. Bot.* vol. xv., No. lviii., p. 314).—The authors remark that until recently the systematic side of mycology had received most attention in Britain; a fact which probably accounts for the absence of any specific work on coprophilous or dung-borne fungi, many of which, on account of being the most primitive representatives of their respective groups, are perhaps more interesting from a morphological than a purely systematic standpoint. The absence of any specific work on these Fungi makes this paper extremely valuable. It appears that they do not form a concrete group, and cannot therefore be treated from a comparative point of view; but they do nevertheless present structural features which claim attention. It is shown for *Ascobolus* that wholesale diffusion of the spores by wind is out of the question. They are ejected—in common with those of *Ryparobius*, *Saccobolus*, *Sordaria*, and *Thelebolus*—in an agglutinated mass. It appears that the spores from fungus on a given piece of dung are ejected and alight on surrounding grass, which is then eaten by some animal, and its dung in turn produces more fungi. As a rule the various species are not confined to the dung of any particular animal. Many not unfrequently flourish on the same substratum, and no fewer than seventy-two species have been recorded as growing on the dung of rabbit. The investigations of the authors have shown that a careful study of the fungi growing on the dung of various animals will in all probability add many species to our mycologic flora. New genera and a number of new species are here described.—*R. I. L.*

Coprophilous Fungi, Researches on. Second paper. By George Massee, F.L.S., and Ernest S. Salmon, F.L.S. (*Ann. Bot.* vol. xvi., No. 61, p. 57; March 1902).—In the first paper allusion was made to the generally accepted opinion that the spores of many coprophilous fungi are capable of germination only after having passed through the alimentary canal of an animal. No direct evidence of this had been recorded, save by Janczewski. He had failed to germinate spores of *Ascobolus furfuraceus* on nutrient solutions, but on feeding a rabbit with bread containing the spores found that they had germinated when the dung was deposited. In order to investigate this point further the present authors have carried out the following experiments: "A portion of the intestine of a recently killed rabbit containing dung was tied up at the two ends before being removed from the body. The tied-up portion of the intestine was then removed and placed in a sterilised vessel covered by a bell-jar, the dung being exposed by cutting the skin of the intestine. At the expiration of six days, during which period the bell-jar had not been removed, the dung was covered with a profuse growth of *Pilaira anomala*, Schroet., *Pilobolus crystallinus*, Tode, *Mucor Mucedo*, L., *Chætocladium Jonesii*, Fres., parasitic on the *Mucor*, and *Coprinus niveus*, Pers. A second portion of rabbit-dung obtained under conditions similar to those described above yielded, at the expiration of a fortnight, all the species enumerated above under the first experiment, and, in addition, *Gymnoascus Reessii*, Baran., *Humaria granulata*, Sacc., *Sporormia intermedia*, Wint., and *Sordaria decipiens*, Wint. A third experiment conducted with sheep-dung, obtained directly from the intestine as before, and only removed from it when placed under a bell-jar, yielded *Pilaira anomala*, Schroet., *Pilobolus crystallinus*, Tode, *Chætocladium Jonesii*, Fries., *Ascobolus immersus*, Pers., and a Hymenomycete belonging to the genus *Geotrichum*, Pers. The above experiments conducted with all possible care . . . prove conclusively that the various species of fungi occurring on dung originate from spores swallowed by the animal along with its food." Nearly eighty species are enumerated, and a large proportion are also described. This number includes two new genera and various new species. Several have occurred on the dung of exotic animals obtained through the kindness of Mr. C. Bartlett, of the Zoological Gardens, Regent's Park. Under *Anixiopsis stercoraria*, Hans., it is said that Hansen succeeded in germinating its spores in various media (beerwort, cooked rice, decoction of rabbit-dung) after the spores had been kept for twenty-one years. Two beautiful plates are given, which show that these fungi are exceedingly attractive in the various forms they assume. There are 131 figures, and it is needless to say that the paper is valuable and important on the subject upon which it treats.

R. I. L.

Cork Tissues in Roots.

Cork Tissues in Roots of some Rosaceous Genera. By Martha Bunting, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii., No. 1, p. 54; pl. 10).—Large intercellular spaces are present in the cork region of the herbaceous genera, smaller spaces in the shrubby genera, but absent in the arborescent genera studied.

A marked characteristic of the herbaceous and shrubby genera is the annular arrangement of the cells of the periderm region. In the arborescent specimens the annular arrangement is not a feature. Results obtained from the study of this annular arrangement suggest that each ring corresponds to a year's growth.

In herbaceous and shrubby species a notable feature is the presence of a uniseriate layer of cells in which a lamella of suberin is present in the cell walls; this may or may not be present in the multiseriate layers.

Nuclei have been noted alike in the uniseriate layers on which the cell walls and contents are pigmented and in the multiseriate layers. Observed in some regions in cells of the eighth layer.

Starch is present in cork cells of all the rosaceous genera, smaller quantities in the uniseriate than in the multiseriate layers, and in arborescent than in herbaceous.

Pigment found in all the rosaceous genera investigated.

Results of these investigations upon the periderm indicate a possible evolutionary relation of the groups of *Rosaceæ*.—*M. C. C.*

Cronartium.

Cronartium. On an epidemic of *Cronartium ribicola* (Dietr.) in the Dahlemer Botanic Gardens. By P. Hennings (*Not. König. Bot. Berlin*, vol. iii. (1902), No. 28, p. 172).—The curious uredine *Cronartium* has attained considerable notoriety of late years owing to its having been shown to be a heterœcious form—uredo- and teleuto-spores—of one of the several æcidia known as *Peridermium* on Pines.

Hennings points out that although *Peridermium Strobi* is not known to him in the neighbourhood of Berlin, its alternate form *Cronartium ribicola* is common in epidemic form on various species of *Ribes*, and especially on *R. nigrum*, *R. aureum*, and *R. rubrum*.

After giving evidence that this fungus does not form a perennial mycelium in these Currants, and observing that the *Peridermium* is absent from the Pines near the Dahlemer Garden, he urges the significance for plant pathology of the fact that the *Cronartium* nevertheless attacks, and maintains itself on, various species of *Ribes* of the sections *Ribesia*, *Grossularia*, and *Siphocalyx*, e.g. on *Ribes nigrum* var. *heterophyllum*, *R. bracteosum*, *R. multiflorum*, *R. petræum*, *R. americanum*, *R. rubrum*, *R. floridum*, *R. sanguineum*, *R. Gordonianum*, *R. aureum* var. *leiobotrys*, *R. tenuiflorum*, *R. Grossularia*, *R. Cynobasti*, *R. aciculare*, *R. setosum*, *R. oxycanthoides*, *R. subvestitum*, *R. triste*, *R. rotundifolium*, *R. hirtellum*, *R. divaricatum*, *R. niveum*, *R. irriguum*, *R. triflorum*, *R. prostratum*. On some of these the fungus is observed for the first time.

Hennings regards the explanation of the fact that the *Cronartium* affects the leaves of different species in different degrees as depending on the varying texture, hairiness, &c. of the leaves; but in view of the recent experiments, which show clearly that the relative immunity from, or predisposition to, epidemics of rust-fungi is independent of the anatomical structure of the grass-leaves concerned, it would seem that this view of Hennings needs critical and experimental investigation.

H. M. W.

Ecology.

Ecological Relations of the Vegetation of W. Texas. By W. L. Bray (*Bot. Gaz.* xxxii. No. 2, p. 99; No. 3, p. 195; No. 4, p. 262). This valuable paper, extending through three numbers, contains plans and photos. First dealing with temperatures over the numerous subdivisions of the country, he points out that while in the south, on the coast, it is tropical, in the north, latitude 32°, there are mountains 9,000 feet in height, and in the extreme north, an elevation of 5,000 feet, so that the extremes of a continental climate exist.

With regard to the rainfall, beginning with an average of 30 inches at the 98th meridian, that at the west decreases to 9 inches. The organisation of vegetation with respect to moisture emphasises the zones of precipitation into which the State may be divided, the result being a complete transition from the mesophytic flora on the east to the intensely xerophytic one on the west. Thus *Juglans nigra* is succeeded by *J. rupestris*, and *Juniperus virginiana* by *J. sabinoides*.

The next point is the prevalent direction of wind, the heated plains being an efficient cause of strong breezes. Their significance is (1) in their mechanical impact; (2) in rapid evaporation; (3) in erosion and transportation of soils; (4) in their humidity.

With reference to light its effect in Texas is seen upon the general dwarfing of the vegetation and in the "orchard tree" type of trees. Experiments made with Maize showed that grain sown in Texas produced a much shorter stalk than the same variety in New York. "The sun's rays are almost at the maximum intensity during the vegetative season, and their intensity is undiminished by atmospheric moisture."

Plant Formations.—These are included in (1) grass, (2) woody, (3) succulent, (4) rocks, (5) halophytic. The first is most prominent, as

"Texas is thought of commonly as a land of Grasses"; but it is xerophytic nevertheless, illustrated by the 'Buffalo Grass' (*Bulbilis dactyloides*).

The author then considers the various plains of Texas and the "Grass formations connected with them," with photographic illustrations.

Being xerophytic in all species of Grass "the underground parts are reservoirs of food, and not infrequently of water, protected against the extremes of heat and drought to which the arid soil is subjected." They consist of succulent fibrous roots with a thick zone of mucilaginous or saponaceous tissue; a woody subterranean tuberous caudex; mucilaginous bulbs with impervious coats and deep irregular or fusiform roots with hard flinty coats, according to the species, respectively.

"Mountains and South Plateau Slope" are next considered. With regard to the Grass "A Summary of the Adaptation Features of this Type of Formation" shows: (1) rapid transitions from active to dormant conditions; (2) great resistance to extreme dryness and heat (including fires) while in the dormant stage; (3) equally great recuperative power after extreme treatment; (4) large food storage of fats and sugars in portions which retain vitality during dormant periods; (5) the quality of perfect drying *in situ*, thus not only covering the soil and holding it in place, but also protecting the vital parts.

The woody vegetation is then considered, largely based on moisture relations. First are the xerophytic types, as *Juniperus sabinoides*; the "Shin" Oak (*Quercus breviloba*) forms scrub thickets; and the *Quercus virginiana*, "a dwarfed live Oak," covering lower hill slopes growing on a rubbly soil.

Then follows a consideration of the semi-xerophytic forests of the high mountain summits. Of these *Pinus ponderosa* at 9,000 feet, 50 feet high, is the prevalent species. *Pseudotsuga taxifolia*, *Pinus flexilis*, *P. edulis*, *Juniperus pachyphlœa*, and Oaks of the xerophytic slopes.

In the lower cañons the above dwarfed arborescent species become large trees of regular symmetrical growth.

From the xerophytic and sub-xerophytic the author passes on to the true mesophytic forest and timber formations, as well as the "Chaparral." This is a shrubby formation of warm, temperate, or semi-tropical type, where there is a minimum of rain, a dry air with great winds, much and intense sunshine, and a loose shifting soil destitute of vegetable mould. The vegetation consists of larger species of *Mimosæ* and forty species of *Prosopis*. *Acacia Farnesiana* prevails on the low moister coast prairie clays, and other species of Acacia are prevalent in other districts.

After considering different types of Chaparral the author discusses "Formations of Succulent on Water-storage Vegetation." The contrast between this and the preceding formations is that whereas those types had adjusted themselves to xerophytic conditions by retaining the least amount of sap-bearing tissue, this type has gone exactly to the opposite extreme. This type includes the Cactus, the Yucca, and the Agave vegetation, together with such ephemeral plants as *Sedum*, *Talinum*, and *Portulaca*.

Next follows a consideration of the rock vegetation of cryptogamous plants. The elements consist of a species of *Nostoc*, a mat-forming

Scytonema, and several matted leathery lichens. Besides these there are xerophytic forms: *Selaginella lepidophylla* (a "resurrection plant") and *S. rupestris* are abundant on granite. Lastly xerophytic Mosses and Liverworts occur.

Of the halophytic vegetation the following are characteristic plants:—*Sporobolus airoides, Sucæda suffruticosa,* and *S. depressa, Spirostachys occidentalis, Larrea mexicana,* and *Frankenia Jamesii.*

The author concludes by considering the changes in prevalent formations due to agencies of civilisation or other causes.—*G. H.*

Effect of Electric Light.

Electro-horticulture. By F. W. Rane (*Bull.* 37, *West Virginia Agr. Exp. Stn.* vol. iv., No. 1, p. 3; 1894).—In 1892 a series of experiments was inaugurated for testing the relations of *incandescent* electric light to plants grown in the greenhouse. Previous experiments had all been with the use of the *arc* lamp (*Cornell Exp. Stn. Bull.* Nos. 30, 42, and 58). [For effect of gaslight see p. 264.]

After enumerating several objections to the arc lamp, the author observes that the essential difference concerned in the present paper is that in the arc light chemical rays predominate, while in the incandescent light these are only slightly present.

Professor Bailey found with the arc that the nearer the plant grew to the naked light, the greater was the acceleration. The plants "ran to seed" before edible leaves were formed, which were smaller and curled. An opal globe secured partially better results. Still better results were obtained by placing the arc light with a globe *outside* the glasshouse.

In the experiments with incandescent lights, begun in 1892, in each instance the light was suspended from the peak of the house and hung $2\frac{1}{2}$ feet above the bed. For seven weeks a 16-candle power was used; subsequently a rosette of seven such lights was substituted, *i.e.* equal to 112-candle power. In one house (A) the single light was used continually every night; in the other (B) the plants were treated normally with regard to Lettuces. The average weights of two varieties were in (A) 2 and 1·8 oz.; in (B) 1·8 and 1·5 respectively.

The result of using the seven lights together (*i.e.* 112-candle power instead of 16). The heights of three varieties were as follows: (A) 13, 10, 9 inches; (B) 10, 6, 7 inches. All the electric light Lettuce was thought to be much more tender than in the other house. The weight of each of the varieties was all in favour of the electric-lighted plants, viz. one-eighth, one-fourth, one-sixth better respectively.

Spinach soon showed the effects as follows: After growing in the two houses (A) and (B) as before, from February 28 to March 21, from seed, in (A) $7\frac{1}{2}$ inches, 11 inches, and 9 inches, in three beds. In (B) 4 inches, 4 inches, in two beds. A photograph shows the relative heights taken on April 15 as in the proportions of 1 ft. 3 in., 3 ft., 1 ft. $6\frac{1}{2}$ in. in house (A).

Cauliflowers occupying the same beds as the Spinach had the following differences in size: (A) 11 inches, 19 inches, 15 inches; (B) 10 inches, 10 inches. But the author observes, although its growth was taller in the light, it did not produce as fine heads as that in the dark house and shaded portions of the light house.

With regard to Beets in the light house, greater individual weight was secured in a few instances ; but in the dark house a greater number of average marketable Beets were found. They are not a profitable crop, as they take a considerable time to mature.

In the season 1893–4 other plants were tried, as Peas, Beans, Spinach, Endive, Coleus cuttings, Geranium, Strobilanthes, Echeveria, Heliotrope, Marguerite, Daisy, and Begonia.

Peas and Beans germinated from three to four days earlier in the dark house than in the light, but it was found that the soil was moister, not being level, though Beans bloomed four days earlier in the dark house, in six more days the Beans in the dark were bearing freely, while they were blossoming freely in light, but with no marketable pods. In five more days the Beans in the light house began to bear.

The Beans under the light were not able to overtake those in the dark house. The difference in *moisture*, therefore, had more effect upon their growth than the difference in the light.

The Peas, on the other hand, of the light house, although from three to four days behind in starting, overtook those in the dark and blossomed at the same time. They also gained on those in the dark and produced, on the whole, larger pods.

The effect on Spinach, Endive, and Lettuce was to make them run to seed quickly ; the plants in the dark house made normal and solid growth. The question of watering is even more important from an economic standpoint than that of lighting by electricity; but when both are favourable an ideal condition is approached.

Coleus cuttings in the dark house were taller and produced better plants. Their heights were as seven to four ; they enjoy a moist soil.

Of potted plants Heliotrope blossomed first under light on December 13, and not until January 3 in the dark house. Geranium and others all behaved similarly.

[See *Elektro-Kultur, durch elektrische Behandlung,—Auf mehrjähriger Versuche dargestellt*, von Dr. Selim Lemström, Professor der Physik an der Universität Helsingfors (*Gard. Chron.*, July 26, 1902, p. 49).]—*G. H.*

Effect of Ether.

Etherisation of Plants. Anon. (*Gard. Chron.* No. 792, p. 144, 1/3/1902).—In an article on the use of the electric light, and of ether in forcing plants, some account is given of the use of ether in forcing plants into flower prematurely, and the various plants with which experiments have been made and the result of the experiments ; it is claimed that plants that have been etherised can be forced at a lower temperature than others, and that various flowering shrubs can be brought into blossom some eight or ten days sooner than would otherwise have been the case. It is admitted that there are certain difficulties and inconveniences in this method of treatment, which no doubt in time will be overcome.

G. S. S.

Biology of Erysipheæ.

Erysipheæ, Researches on the Biology of. By F. W. Neger (*Flora*, xc. 1902, pp. 221–272 ; 27 woodcuts).—This is in continuation of the author's previous paper (*ibid.* lxxxviii. 1901); see JOURNAL R.H.S. Vol. XXVI. p. 890).

Germination of the Conidia ("*Oidium*").—This is favoured by light, and the germ-hyphæ are heliotropic and grow faster in the light. The behaviour of the conidia of several species germinating on various plants is followed and described. Conidia of "*Erysiphe Cichoracearum*," of the same habit, but found on different species, were again sown on a number of species. Infection failed in most cases of genera, or even species of the same genus, other than the original host. Thus conidia from *Artemisia vulgaris* failed to infect *Senecio*, *Hieracium*, *Lactuca*, *Sonchus*, and even *Artemisia Absinthium*. The *Erysiphe* on *Senecio vulgaris* failed to infect *Hieracium*, and only infected *Lactuca muralis* in one spot of many dusted with the spores. Thus there would seem to be a physiological racial character, to which the morphology gives no clue, just as Ward has shown for *Uredineæ*. The conidia are but short-lived, and will not survive the winter. Infection from one season to the next can only be effected by the ascospores. It is suggested that these have not the same specialisation as the conidia, but that the host which is directly infested by the ascospore impresses its proper physiological character on the conidia throughout the whole conidial cycle. Thus Erikson showed that the uredospores (*Puccinia coronata*) developed on the Oat will not affect the Foxtail, and *vice versa*. But infecting the Buckthorn with the teleutospores from the Foxtail, he obtained the *Æcidium*, whose spores would now infect the Oat, though this does not hold good for all species of *Puccinia*.

Sphærotheca Humuli sends haustoria only into the epidermic cells of the Hop, which enlarge enormously. *Uncinula Salicis* sends merely fine haustoria into the epiderm of the Willow, but large ones are formed by their penetration into the underlying palisade-cells.

The conidia of *Phyllactinia* are not abstricted singly, but form true *Oidium*-chains.

Uncinula Aceris produces two forms of conidia: (1) "Normal" large, rounded, easily separating, germinating readily; (2) "starved" minute, oblong, adhering in chains, not germinating.—*M. H.*

FIGS AND CAPRIFICATION.

The Fig: its History, Culture, and Curing. By G. Eisen, Ph. D. (*Washington Gov. Pr. Off.*, 1901. Illustrated by photos and cuts).—This elaborate work consists of 20 chapters. After dealing with the name and derivation, Fig industry and botany of the Fig, the culture in various foreign countries is described as follows:—Smyrna, Greece, N. Africa, Italy, Portugal, France, England, Spain, Southern States of N. America, Mexico, California.

Chapter IV., consisting of pp. 74–120, deals with caprification, of which an abridged account is appended.

The concluding chapters are concerned with the technical details of cultivation, as climatic conditions, propagation, planting a Fig orchard, pruning, irrigation, diseases, and insect enemies. Then follow the drying and curing of Figs, as well as packing and shipping fresh Figs.

Chapter XIV. deals with the terms used for describing Figs.

Chapter XV. contains a catalogue and description of Figs.

Chapter XVI. treats of the chemical analysis of soils and Figs ; while the remaining four chapters contain statistics of the production and importation of Figs, household recipes, bibliography, and tables of temperature, precipitation, and humidity in the principal Fig regions.

Caprification.—The fifth chapter, containing 58 pages, is devoted to caprification as now practised in California with Smyrna Figs only, all other edible kinds, some 100 in number, not requiring it; for although the receptacles contain female flowers in plenty, if not always exclusively so, they mature the fruits without setting any seed at all, as pipless Oranges, seedless Cucumbers, Bananas, &c.

Some botanists maintain that caprification, or the fertilisation of the edible Fig with the pollen of the wild 'Caprifig' by means of a minute wasp (*Blastophaga grassorum*), is unnecessary, they having experimented with Figs which do not require it. But experiments prove that for the varieties from Smyrna it is essential. There are two varieties of the latter at least, recognised as 'Bulletin' and 'Lobfig.'

The Caprifig contains some 600 wasps, and one tree will be sufficient for 50 Smyrna trees.

They should be grown elsewhere than in the orchard and in more shady places.

To secure a crop of wasps one to five good Caprifigs are suspended at the right period in a Caprifig tree to start a colony. There are three annual crops called 'Profici' in March or April; the 'Mammoni' or summer crops and the 'Mamme' or winter crop.

As these may not be always respectively quite ready with the Blastophaga, it is desirable to have different varieties of the Caprifig.

The crops of the Edible Fig are also three annually, corresponding to those of the Caprifig ; but some trees bear one or two crops only.

Shortly before the Fig tree begins to leaf out in the spring small button-like Figs push out from the last year's wood from the axils of the *last* year's fallen leaves. They mature in May or June. This is the first crop, known as brebas (or St. John's Figs in Malta, as they ripen about St. John Baptist's day, June 24).

The second crop arises from the axils of the *present* year's leaves. These form the main crop, ripening in August.

The third crop forms in August, ripening in the winter; but it is not greatly distinct from the second crop, both developing from the axils of the leaves of the season. Sometimes the last Figs of the third crop do not fall in the autumn, but in the next spring, just as the first crop.

In the Caprifig the three crops correspond to those of the Edible Fig. Like the Edible Fig trees they may bear one or two only of the three crops.

At Niles, California, the crops of the Caprifig succeed each other as follows: At the fall many Figs as large as Walnuts are situated at the ends of the branches. They first appeared in July and were caprificated in September. This is *the third* crop (Mamme). In March following they became mature, and the wasps escaping from them enter *the first* new crop (Profici).

The first crop (Profici) began to appear in the previous December, and in March were caprificated by the wasps from the Mamme.

In June and July they are ready wherewith to caprificate the *second* crop (Mammoni).

The second crop began to set in June and became mature in August. It is the only crop which does not pass the winter. The purpose of this second crop is to furnish wasps for the third crop (Mamme) and to furnish seeds.

In the best Smyrna varieties the various crops of the Caprifig are confined to distinct trees known by the following names.

The trees which bear the winter crop called "boghadhes" are known as "orginos boghadhes"; while those trees which bear the spring crop, or "ashmadhes," are known as "orginos ashmadhes."

The Caprifigs require the presence of the Blastophaga wasps to enable them to bear seeds; but in order to produce ripe pollen-bearing Figs it seems that the wasps are not necessary. Hence a Caprifig tree may possess two kinds of figs, viz. "polliniferous" and "insectiferous." Before caprification the Figs are all alike; but a difference begins to appear after the entry of the wasps. Their presence affects the branches as well as the Figs by inciting them to grow more vigorously, and even the leaves are larger. A single caprificated or insectiferous Fig will give a character to the whole branch on which it grows. The polliniferous Figs remain smaller and more oblong and soon assume a yellow colour and fall off, whereas the insectiferous Fig grows large and turbinate and does not fall. These are the only Figs useful for caprification. They carry three kinds of flowers, male, female, and gall flowers, all in the same fruit. There exists also a Caprifig tree which bears Mammoni which possesses only pistillate and gall flowers, but it is comparatively rare.

Through cultivation and selection numerous types of the Caprifig tree have been originated. Thus in California there are about a dozen varieties.

The importance of growing several varieties of Caprifigs in one orchard cannot be over-estimated, as it will certainly be found that one variety which will be suitable in one place will be a failure in another; besides, some bear only two of the three necessary crops. Home-raised seedlings should therefore be resorted to, as they are likely to produce varieties suitable to the locality where they are to be grown. The principal feature of a good Caprifig orchard is that there should always be Figs of a proper size to receive the wasps wherever they hatch out.

With regard to the structure of Figs, the cultivated Figs, as a rule, contain female flowers only, which, not being pollinated, contain no ovules [on ripening, the outer part of the carpel deliquesces into mucilage, leaving a seed-like inner shell, which contains the ovule-skin only.—G. H.]

In the Caprifig there are male, female, and gall flowers. The first are always around the orifice, the others being mixed below them.

The Mamme or winter crop, as well as the Profici, contain male and gall flowers only. The Mammoni alone possessed both female and gall flowers.

The male flower has from three to five petals, no corolla, with three or more stamens with polliniferous anthers.

In the first crop the stamens attain their full development in June or July, or about two months after the maturity of the stigmas of the female flowers, which therefore cannot be pollinated by the stamens in the same Fig. Their function is to pollinate the female flowers of the succeeding crop. The pollen of the Profici is very abundant and of a pale yellow colour.

The Edible Fig does not, as a rule, possess any male flowers at all.

The anthers in the male flowers are not always properly developed. This is especially the case in seedlings raised from Smyrna Fig seeds which originated from a pollination with the Caprifig. Such seedlings do not all possess male flowers; those that do are more or less similar to the Caprifig flowers, the anthers frequently being as well developed as in the real Wild Fig.

Female flowers and fertile seeds occur only in the second crop or Mammoni, but very rarely is there more than one or two seeds to a Fig.

The female flower has from three to five sepals, no corolla or stamens. The ovary is ovoid surmounted by a style with two stigmas, one being longer than the other.

When the male flowers of the Profici are mature, female flowers of the second crop of the Smyrna Figs are prepared to receive the pollen. This is in June or July according to climatic conditions.

The gall flowers in all Caprifigs are female flowers of which the pistil is modified in anticipation of the reception of the egg of the wasp. They never produce seed. The sepals are smaller and more unequal in size, the ovary is more globular in shape, the stigma funnel-shaped, and the stigmatic surfaces rudimentary.

On the other hand the cause of the inability of the wasp to breed in common Edible Figs is due to the fact that they contain only flowers having pistils unsuitable as breeding-places for the wasps, not being modified as of gall flowers, and being apparently degenerate in form.

With regard to male flowers in Edible Figs it is the rule that there are none, female flowers occupying the whole of the interior surface.

A variety which regularly produces seed is 'Croisie,' cultivated at Croisie on the coast of Brittany.

A somewhat similar Fig is cultivated at Cherbourg, but the male flowers are degenerated. They are believed to be highly developed Caprifigs which have become edible.

One instance only is known of male flowers in an Edible Fig in California. It occurred in a box of Figs from Cordelia, in Solano County, of a large yellow variety. The zone of male flowers produced an abundance of pollen. It is thought to be possibly identical with the Croisie.

Seedlings have been raised from Smyrna Figs, which must be considered as improved Caprifigs—*i.e.* improved by being raised from seed of Smyrna Figs.

Edible Figs possessing male flowers are inferior from a horticultural point of view.

The Erinocyce Fig was first described by Pontedera. It is characterised as standing halfway between the Caprifig and the Edible Fig. Its first crop possesses male flowers as well as gall flowers with wasps. This crop is not edible. The second crop contains perfect female flowers. Solms-Laubach states that this second crop or Mammoni possessed both female flowers with perfect embryos and gall flowers with wasps.

[One of the Figs grown at the gardens of the Royal Horticultural Society at Chiswick is called 'Pingo de Mel.' It contains male flowers, but there is no pollen. The remainder are, in *shape*, all gall flowers, but of course without the Blastophaga. The origin of this Fig has not at present been traced beyond its having come from Portugal.—*G. H.*]

With the exception of the Smyrna Figs all other cultivated sorts bear no seeds. Being entirely female and never caprificated they mature without them, like certain Cucumbers, Bananas, Pears, Oranges, &c. The Smyrna Figs, however, cannot ripen without also containing fertile seeds. They contain no male flowers ; hence caprification is essential.

The Smyrna Figs were first imported into California in 1880, but for ten years not a single ripe fruit was borne. They were tried in various districts, bore abundance of Figs with flowers, but they invariably fell.

Experimenting in 1882, by introducing pollen when the female flowers were receptive, numerous fully mature and perfect Smyrna Figs were obtained. In 1900 several thousand Smyrna Fig trees were caprificated in the Roeding Orchard, near Fresno. The result was that some six tons of dried Figs of the true Smyrna varieties were produced. In 1901 30,000 Caprifigs were used. There exist now in California some five or six different varieties of the genuine Smyrna Figs and some nineteen different kinds of Caprifigs.

The remainder of this chapter on caprification is devoted to a description, with figures, of the Blastophaga, and an account of its life-history, practical caprification, and its effects.

A few words on the importance of seeds in dried Figs are added, showing the superiority in flavour of Figs in which the oily embryo has been developed, as this imparts an aromatic and nutty taste. It is only during the process of drying that the aromatic taste of the seed is permeated through the pulp of the Fig. Smyrna Figs when dried are therefore more highly flavoured than any other Figs.

Paragraphs follow upon the kinds of Figs which should be caprificated, where it is practised, on the different species of Blastophaga in different species of Figs.

This fourth chapter then concludes with historical notes on caprification.—*G. H.* (See also p. 309.)

Fungicides and Insecticides.

Fungicides and Insecticides. Various authors (*Mass. U.S.A. Hatch Exp. Sta., Bull.* No. 80, pp. 1–15; 1902).—The following mixtures are selected from a number of others the preparation of which may be of some service to English horticulturists. It should be borne in mind, however, that fungicides and insecticides may vary in their effect under certain climatic conditions. It is important, therefore, that all the formulas or mixtures recommended by other countries should be tested on a small scale before making wholesale applications.

Fungicides.

Bordeaux Mixture.

4 lb. copper sulphate (blue vitriol).
4 lb. lime (unslaked).
25–50 gallons water.

Dissolve the copper in hot or cold water, using a wooden or earthen vessel. Slake the lime in a tub, adding the water cautiously and only in sufficient amount to insure thorough slaking. After thoroughly slaking, more water can be added and stirred in until it has the consistency of thick cream. When both are cold pour the lime into the diluted copper solution of required strength, straining it through a fine-mesh sieve or a gunny cloth, and thoroughly mix.

The standard mixtures are :

(*a*) 25 gallons (full-strength solution, or 4-4-25 formula).
(*b*) 50 gallons (half-strength mixture, or 4-4-50 formula).

It is then ready for use. Considerable trouble has frequently been experienced in preparing the Bordeaux mixture. Care should be taken that the lime is of good quality, and well burned, and has not been air-slaked. Where small amounts of lime are slaked it is advisable to use hot water. The lime should not be allowed to become dry in slaking, neither should it become entirely submerged in water. Lime slakes best when supplied with just enough water to develop a large amount of heat, which renders the process active. If the amount of lime is insufficient, there is a danger of burning tender foliage. In order to obviate that, the mixture can be tested with a knife-blade or with ferrocyanide of potassium (1 oz. to 5 or 6 oz. of water). If the amount of lime is insufficient, copper will be deposited on the knife-blade, while a deep brownish-red colour will be imparted to the mixture when ferrocyanide of potassium is added. Lime should be added until neither reaction occurs. A slight excess of lime, however, is desirable.

The Bordeaux mixture is best when first prepared. Stock solutions of lime and copper can be made and mixed when required.

The following, known as the 6-4-50 formula, is in very general use :—

6 lb. copper sulphate.
4 lb. lime.
50 gallons water.

Bordeaux Mixture for Peach Foliage.

The Bordeaux mixture as ordinarily applied frequently injures to some extent the foliage of the Peach &c., causing a shot-hole effect on the leaves. This injurious effect has been shown to be largely obviated by the use of the following :

3 lb. copper sulphate.
6 lb. lime.
50 gallons water.

This is known as the 3-6-50 formula. Some experimenters have also recommended the following for Peach foliage :

(*a*) 2-2-50 formula (Cornell Agr. Exp. Sta., Bull. 180).
(*b*) 3-9-50 formula.

The latter contains three times as much lime as copper sulphate.

Copper Sulphate Solution.

(Strong Solution.)

1 lb. copper sulphate.
25 gallons water.

Applied only on trees without foliage.

Copper Sulphate Solution.

(Weak Solution.)

2–4 oz. copper sulphate.
50 gallons water.

For trees in foliage.

Potassium Sulphide.

3 oz. potassium sulphide.
10 gallons water.

Valuable for Goosebery mildews &c.

Potassium Permanganate.

1 part potassium permanganate.
2 parts soap.
100 parts water.

Recommended in France for black rot and mildew of the Grape &c.

Iron Sulphate and Sulphuric Acid.

Water (hot), 100 parts.
Iron sulphate, as much as will dissolve.
Sulphuric acid, 1 part.

Prepare solution before using. Add the acid to the crystals and then pour on the water. Valuable for treatment of dormant Grape vines affected with anthracnose, application being made with sponge or brush.

Corrosive Sublimate.

(For Potato Scab.)

2 oz. corrosive sublimate.
15 gallons water.

Dissolve the corrosive sublimate in two gallons of hot water, then dilute the 15 gallons, allowing the same to stand five or six hours, during which time thoroughly agitate the solution several times. Place the seed Potatos in a sack and immerse in the solution $1\frac{1}{2}$ hour. Corrosive sublimate is very poisonous; consequently care should be taken in handling it; nor should the treated Potatos be eaten by stock. The solution should not be made in metallic vessels.

Formalin.

(For Potato Scab.)

3 oz. formalin (40 per cent. solution).
15 gallons water.

Used for the same purpose as corrosive sublimate, but not poisonous. Immerse the seed Potatos for two hours.

Insecticides.

Resin Lime Mixture.

5 lb. pulverised resin.
1 lb. concentrated lye.
1 pint fish or other animal oil.
5 gallons water.

Place the oil, resin, and one gallon of hot water in an iron kettle and heat till the resin softens, then add the lye and stir thoroughly ; now add four gallons of hot water and boil till a little will mix with cold water and give a clear amber-coloured liquid ; add water to make up five gallons. Keep this as a stock solution. For use take—

1 gallon stock solution.
16 gallons water.
3 gallons milk of lime.
$\frac{1}{4}$ lb. Paris green.

The object of this preparation is to obtain an adhesive material which will cause the poison to adhere to smooth leaves. It has been highly recommended by the New York State (Geneva) Experimental Station.

Lime, Salt, and Sulphur.

(*Oregon Formula.*)

50 lb. unslaked lime.
50 lb. flowers of sulphur.
50 lb. common salt.

Slake the lime in enough water to do it thoroughly ; add the sulphur and boil for an hour at least, adding water if necessary. Then add the salt and boil 15 minutes more. Add water to make 150 gallons and spray hot through a coarse nozzle.

Lime, Salt, and Sulphur.

(*Marlatt's Formula.*)

30 lb. unslaked lime.
30 lb. sulphur.
15 lb. salt.
60 gallons water.

Boil with steam for four hours and apply hot.

Insect Powder.

(*Pyrethrum.*)

Mix with half its bulk of flour and keep it in a tight can for 24 hours ; then dust over the plants, or—

100 grains insect powder.
2 gallons water.
Mix together and spray.

Ivory Soap.

1 bar ivory soap (10-cent size).
15 gallons water.

Apply warm, as it thickens on cooling. Recommended for rose mildew, red spider, plant lice, &c.—*R. N.*

Carbon Bisulphide Insecticides.

Insecticide, Carbon Bisulphide as an. By W. E. Hinds (*U.S.A. Dept. Agr., Far. Bull.* No. 145; pp. 1-28; 1902).—This paper gives the principal facts concerning the use and effect of carbon bisulphide, together with an historical account of its uses in economic zoology. The chemical side of the subject is treated of in an appendix setting forth the properties and behaviour of the liquid under various conditions.

Carbon bisulphide is a colourless watery liquid formed by the union of two elementary particles of sulphur with one of carbon (charcoal). Its chemical symbol is CS_2. It is made on a large scale by passing the fumes of burning sulphur over red-hot charcoal. The resulting vapours are condensed to a liquid form by cooling, and the impurities are removed therefrom. It is very volatile. The rapidity of evaporation depends mainly upon the area of the evaporating surface and the temperature of the liquid and the air. When perfectly pure the liquid has an acrid taste, with an odour somewhat resembling ether or chloroform. The ordinary commercial article has, however, a rank fœtid odour that is extremely offensive, and is liable to stain articles treated with it. The vapour is 2·63 times as heavy as the air, and although it diffuses quite rapidly it tends to work downwards more strongly than upwards; it would therefore be more dense at the lower levels. Both the vapour and the solution are powerful disinfectants, and meats are said to keep in an atmosphere of it for months. The liquid boils at a temperature of 115° F.

Effects of Inhalation of the Vapour.

The gas is highly poisonous, producing giddiness, vomiting, congestion, coma, and finally death. These, of course, are its extreme effects. The operator should not, however, enter a room which is heavily charged with the vapour.

Carbon bisulphide is applicable only where the vapour can be more or less confined, and is used chiefly for root-feeding insects, and for insects affecting stored grain and wearing apparel. For use against the *Phylloxera* and other root-feeding insects the following information is given:—

Diffusion of the Vapour in the Soil.—Upon being introduced into the soil at some depth below the surface the liquid evaporates as it does in the open air, only much more slowly. The vapour tends to diffuse through all the air spaces of the soil. It thus produces an atmosphere which is fatal to all insects living within its reach. The rapidity of evaporation, the extent of diffusion, and the persistence of the vapour in the soil vary widely in soils of varying characters and conditions, so no one rule of application can be employed in all cases, and it thus becomes necessary to understand the influence of various factors that proper allowance may be made for them and the destruction of the insects attained without injuring the plants.

Moisture.—Carbon bisulphide evaporates most rapidly in a warm, dry, sandy soil, and the persistence of the vapour is also shortest in such soil. In fact it diffuses so rapidly that most insects will survive an ordinary dose; and if the dose is increased so as to kill the insects, it is likely to kill the vines as well. The treatment cannot be successfully applied on such a soil in its dry condition. On the other hand, diffusion is slowest in heavy wet clay soil; and when such soil is saturated with water it is almost entirely prevented. Moisture lowers the temperature and decreases the permeability of the soil; it also prevents the evaporation of the liquid, and thus retards diffusion. Between the two extremes there is a medium condition of moisture which is most favourable for treatment.

Character of Soil.—Sandy soil permits an even but too rapid diffusion of the vapour. Rocky soils are not of even texture, and naturally the vapours follow the lines of least resistance. Heavy clay soils, when very dry, are usually much broken by cracks and fissures, which may run from the surface to a considerable depth. Through such fissures the vapour escapes rapidly without permeating the soil to any extent, and its insecticidal value is therefore slight. But when such a soil is well moistened it is even in texture and very favourable to treatment.

Depth of Soil.—The depth of the soil is an important factor in determining how much carbon bisulphide must be used for a given area. If the soil is shallow and the subsoil very dense and impervious, it is evident that much less liquid will be required to produce a death atmosphere than will be needed in a soil of much greater depth. In soils of the same character and condition the amount needed will be proportional to the permeable depth of the soil. In heavy, compact soils increase the number of injections and diminish the dose; in light, deep, permeable soils decrease the number of holes and increase the dose.

Amount to use.—In field experiments with the Grape, using plain carbon bisulphide in "quite fresh" soil, vines were found to withstand 105 c.c. of carbon bisulphide (4·4 oz. nearly), divided equally among three holes placed about 16 inches from the base of the vine and at a depth of about 20 inches; but 180 c.c. ($7\frac{1}{2}$ oz.) proved fatal to the vines. In a warmer, drier, more shallow soil a dose of 90 c.c. per vine, similarly placed, proved fatal. After considerable rain, when the ground was quite wet, a vine withstood 260 c.c. of carbon bisulphide, and some vines are said to have withstood 400 c.c.

Conditions favourable to Treatment.—The treatment should never be applied for some time after ploughing or cultivating, as a firm, compact, moist surface is much more favourable to the retention of the vapour. For the same reason about fifteen days should be allowed after treatment before cultivation is resumed. If the soil is either very wet or very dry, treatment should be withheld. To be in the most favourable condition for treatment the soil should be quite moist and moderately permeable, with a firm even surface, well compacted by rain, and having a depth of at least eight inches.

Extent of Diffusion.—The extent of diffusion of the vapour determines the distance apart at which the injections must be made in order to reach all parts of the soil evenly and effectively. This varies considerably with the amount of the dose, the temperature and humidity of the soil, and other conditions. It has been found more satisfactory to employ small and frequent doses than a few large ones. A dose of five or six grams ($\frac{1}{5}$ to $\frac{1}{4}$ oz.) is believed to be thoroughly effective through a radius of from 12 to 20 inches, though it may penetrate much farther than that. The general rule is to make three injections per square metre ($1\frac{1}{5}$ square yards nearly) in light soils, and four injections in heavy soils. The arrangement of the holes must necessarily vary more or less, according to the system of planting. They should be at regular intervals, however, so as to cover the ground evenly, and never nearer than a foot to the base of the vine. It must be remembered that to be effective all the ground must be treated, and not merely those places where the presence of the enemy is proven by its injuries.

Repeated Treatment.—On account of the liability of injuring the vines it has been found best to make the treatment in two small applications, separated by an interval of from six to ten days. This decreases the density of the vapour, but continues its action for a much longer time. It removes the danger of injuring the vines, and gives even better results upon the insects than would be obtained by one large dose. The total amount of carbon bisulphide to be used should be divided into as many equal parts as there are injections to be made. The holes for the second treatment should be intermediate between those of the first.

Depth of the Holes.—The depth of the holes depends somewhat upon the depth and permeability of the soil, the average depth being about a foot. A depth of 16 inches is desirable upon deep or very permeable soil.

Season of Application.—Treatment may be applied at any season of the year; but as it is followed by a slight check in growth it should not be applied either at the flowering or fruiting season, as the check would injure the crop most at those seasons. The injury to the vines results from the killing of the tender fibrous feeding roots. It would therefore be better to apply the treatment before these roots have started much—that is, early in spring—or after they have become hardened—that is, after fruitage in the fall. The condition of the soil usually favours the spring treatment, and the condition of the insect is said to make it more susceptible at that time. Spring, therefore, appears to be the most favourable season.

Amount to use per Acre.—Two entirely different objects may be had in treatment. First, to stamp out entirely and surely all traces of the pest upon its first appearance in a vineyard, or when desiring to reset, regardless of the life of the vines; second, to control the pest in such a way as to prevent its multiplication while continuing the culture of the vineyard. The first is called the extinction treatment; the second, cultural treatment. The method of application is the same in each case, but the amount of the dose differs. To secure extinction it is usual to apply about 300 grams (10 oz. nearly) per vine, using 150 grams in each of two applications ten or twelve days apart. This is said to kill ninety-nine out of every hundred vines. In cultural treatment the amount of the liquid to be used varies according to the conditions previously described, from 140 to 265 lb. per acre.

Instruments for Application.—One of the principal difficulties in the first use of carbon bisulphide was to force the vapours to the desired depth. When first used below the surface it was poured into holes formed by driving an iron bar with a maul. The demand for a more convenient, accurate, and rapid working instrument was soon met by the invention of the pal-injector by M. Gastine. This instrument was later improved by M. Vermorel, and it fills the need admirably. The carbon bisulphide is placed in a large chamber, from which an outlet leads down through a series of valves, so adjusted that the amount of each discharge can be exactly regulated as desired, and open near the tip of a pointed bar. The instrument is forced into the ground by the handle and the pressure of the foot upon a spur to a depth of about a foot; the central plunger is then pressed down and the desired amount of liquid is discharged; the instrument is withdrawn and the hole closed with the foot, or, as it is usual in extensive work, another workman follows with a rammer, with which the holes are closed and the soil at the same time is firmly compacted. It is said that two men working together in this way can make between 2,000 and 3,000 injections per day. One acre will require on the average from 10,000 to 12,000 holes.

Many of the foregoing statements regarding the treatment of Phylloxera apply equally well to the treatment of other insects living under ground.

Treatment for Root Maggots.—Carbon bisulphide has been more or less successfully used for the Cabbage-root maggot ever since Professor A. J. Cook experimented with it with such success that he began to recommend it. There is no doubt that its efficacy varies considerably with the nature of the soil, and there is equally little doubt that many of the failures which have been reported in its use have been due very largely to improper or too tardy application. If the liquid comes in contact with the roots, it will undoubtedly prove fatal to the plant, but a considerable amount of the vapour will do no harm. If the remedy is delayed until the plants are badly wilted, it is very likely they will not recover, even though the enemy be killed, but their death cannot fairly be attributed to the carbon bisulphide. Some growers who have tested it thoroughly state that it will work on clay or sand without injuring the plants. It has been found fatal to the pupæ as well as the larvæ. Mr. M. V. Slingerland, of the Cornell University Agricultural Experiment Station, investigated the subject in 1894,* and his "experiments demonstrated that when properly applied the substance was sure death to the insects and did not injure the plants."

Whatever the instrument used, the treatment should be made in practically the same way. The hole should start three or four inches from the stem of the plant and run down obliquely to a point a little below the roots, where the liquid is deposited. The hole is then closed with earth and compacted by pressure of the foot. The dose required varies from a teaspoonful for large plants (four teaspoonfuls = one tablespoonful = $\frac{1}{2}$ fluid ounce approximately). One injection will be sufficient if made in time, but if delayed too long nothing can save the plants. The conditions of the soil noted under Phylloxera treatment will have practically the same influence in this case.

Destruction of Ants.

Carbon bisulphide is the best remedy known for the destruction of ants, which are frequently great nuisances to farmers and gardeners.

* See Bull. No. 78, Cornell University Experiment Station.

With a little careful observation most of the common house ants, except the little red house ants, can usually be traced to their homes out of doors. The only effectual way of stopping the annoyance or injury from these insects is to destroy the queens living in the nests which they never leave.

Method of Treatment.—The treatment consists in making one or more holes in the nest with a stick, and pouring into each hole one or two ounces of carbon bisulphide. The hole may be closed immediately by stepping on it, or, as many writers suggest, the vapour may be exploded at the mouth of the hole with a match in order to drive the fumes deeper in the chamber. If the latter method is adopted the hole should be covered with fresh earth immediately after the explosion in order to put out the fire and confine the fumes. If this is not done a large portion of the gas will be burned and the efficiency of the treatment be lessened thereby. Right at this point an added word of caution must be given. After the explosion the vapour continues to burn with a colourless flame. It is therefore invisible, but its presence may be easily perceived by holding the hand over the opening or blowing into it. This point should be carefully noted, for if the operator, thinking the fire had ceased and desiring to make an examination of the insects doubly certain, should attempt to recharge the hole from a can or a bottle an explosion would surely follow, with possible fatal results. Explosion does not appear to add to the efficacy of the treatment and is not at all necessary. If it is not attempted it may be well to cover the nest with a wet blanket, which will greatly aid in confining the fumes. If any considerable area is infested, as is often the case in lawns, the holes should not be more than $1\frac{1}{2}$ ft. apart each way, and after the close of the application the surface may be thoroughly watered, as the wet surface will add to the efficiency of the treatment by preventing the rapid diffusion of the fumes into the air.

Other Subterranean Uses.

The vapour of carbon bisulphide applied at the rates previously recommended is said to have a marked action against certain cryptogamic parasites of plants, though its influence in this direction does not appear to have been much studied. It is also said to be fatal to the nematode worms, which are frequently injurious. In greenhouses these would seem to be particularly susceptible to effective treatment. The vapour of carbon bisulphide is fatal to animal life of all forms if inhaled in sufficient quantity. Within recent years this chemical has come into quite extensive and successful use against a class of small mammals which are common nuisances, if not actual pests, in many parts of the country, and particularly in the West. To Prof. E. W. Hilgard, of the University of California, is given the credit of being the first to employ this remedy against ground squirrels and gophers. It is a matter of common knowledge that this agent is by far the safest and most efficient known for the destruction of prairie dogs, gophers, pocket gophers, ground squirrels, wood chunks, moles, and other pests having similar burrowing habits. The subject is quite an extensive one, and as it is now being given consideration by the division of Biological Survey, and does not properly come within the province of the division of entomology, further comments here are unnecessary.

Destroying Borers in Trunks of Trees.

A great deal has been written in favour of this use of carbon bisulphide. It is apparent that only the large borers which work in the trunks and lower branches of trees will be good subjects for this treatment. There are usually but few of these in each trunk, and the outlets of such burrows as contain active borers are usually marked by the sawdust and castings which the borers throw out therefrom. Only these burrows should be treated. Clean-cut empty holes in the trunk indicate that the insect has become adult and left the tree. It is therefore a useless waste to inject the liquid into such holes. In Peach, Plum, Apricot, and Cherry trees (all stone fruits) an abundant exudation of sap through the outlet of the burrows causes a ball of gum, mixed with castings, to collect around the hole. This should be scraped off before the treatment is applied.

Method of Treatment.—Having cleaned out the mouth of the hole as well as possible, inject a small quantity of carbon bisulphide and close the hole tightly with a little grafting wax. This will quickly kill the borer. The saving of time alone will fully pay for the small amount of carbon bisulphide required. The liquid may be conveniently applied by means of a spring-bottomed oil-can.

Treatment of Stored Products.

Agricultural products are frequently brought together in storehouses, mills, &c. in immense quantities, and when allowed to stand for some time, as is often the case, become particularly favourable material for the nourishment and multiplication of a large number of insect species. To exterminate these necessitates the treatment of an entire room or building.

The Fumigation of Buildings.—Carbon bisulphide is used in fumigating milling establishments, warehouses, storage rooms, grain elevators, stores, houses, barns, &c., for the destruction of insects affecting stored cereals and vegetable products, manufactured food products, dried Tobacco and its various products, drug-store insects, and household insects which may be sufficiently numerous or injurious to warrant such treatment. Besides being efficient for the destruction of such insects, it will also kill other animals, such as rats and mice, which it may reach. The most favourable time for application may vary somewhat, as will be shown by the individual life-histories of the insects treated. It would require too much space to mention all the minor details.

Preliminary Investigation.—When a fumigation of this kind is undertaken, preliminary investigation should be made which should make clear the nature of the pest, its habits, its injury, and as much of its life-history as may be necessary to show whether one time will be more favourable to treatment than another. The building or room should be examined, its tightness ascertained, and its floor area and cubic contents computed. Objections to treatment and unavoidable dangers should be considered.

In short all the pros and cons should be carefully weighed before treatment is determined upon.

Preparations for Treatment.—The building should be made as tight as possible. If glass is out it should be reset, doors and windows should be made to fit snugly, and a special examination should be made for cracks and leaks around the floors and lower walls. The place should be thoroughly swept and cleaned, and a coat of whitewash may sometimes be desirable. The material infested may be exposed, and, if movable, placed on the floors.

Shallow tin pans or plates make good evaporating dishes. The larger the evaporating area the better. There should be about one square foot of evaporating surface to every 25 square feet of floor area, and each square foot of evaporating surface should receive from $\frac{1}{2}$ to 1 lb. of liquid. These figures are, of course, only suggested and approximate. Pans should be placed as high in the room as possible, since the vapour is so heavy that it settles most heavily to the lower parts. Care should be taken, when placing the pans, to see that they are nearly level, though ordinarily no particular harm will be done if some of it is spilled. It should not be found necessary to lose time in adjusting such things after the application is begun. If there are special places—difficult of access for treatment with the pans—cotton waste, bundles of rags, or the like may be saturated and thrown into these places. Everything should be done to avoid unnecessary delays and to facilitate the rapid exposure of the liquid. If the liquid is bought in large quantities, small receptacles may have to be provided for transferring it to the pans.

The Exposure of the Liquid.

As many men may assist in the exposure as can work to advantage. Before the cans or drums are opened the men should be cautioned as to the nature of the liquid, the danger from fire, and the necessity for rapid work. If more than one floor is to be treated, begin at the bottom and work upwards. Carefully close and fasten all windows and outer doors, except one through which exit is to be made when the operation is completed. Pour out the liquid as rapidly as may be done, giving each pan about its predetermined amount, and then get out quickly. Close the door and keep it locked for twenty-four hours at least—longer if possible. The best plan usually is to apply the liquid after work-hours but before dark Saturday evening, and leave the building closed till the following Monday morning.

Ventilation.—Doors and windows are then opened wide at least one or two hours before it is time to resume work. The vapours disappear rapidly in the open air, and after an hour there will ordinarily be no danger in entering and but little trace of the disagreeable odour. Slight traces of the odour will probably linger in the corners and places where the air does not move freely, but these gradually disappear.

Precautions.—Attention has been called to the dangers from fire in the presence of carbon bisulphide vapour in the air, but special reference should be made to it in connection with the treatment of buildings. It is customary to mention the danger of bringing a lighted cigar or any such thing into the presence of the fumes. The application should always be made in daylight, as no artificial light of any kind is allowable. Even electric lights may not be used, since when turning them on or off there is aways danger of producing a spark, which would prove disastrous if the vapour should be present in the proper proportion. Heated steam pipes constitute another danger to be guarded against, and they should be allowed to cool before the application is made. Electric fans must not be run, as they very frequently give off sparks. It is safer to have no heat of any kind in the building while the exposure is being made; and it is a matter of courtesy, as well as a precaution, to warn the owners of adjoining premises of the nature of the work being done, and of the need for care if the vapours should penetrate to their rooms to any extent. It would be an added measure of safety to have a watchman to guard the premises from the time the application is made until ventilation is complete.

Treatment of Seeds.

Many kinds of grain and garden seeds are subject to the attack of insects. Contrary to the assertions of many seedsmen, such insects do injure the germinating power of the seed. Even if the embryo itself escapes attack, which is by no means always the case, the supply of the reserve food material upon which it depends wholly for its start in life is more or less consumed by the pest, and the vitality of the young plant is proportionally weakened thereby. The principal seeds attacked are Corn, Wheat, Rice, Peas, Beans, and Cow-peas, while vegetable Peas suffer more or less. Experiment has not yet shown any insecticide equal to carbon bisulphide for the destruction of all these seed insects.

Method of Treatment.—Seeds designed for treatment with carbon bisulphide should be placed in barrels, bins, or rooms, care being taken especially to have the receptacle tight around the sides and bottom. The cubic contents of the receptacle should be computed and carbon bisulphide applied at the rate of from 1 to $1\frac{1}{2}$ lb. for each 1,000 cubic feet of space, which is the capacity of a bin or room ten feet each way. A barrel will require a larger proportional amount unless it is very tight. The liquid is placed on the top of the seed in shallow pans or soup plates, about a teacupful being placed in each. A small bin or barrel may be covered sufficiently tight with heavy blankets or oilcloth. The receptacle should be kept tightly closed from twenty-four to thirty-six hours with perfect assurance that the germinating power of the seed will not be injured. Rye, Millet, Barley, and Crimson Clover are most liable to injury, and should receive the minimum of treatment.

Fumigation Houses—In the large seed-growing districts special houses are constructed for this work. The following description of the house and the manner of treatment is given by Professor A. J. Cook: *—"The house is made air-tight; even the door is made very close-fitting, and it is made still closer by pasting paper over the edges upon closing it, after filling the house with sacks of Peas. An air-tight flue at one end opens at the very top into the building and at the bottom out of doors. A sort of chute with an adjustable air-tight valve is arranged for the turning on of the liquid. The liquid is turned on until the odour shows that the vapour

* Bull. No. 58, Michigan Agr. Exp. Sta.

is pouring out at the bottom of the flue. Then of course the air has been forced out by the vapour, when the valve is closed. It is left closed for three days ; then the doors are opened that the vapour may escape, when all the weevils will be dead. As a rule seed pest enter the seeds in the field. Treatment therefore is more effective if made as soon as possible after harvesting."

Treatment for Clothes Moths.

The various insects which infest clothing, furs, &c., may be more conveniently and surely destroyed by an application of carbon bisulphide than by anything else. Moth balls, camphor, &c. may do some good by deterring the females from depositing their eggs upon articles treated therewith, but they have no killing power whatever, and if the eggs have already been deposited the young larvæ will feed after hatching as though there were no moth balls or camphor present. Carbon bisulphide, however, will not only keep the adults away, but it will also destroy all stages of the pest infesting the goods. When woollens, furs, and the like are stored away for the summer, they may be placed in a tight paper-lined trunk, a large packing box, or such receptacle. When all are stored away place on top a shallow dish holding a few ounces of the liquid, spread some newspapers over the top, and cover tightly. If the box is tight no further attention will be required, but if not it will insure safety to repeat the dose every few weeks through the hot weather. It is an excellent plan to provide a large tight packing-chest having a small sponge, bunch of cotton waste, or some such thing on the inside. The chest may then be kept tightly closed and carbon bisulphide may be poured through the hole upon the absorbent as may be necessary. Plug the hole with a cork and all is secure. The cost of such an arrangement will very soon be saved by the convenience and security of the protection thus afforded. Carpets, rugs, robes, &c. can be easily rid of all pests by a few days' exposure in such a box. The disagreeable odour is much less persistent in the goods than is that of moth balls or tarred paper. If pure carbon bisulphide is used, it will not stain or injure the most delicate articles.—*R. N.*

Internal Phloëm.

Gelsemium sempervirens, Structure and Development of Internal Phloëm. By Caroline B. Thomson, B.S. (*Contr. Bot. Lab. Phil.* vol. ii., No. 1, p. 41 ; pl. 9).—Detailing result of observations made during the winter of 1897-8.

The internal phloëm arises primarily as four longitudinal strands, an integral part of leaf-trace bundles.

The origin of internal phloëm simultaneously with the protoxylem and external phloëm, so that the leaf-trace bundles are bicollateral from the first.

The internal phloëm patches are bounded internally by a two-celled phloëm sheath.

They grow centrifugally by means of a medullary cambium, the inner and older layers in time becoming crushed and obliterated. Death of the pith occurs early in the first year. Continued disintegration of pith and growth of internal phloëm results in filling up the pith cavity with the latter.

The internal phloëm, which runs into the petiole, constitutes there a bicollateral bundle system, but at the base of the petiole it descends through the xylem as two strands; from this point upwards the primitive collateral bundle system prevails. No internal phloëm in root, or lower portion of hypocotyl, nor in the cotyledons.

Internal phloëm is an acquired characteristic of the plant, probably developed in these long and sometimes twisted stems to supplement the external phloëm.—*M. C. C.*

Leaf-traces.

Leaf-traces, Persistence of. By Sir W. T. Thiselton Dyer, K.C.M.G., C.I.E., F.R.S. (*Ann. Bot.* vol. xv., No. lviii., p. 423).—This is the first of a series of morphological notes proposed by the author. He observes that interesting specimens frequently come under notice in a large botanical establishment like Kew which, when relegated to their places in a vast museum collection, do not attract the attention they deserve. Those here in question rarely afford the bases for extended research, yet deserve detailed notice, as they often illustrate important theoretical points that may be useful to teachers for lecture illustrations. The present note answers to more than this, and besides being of importance to the phytolithologist is of interest to all who are concerned with wood structure. It is remarked as apparently not generally known that when leaves are more or less persistent the leaf-traces are continued to them through successive annual zones of wood. This fact results in curious structure which so far as the author is aware, is peculiar to *Araucaria* amongst Conifers, and he further on observes that "the persistence of leaf-traces affords apparently a decisive character for assigning fossil coniferous woods on which they occur, at any rate to the *Araucarineæ.*" It is pointed out that in *Pinus* a structure may be found which at first sight is similar, but here the "traces" penetrating the annual rings are not mere leaf-traces, but are the fibro-vascular cylinders of limited branches. Three beautiful photographs are reproduced, two of them showing the above-mentioned structure of *Pinus*, and the third that of *Araucaria* with the leaf-traces traversing successive annual rings and perforating a ring cut through tangentially.—*R. I. L.*

Intra-ovarian Germination.

Melon, Precocious Germination in a. By Sir W. T. Thiselton-Dyer, K.C.M.G., C.I.E., F.R.S. (*Ann. Bot.* vol. xvi., No. 41, p. 149; March 1902).—An exceptionally remarkable case of the abnormal germination of seeds within a fruit is here fully treated, and also illustrated by means of a plate, showing the fruit cut open, with numerous well-developed seedlings *in situ.* On the following plate it is conclusively shown, by three drawings of the removed young plants, that they do arise from seeds, and have not originated from intra-ovarian buds. The author writes: "The Melon figured in pl. viii. was kindly sent to me in July 1898 by General the Right Hon. Sir Dighton Probyn. It had been grown at

Sandringham in the gardens of H.R.H. the Prince of Wales, now H.M. the King, and when cut open on the table at Marlborough House the interior was seen to be filled with well-developed seedlings, as shown in the figure. The specimen was so striking that it was eventually preserved in spirit and placed in the Kew Museums." Further examples exhibiting the same condition were supplied from the same source, and these were submitted to careful examination by Mr. Horace Brown, F.R.S., who was working in the Jodrell Laboratory. He found that "the cotyledonary leaves of several plantlets measured 1½ inch long and 1¼ inch across, and were of a light green colour. The hypocotyls were about 2 inches long and ¼ inch in diameter. The roots were well developed, with secondary root fibres up to ½ inch in length. . . . In one instance a tap root was found to have actually penetrated the solid parenchyma of the pericarp to a depth of about ½ inch, considerable force being required to withdraw it. . . . Penetration of the pericarp by the roots seemed to have occurred only in exceptional cases; for the most part they ramified amid the placentas and the broken-down ovarian tissue, from which they seem to have derived their nourishment. The dry weight of the plantlets far exceeded that of the seeds from which they were produced. . . . The dry weight of one of the plantlets was 0·1929 gram, or about twenty times the weight of the seed from which it sprang. . . . I think the amount of chlorophyll present must be very small. It does not give a strong coloration to the alcohol in which the plants are immersed, and what little green there is fades rapidly on exposure to light." The author writes: "Whether the small amount of chlorophyll present in the Melon seedlings was effective functionally to an appreciable extent may be doubted. The chemical changes which took place in the interior of the fruit would be accompanied by the evolution of carbonic acid, which would probably be present in any part of the internal cavity not occupied by fluid in greater proportion than in atmospheric air. But the illumination of the seedlings would be too feeble to allow of its being fixed and decomposed. On the whole the nutrition of the seedlings closely approached that of a saprophyte. What is, however, noteworthy is that it must have been practically anaërobic. At any rate, it is evident that the working up of the disintegrated tissues of the parent Melon into new living tissue required a minimum amount of oxygen." Mr. A. Mackellar, who grew the Melons, wrote Sir William that "no doubt the cause of the seeds germinating and growing in the Melons is the unusual length of time the Melons have kept fresh. I have seen seeds germinated in a Melon before, but not so far developed as in this case." The author of the paper refers to the precocious germination of seeds in the Orange and other species of *Citrus*, and in the Papaw (*Carica Papaya*). He observes that in the vast majority of cases seeds remain dormant for a considerable time after maturity, and says that this is no doubt an adaptive character which has been acquired in order to facilitate their dispersion to considerable distances. "It might be expected, therefore, that in the case of gregarious plants, whose seeds grow where they fall, precocious germination might occur. It is actually met with amongst the *Dipterocarpeæ*; Blume figures a case in *Dipterocarpus retusus*. It is especially characteristic of the Mangroves (*Rhizophoreæ*)." The case of

Bertholletia, described by Mr. Watson in the "Annals of Botany," is also alluded to in this connection.—*R. I. L.*

Mycorhizoid Structures.

Mycorhizoid Structures in Marchantiaceæ. By M. Golenkin (*Flora*, xc. 1902, pp. 209–220; pl. 11).—This occurs in *Marchantia palmata*, *M. paleacea*, *Preissia commutata*, *Fegatella conica*, *Targionia hypophylla*, *Plagiochasma elongatum* (from Java); but not in *Marchantia polymorpha*, *Lunularia*, nor eighteen other species, including *Ricciecæ*. It is "endotrophic," and forms in *Preissia* and *Marchantia* two dark violet cords of oval section, one on either side of the central groove, respecting the lower epiderm and the branching green cells. The distribution differs in the other species. The affected cells are traversed by numerous hyphæ, and never contain starch or chloroplasts, though they retain protoplasm and nucleus. The hyphæ grow through the cells of the non-lacunar tissue, infecting the youngest ones about 5 mm. from the growing point. None enter the air chambers, and the stalk of the inflorescence also escapes infection.

Attempts to cultivate *Preissia* and *Fegatella* species from bulbels and spores on sterilised earth gave weakly plants (soon killed by parasitic fungi), or none. The strongest wild specimens producing female fruit were always infected. The *Marchantias*, however, were in some cases free from mycorhiza and yet flourished, though they gave no inflorescences; this, however, frequently occurs in cultures. [The description of these observations and experiments is lacking in detail; thus we find no account of "control experiments" on *Preissia* and *Fegatella* in ordinary soil.] It is suggested that the function of the mycorhiza is to resist drought. The fungus could not be identified. It is compared with the symbiotic fungi of *Neottia* to the prothallus of *Lycopodium*.—*M. H.*

Secretion in Nectaries.

Nectaries, Mechanism of Secretion in Extra-floral. By Haupt Hugo (*Flora*, vol. xc. 1902, pp. 1–41).—A very interesting account of these organs studied in a limited number of European plants. Secretion commences automatically at a certain age and when the air is sufficiently moist; its continuance depends partly on the presence of the excreted sugar becoming concentrated and exercising osmotic attraction. But as the removal of the nectar does not *invariably* (as hitherto believed) arrest the secretion, the starting mechanism must be renewed. In other cases the removal of the nectar is followed by a secretion of mere water, the nectary thus becoming a water-gland (hydathode). This proves that the secretion is in part due to internal pressure. In some few cases only (*Vicia*, *Euphorbia*) light—the less refrangible rays—has a direct influence on the secretion, as well as an indirect one through the illumination of other parts of the plant. Secretion never *begins* below a minimum temperature proper to the plant, though already active nectaries will continue to secrete more slowly when the temperature falls below this. The arrest of the secretion with the age of the organ is sometimes accompanied even by resorption of the nectar; in *Vicia* and *Euphorbia* darkening alone will determine this. Nectaries capable of absorbing their own nectar can absorb also syrup artificially supplied. The internal pressure of the secreting cells is very high; and as they only begin to plasmolyse in 10 per cent. solution of KNO_3, it must equal at least thirty atmospheres. Some interesting anatomical details are given, for which the author claims no novelty any more than he does for the view that the function is protective, attracting ants *from* the flowers &c. *to* the herbaceous parts, which they largely preserve from caterpillars &c.—*M. H.*

Digestion in Nepenthes.

Nepenthes, Proteolytic Enzyme of. By Prof. S. H. Vines, M.A., D.Sc., F.R.S. (*Ann. Bot.* vol. xv., No lx., p. 563).—An enzyme is a soluble ferment, and one that is proteolytic decomposes proteids. The author returns to the subject of the digestion of *Nepenthes* in order to bring to notice a paper of considerable importance, by the late Georges Clautriau, which is not easily accessible to English readers. Clautriau is believed to have been the first to investigate the physiology of the pitchers in the native habitat of the plant. The acidity of the liquid was the subject of special attention, and he found that it was caused not only by the introduction of any foreign body, but also by mechanical stimulation, such as a vigorous shaking of the pitcher, open or unopened. This is interesting because Nepenthin— the name proposed by Professor Vines for this enzyme—is active only in presence of acid; indeed the digestion of *Nepenthes*, the author remarks (contrary to the view held by Clautriau), is very much hastened by the addition of hydrochloric acid, or organic acid like citric acid. Clautriau observed that living insect larvæ, especially those of the mosquito, are to be found in the pitchers, and he rightly argued that this could not be accepted as evidence of digestive inactivity, but rather that it is evidence of the special adaptation of the larvæ for such a situation, just as parasites may be adapted to the digestive canal of an animal. Clautriau expresses a doubt as to the presence of enzyme in the liquid of unopened pitchers, but the author's experience entirely confirms the statement of Gorup-Basanez that this liquid is very active when acidified. The really important difference of opinion between Clautriau and the author is as to the nature of this proteolytic enzyme. The former regarded it as a pepsin, that is, an enzyme acting on the higher proteids in an acid medium, giving rise to peptones, but incapable of decomposing proteids into non-proteid substances. Prof. Vines, on the other hand, has found that the enzyme is a trypsin, and has endeavoured to prove that digestion proceeds to the further stage of producing substances characteristic of tryptic digestion. Sufficient has been said to show the interest of this paper, but further remark must be made in order to point out Professor Vines's suggestion that all known proteolytic enzymes of plants are tryptic. This suggestion, he thinks, may be expanded into the proposition that tryptic digestion is a property of all living organisms, and that it is the more primitive form of the digestive process.—*R. I. L.*

On Prothalli.

Ophioglossum pendulum and Helminthostachys zeylanica, On the Prothalli of. By William H. Lang, M.B., D.Sc., Lecturer in

Botany at Queen Margaret College, Glasgow University. With Plates I., II., and III. (*Ann. Bot.* vol. xvi., No. 61, p. 23; March 1902).—"The difference of opinion which exists among investigators who have studied the *Ophioglossaceæ* as to the phylogeny of this small group of vascular Cryptogams is well known. Palæobotany has not afforded decisive indications of connecting links with either the Filicineous or the Lycopodineous phylum, and comparative study of the existing forms is alone available in the solution of the problem." This study the author has entered upon in the present paper, where only the evidence of the gametophyte is considered. It appears that he himself was the first to describe the prothallus of *Helminthostachys zeylanica*. (See *Proc. Roy. Soc.* vol. lxviii. 1901, p. 405.) The prothallus is therefore known of all three genera which compose the sub-order *Ophioglossaceæ*, viz. *Ophioglossum*, *Helminthostachys*, and *Botrychium*.

Writing of *Ophioglossum pendulum* the author says that "after a year and a half the largest prothallus consisted of but three cells and were still partially enclosed in the exospore. A most remarkable circumstance in connection with the prothallus of this Fern, and also of *Helminthostachys*, is the possession of a symbiotic fungus which grows within their tissues. In the latter case it dies about the time that the sexual region begins to elongate. It will be interesting to gardeners that in each case the prothallus is subterranean, that of *Helminthostachys* growing at a depth of two inches. The author remarks that the prothalli of the three living genera of the *Ophioglossaceæ*, while differing in details, present essential points of agreement with one another. He does not think that there is relationship with the Lycopodiales. "It does not appear too much to say that while some general resemblances standing in relation to similar modes of life can be traced there are no characters, the morphological value of which is attested by constancy through obviously allied groups, indicating affinity between the two. On the other hand, important points of difference exist in the type of symmetry, in the sexual organs, and in the embryogeny. . . . It would appear that the available evidence points to the origin of the type of prothallus found in the *Ophioglossaceæ* from forms not unlike the gametophyte of the existing *Marattiaceæ*, though possibly belonging to a more primitive group." This important paper is illustrated by seventy figures.

R. I. L.

NAVEL ORANGES.

Orange, Pleiotaxy of Gynæcium in. By Sir William T. Thiselton-Dyer (*Ann. Bot.* vol. xvi., No. 61, p. 154; March 1902).—This note is of considerable interest in view of the present sale in the markets of the 'Californian Navel Orange,'* a peculiar variety of firm flesh and distinctive flavour, possessing a conformation at the top of the fruit which justifies the title. This variety is alluded to, but the note refers, in the first place, to an abnormal fruit sent to the author and illustrated on Plate IX. "In this case the axis has been prolonged and has given rise to another series of carpels, forming a smaller fruit, which is entirely

* The original tree from which the whole of the trees in California have been derived is said still to exist in the Botanic Gardens at Washington.

immersed in the external one. A similar state of things to that now described is said to be characteristic of the so-called Californian Navel Orange. This apparently originated as an isolated sport, as the trees in California are said to have been all propagated from one which is still preserved at Washington." Fruits of the Navel Orange were recently brought to the present writer, who found that the additional carpels were quite at the top of the fruit, not actually protruding, but showing sufficiently to be suggestive of term applied for a name. The author of the note says that "A. P. de Candolle regarded the rind of the Orange as developed from the torus or receptacle, which is usually regarded as an axial structure ('Organographie,' vol. ii., p. 41), and Masters ('Teratology,' p. 75) favours this view. In the case now figured the external rind had been removed before it came to my hands. The carpels are united below to the prolonged axis, but are separated above to leave an open pit, at the bottom of which is the secondary fruit. The ventral surface of the carpels is clothed with the characteristic glandular 'rind.' This is shown in section in fig. 5, where the glands are unusually prominent and crowded together in groups with little intervening tissue. In such a position the 'rind' could hardly be an axial structure. The secondary fruit is shown in section in fig. 6, except that the number of carpels is fewer than ordinary; there is no deviation from the normal structure. Fruits with one series of carpels may be regarded as reductions from a more generalised multiseriate type. The interest of a case such as I have described is the proof that a tendency to revert to the more generalised type may still be latent."—*R. I. L.*

Variety of Methods of Opening of Capsules.

Orchid Capsules, Opening of (*Beih. Bot. Cent.* bd. xi., ht. 7, pp. 486–521; 2 plates).—Herr Arthur Horowitz gives an account of the mechanism of the opening of these fruits. The following types are distinguished.

1. *Thunia Marshalliana.* Constrictions appear along the middle of the carpels through this part ceasing to develop and a longitudinal slit appears.

2. Many European forms open in three longitudinal slits on account of the strains set up by the difference in contraction of the strongly thickened midribs of the carpels and of their slightly thickened placental portions. In the latter the rows of cells run horizontally and not vertically.

3. *Paphiopedilum*, &c., differs in having one or two special rows of cells which facilitate the splitting.

4. Also similar, but with several rows of cells (*Bulbophyllum* sp.).

5. Special rectangular masses of thin-walled cells separate the inner epidermis from the sterile valves and assist in the opening. (*Cœlogyne* sp., *Epidendrum* sp.).

6. Strong fibre cells, which are unable to contract longitudinally, are formed on both sides of each of the six vascular bundles. Thus slits appear at each of these rows of fibre cells (*Pleurothallis*). Hygroscopic hairs on the inner surface of the placental region appear to distribute the

seeds by rapid twisting and turning movements. These hairs are figured on plate 2. *G. F. S.-E.*

Influence of Gaslight.

Plant Growth, A Study of the Effect of Incandescent Gaslight on. By L. C. Corbett (*West Virginia Agr. Exp. St.*, Morgantown, W. Va. *Bull.* 62, p. 79 ; 1899).

After referring to previous observers the author considered that the *quality* and *intensity* rather than the manner of making the artificial light should be investigated. Hence he commenced in 1895 to test the influence of the Welsbach incandescent gaslight upon various plants growing in greenhouses. Experiments were continued up to 1899.

In no case was the artificial light found to be a satisfactory substitute for daylight.

Lettuces were first grown in two houses, some under normal conditions, the others subjected to incandescent light at night only. Two methods were tried—raising plants in pots and transplanting them to the stage (the house), and sowing the seed. These latter grew too tall without making a sufficient spread of leaves to give the greatest weight for the area occupied. Photographs and nine charts illustrate two important factors in the behaviour of the plants: the plants near the light—eight lights being all at one end—show a much greater growth than those near the other end of the house. A less marked variation is shown in the curve of growth of the plants in the normal section made at the same time. The light house thus shows in a marked way the influence of the lamp upon the plants near by as well as suggesting the range of its influence.

The advantages of the light were corroborated by weights. Thus the weight of 400 plants in the light area was 68·56 lb., and in the normal 49·428 lb. The plants had been under the influence of the light forty-six nights. During that period the lamps were turned on at 5 o'clock P.M. and extinguished at 7.15 next morning, thus making 655·5 hours that the plants were actually exposed to the stimulus of the light, against 448·5 hours that they were in normal conditions. Hence the plants exposed to the gaslight exceeded those normally grown by 38·7 per cent. of the total weight of the plants in the normal house.

To test the rapidity of growth the auxanometer was used, with the result that during twenty-four hours was the more rapid rate of growth of the light-house plants. The light plant was found to grow 1¼ inch more in eight days than the normal plant.

With regard to the most active period of growth for the plant in the light section, it began at 11 P.M. and continued to 9 A.M.; while during the same space of time the normal plant gave an active growth period beginning at 4 A.M. and continuing until 11 A.M. Hence in the case of the light plant the period was ten hours, while in the normal house the period was seven hours.

With regard to Radishes grown between the rows of Lettuces a very slight advantage as to the size of the roots appeared as the result of the incandescent light. As to Spinach no plant used responded more to the stimulating influence of the gaslight.

Not only was light growth stimulated in the manner shown by the chart, but a marked tendency to run to seed became noticeable in all plants near the light.

Sugar Beets show interesting results. It has been well known that in the United States Sugar Beet grows much more profitably in high latitudes, where short growing seasons are the rule, and where the sun shines with great intensity for days uninterrupted by cloud or fog. The result of the experiments showed that while the size and weight of the roots under the gaslight were less than under normal conditions, the foliage was greater under the gaslight. But when analyses for sugar were made the percentages were greater for the roots under the light in the proportion of 6·10 to 5·53.

The author adds an interesting section upon the range of the influence of the incandescent gaslight and of the arc light. It was noticeable in his experiments that the maximum of influence was not upon the plants growing *nearest to* the light, but at a short distance from it. This is explained by the way the light is distributed from the glowing mantle, for the angle covered by the gas lamp is not only much greater than for the electric light, but the distribution of the light from the latter is more localised, and is more intense than is the case with the Welsbach. The greatest quantity of light is given off from the electric light within the area $11\frac{1}{2}$ to 24 feet from the perpendicular; while the light is much less intense from the Welsbach, and is given off over a belt covered by $8\frac{1}{2}$ to 17 feet from the perpendicular (*i.e.* through the light itself), 12 feet being the place of maximum intensity of the light.

The range of the Welsbach lamp is from 12 to 16 feet for the greatest stimulating influence, with a marked influence up to 24 feet.—*G. H.*

Structure &c. of Pollen.

Pollen-tube, Development of, and Division of the Generative Nucleus in certain Species of Pinus. By Miss Margaret C. Fergusson (*Ann. Bot.* vol. xv., No. lviii., p. 193).—This is a valuable study by the authoress, and incidentally an important *résumé* of the work done by others in a field of investigation which has waited, to a large extent, for modern means of research, and in which, at least for other genera, much, no doubt, remains to be done. Three plates with fifty-one figures are given and some sixty-one papers are cited. Among the facts stated in the summary are the following: The structure of the pollen-grain agrees fully with that given by Strassburger, 1892. The pollen-grain germinates very soon after pollination, and the vegetative nucleus immediately passes into the tube. During the first season the pollen-tube grows very slowly, and it may be broad and irregular in outline or it may branch freely. Shortly before fertilisation the generative cell, followed by the stalk cell, moves into the pollen-tube. The generative cell, as the other cells of the pollen-grain, is never limited by a well-defined cell-wall, and consists at the time of its division of an irregular protoplasmic body, in the upper part of which the nucleus lies. In the division of the generative nucleus the spindle is extra-nuclear and unipolar in origin. The nuclear membrane persists along the upper part of the nucleus until the early stages in the formation of the daughter-nuclei. This division takes place a little more than a year after pollination and from a week to ten days before fertilisation, about thirteen months elapsing between pollination and fertilisation. The Pines studied were *Pinus Strobus*, *P. austriaca*, *P. rigida*, *P. resinosa*, and *P. montana* var. *uncinata*, the above applying to all these. The authoress remarks that nuclear phenomena are found to vary so much, even within the limits of a given genus, that it no longer seems safe to consider the details of development in a single plant as typical of a large group of plants. No generalisations, therefore, are made for the *Abietineæ*. Conclusions could not even be drawn for the genus *Pinus* without hesitation, for "there may still exist within the genus individuals which are, in certain aspects of nuclear activity, a law unto themselves." One of the most interesting statements made is that nothing suggestive of spermatozoids can be found in Pinus. It is interesting in recollection of the fact that spermatozoids have been declared by Dr. Hirase for *Ginkgo* (*Salisburia*), and that they have been found in *Cycas* and *Zamia* of the allied but more ancient natural order, the *Cycadaceæ*. They are so large in *Zamia* that, according to Webber, they may be seen by the naked eye.—*R. I. L.*

Pollen Cells.

Pollinium and Sperm-cells in Asclepias Cornuti. Decaisne, The Development of the. By C. Stuart Gager, Cornell University. (*Ann. Bot.* vol. xvi., No. 61, p. 123; March 1902).—The flower of *Asclepias*, we read, has always been of interest to botanists. "In 1831 Brown, who separated the Asclepiadeæ as a natural order of plants from the Apocyneæ of Jussieu, made the first serious study of the pollinia. His first paper on this subject appeared in 1809, but he failed to observe the grains of pollen, and thought that the pollinium consisted of one individual cavity filled with minute granular matter mixed with an oily fluid." The views of Link, Treviranus, and Ehrenberg are then quoted. "In 1833, as a result of further researches on the *Asclepiadeæ*, Brown describes the pollen mass on several species of *Asclepias*, particularly in *A. phytolaccoides* and *A. Curassavica*, the figures being drawn by Bauer. He then without doubt considers the cells of the pollinium as true pollen grains." The modern literature on the subject is completely reviewed by the author, and he gives his own work on the archesporium, the tapetum, the primary pollinium cells, and their first and second divisions, the origin of the sperm cells, and the germination of the pollinium cells, in full detail. It is interesting to note that "a rather vigorous circulation of protoplasm was noticeable in freshly germinated pollen-tubes." In the summary it is stated that "the individual cells of the pollinium of *A. Cornuti* are true pollen grains which never become free. . . . The outer membrane of each pollen grain is composed of the wall of the mother-cell (which does not dissolve) plus the cross walls formed by the two divisions of the mother cell. Each pollen grain possesses an inner membrane, which it develops about itself. The generative cell divides, before the formation of the pollen tube, into two sperm-cells, each of which travels down the pollen tube, passing the vegetative nucleus on the way." A paper by Corry and two others by Fry and by

Strassburger are referred to. The author says that "the above three papers leave the identity of the pollen grain and its ontogeny an open question, since the peculiarities of the division are so different from those heretofore observed in other types, and have led many to believe that a shortening of the process takes place in the members of this genus. It would remain an open question until it was proved that all the divisions concerned, up to and including the formation of the sperm cells, are exactly the same in all essential points in *Asclepias* as those which occur in other Angiosperms. This identity is established for the first time by the developmental history as traced in the foregoing paper." Thirty-seven good figures are provided.—*R. I. L.*

Study of Polygala.

Polygala polygama and P. paucifolia, Comparative Structure of the Flowers, with Review of Cleistogamy. By Chas. Hugh Shaw, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii., No. 2, 1901, p. 122; pls. 16, 17).—*Polygala polygama* develops, in addition to the evident and the subterranean types of flower, a third type—the aërial cleistogamic—which may be found abundantly in midsummer. The last are morphologically intermediate between the former two types, and furnish a connected series between the conspicuous and subterranean flowers.

The shoots bearing aërial cleistogamic flowers are more or less geotropic.

The chasmogamic flowers very largely fail to mature seed. The cleistogamic produce seed abundantly.

The five sepals are present in all types of flower. Only the anterior petal is found in the subterranean flowers, and the same, with two others, appear in the aërial cleistogamic. Eight stamens are generally present in the aërial cleistogamic, but more or less reduced; and in the subterranean blooms from three to seven are found, still more reduced. The pistil of the subterranean flowers is greatly reduced, that of the aërial cleistogamic intermediate between the former and the chasmogamic flower: a well-developed nectary in the chasmogamic flower, only traces in the aërial cleistogamic, wanting in the subterranean form.

Stomata present on all parts of the evident calyx. In extreme abundance on the outer surface of the sepals in aërial cleistogamic, and on the calyx of the subterranean flowers, in a rudimentary condition.

The microspores of the evident flowers undergo a great increase in size at the time of flowering, which is true to a less degree of the microspores of the two other types of flowers.

The walls of the microspores are very thick.

A canal is present in the pistil leading from the ovarian cavity to the exterior.

Glandular hairs, found sparsely on the ovary of the evident flowers, present in great abundance on that of the subterranean, pointing to some kind of specialisation.

The chasmogamic flowers of *P. paucifolia* exhibit a condition of initial gynandry, combined with the complete coalescence of stamens and petals.

The hypothesis that cleistogamic flowers are developed to preserve the species when the others fail, is unsatisfactory, because these are produced every year abundantly.

The hypothesis that this development is due to lack of light is probably partially true, but insufficient, as cleistogamic flowers are produced in abundance during sunny midsummer.

The cleistogamic flowers develop seed more rapidly than do the conspicuous ones. It is believed that the purpose of their existence is the economical and speedy production of seed.—*M. C. C.*

Digestive Processes.

Proteolysis, Tryptophane in. By S. H. Vines, M.A., D.Sc., F.R.S., P.L.S. (*Ann. Bot.* vol. xvi., No. 61, p. 1; March 1902).—The unity of all life is strikingly shown in the similarity of the digestive processes in plants and animals. In plants it is most generally associated with the utilisation of reserve materials, but is occasionally met with in connection with the absorption of food from without, when it is a process precisely similar to the digestive processes of the higher animals, though somewhat simpler in its details. Even in the first case above mentioned, of intracellular digestion, the process agrees very closely with that of many of the humbler animals. To this preface, given for the sake of those whose physiology may not be quite recent, let us add that by proteolysis is meant the digestive breaking up of proteids, and that tryptophane is a substance formed in the breaking up of the proteid molecule into non-proteid substances and is characteristic of "tryptic" digestion. In a former number of the annals the author gave evidence to prove that the proteolytic enzyme of Nepenthes, as well as those of the Pineapple and of the Papaw, are essentially tryptic in their mode of action. Here the author writes: "I propose in the present paper to give a more complete account of my observations on bromelin and papaïn, and to describe further experiments which I have made with the enzymes of the Fig (*Ficus Carica*, L.), of the Coconut (*Cocos nucifera*, L.), of germinating seeds of the Bean (*Vicia Faba*, L.), and of the Barley (*Hordeum vulgare*, L.), of Yeast (*Saccharomyces Cerevisiæ*, Meyn), and of the *Bacteria* of putrefaction, as also with animal pepsin. I will so far anticipate as to say at once that in all these cases, under appropriate conditions, I have succeeded in finding tryptophane among the products of digestion of fibrin and Witte-peptone." The experiments are described in considerable detail and many points might be abstracted. In his conclusion the author writes: "The additional instances that I have now given of the production of tryptophane, selected as they are from various classes and from different parts of plants, bear out my previously expressed opinion that the proteolytic enzymes of plants in general are essentially 'tryptic.'" An observation made by the author bears strongly, in this case at any rate, against certain views of the purpose of poison in plants, and his view to this effect must be quoted: "I would add a few words regarding the observation that hydrocyanic acid promotes proteolysis in certain cases. I regard this as a matter of some importance, as it may, if followed up, throw light upon the physiological significance of this acid in plants. Its general occurrence in certain families has long been known, and it was assumed by a too facile œcology that its importance lay in the protection which it was assumed to afford, by reason of its poisonous properties, against the depredations of animals. It is only recently that the matter has been seriously investigated."—*R. I. L.*

The Genus Pythium.

Pythium ultimum, n. sp., Observations on the Biology and Cytology of. By A. H. Frow, D.Sc., F.L.S. (*Ann. Bot.* vol. xv., No. lviii., p. 269).—*Pythium* is a genus of considerable interest to gardeners. When seedlings are found to damp off, or even soft cuttings, it is very likely that the trouble is due to a *Pythium*, encouraged by too much moisture. The whole story is most interestingly told and clearly explained by Professor Marshall Ward in his "Diseases of Plants," and he alone in this country appears to have paid attention to the genus. In the present paper we have a further important study devoted to the life-history, cell structure, and development of a new species, which is fully described and illustrated. Unlike *Pythium de Baryanum*, the common species, it appears to be purely saprophytic, and was found in rotten Cress seedlings grown for the purpose of obtaining *Pythium* material. Since this new species cannot attack a living plant it is not in itself a foe to be understood and guarded against; but the paper dealing with it, accompanied by many illustrations, is valuable for a study of the genus. It is allied to *Peronospora*, and relatives account for many of the diseases to which plants are liable.—*R. I. L.*

Haustoria.

Rhinanthaceæ-Haustoria (*Beih. Bot. Cent.* bd. xi. ht. 7, pp. 437–485; plate).—Herr Adolf Sperlich gives a detailed account of the anatomy and contents of the absorbing suckers on the roots of *Melampyrum*, *Tozzia*, *Alectorolophus*, and *Pedicularis*. *Melampyrum pratense*, *sylvaticum*, and *nemorosum* are shown to be both saprophytic and parasitic, the haustoria of the same plant being attached to both dead organic matter and living roots. The hyaline tissue of the haustoria is formed from divisions of the pericambium and endodermis. Tracheids are not always present, and are frequently wanting when the haustoria are attached to dead material. The haustoria (*Melampyrum*) possess differentiated rows of tracheids, which are in connection with strands of irregularly thickened cells which penetrate the host-root. The end cells of these strands are often elongated, like the hyphæ of a fungus mycelium, and grow through the host. The contents of the haustoria consist of albuminoid crystals in the nuclei of the cortex and hyaline tissue, of bodies resembling (as regards constitution) the "bacteroids" of leguminous root-tubercles, of starch, of amylodextrin, of (probably) glycogen, of Rhinanthin, of phosphoric acid, and of nitrates. The hyaline tissue is rich in albuminous matters. Similar results were obtained for *Tozzia*, *Alectorolophus*, and *Pedicularis*. The author concludes that both nitrates, phosphates, and also organic food material are obtained by the haustoria.

The hyaline tissue is regarded as a reserve tissue, in which also building material is formed.—*G. F. S.-E.*

Varying Sensitiveness of Roots.

Roots, Rheotropism of. By F. C. Newcombe (*Bot. Gaz.* xxxiii. No. 3, p. 177; with 15 figs.).—After an historical review and the methods adopted in the experiments, the author enumerates "plants unsuited to experiment," in that when grown in moving water their roots grow straight downwards (geotropically), unaffected by the pressure of the current. Many roots also show contortion. Of thirty-two species of nine families tested for rheotropism, fourteen were insensitive to the water stream; the rheotropic species were eighteen of six families. This result proved that rheotropism is not a general phenomenon, especially with normally aquatic plants. "It would seem to be of distinct disadvantage for such plants to be rheotropic in their roots; for only by insensitiveness to the flow of water can the roots the most quickly find the solid substratum."

Under rheotropism the roots turn up in *opposition* to the direction of the current. Of plants insensitive the author mentions *Allium Cepa*, *Nasturtium officinale*, *Quercus alba*, *Cucurbita Pepo*, *Citrullus vulgaris*, *Phascolus* sp.

Then follow descriptions of plants having "a low degree of sensitiveness" and "plants with a high degree," of these a dwarf Maize, Wheat, Rye, Barley and Oat, Pea and Buckwheat, Mustard, Cabbage, *Brassica campestris*, and Radish. (The paper is to be continued.)—*G. H.*

Evolution of Male and Female Organs.

Sexual Organs, Homology of, in Development of Male and Female. By K. Goebel (*Flora*, vol. xc. 1902, pp. 279–305).—The author describes the cell divisions that form the nucule of *Characeæ*, compares them with the quadrant divisions of the antheridium, and points out that the sterile "Wendungszellen" at the base of the oosphere are clearly its coequivalents, like the "polar cells" of *Metazoa* and of some *Fucaceæ*, but aborted [a view put forward by the abstractor in "Some Problems of Reproduction" in *Quart. J. Micr. Sci.* 1891, not quoted by the author]. The function of these sterile potential cells is probably nutritive. In *Marchantiaceæ* the primordial cell of the antheridium divides by vertical partitions into quadrants, each of which again divides tangentially into an outer wall-cell and an inner spermatogenous cell. In *Jungermanniceæ* the first division is followed by a symmetrical division of either half into two: (1) a smaller cell which produces part of the wall; and (2) a larger cell which again divides to form a second wall-cell and a spermatogenous cell. Goebel regards cell 1 as equivalent to a quadrant cell of the *Marchantiaceæ*, which is sterilised. This process goes further in the archegonium of both groups, the first division separating a quarter wall-cell from an unsterilised one which gives rise to the remaining wall-cells and the axial row (oosphere and canal- and cap-cells). The first division thus homologises with that of an antheridium one, (vertical) half of which is sterilised from the outset, while the other half may be compared with half the Jungermannian antheridium. Similar considerations apply to the homologies of Leaf-mosses. He cites rather incomplete observations of Lindberg of antheridia with a necklike prolongation on the *female* plants of the diœcious Moss, *Hypnum* (*Brachytherium*) *erythrorhizum*, and a similar account by Janczewski of antheridia prolonged into a neck with canal-cells in *Catharinea* (*Atrichum*). He regards the neck-canal- and central-cells of Pteridophytes as together equivalent to the spermatogenous cells of Pteridophytes. The main differences between the evolution of male and female organs are due (1) to the abeyance of divisions in the female; (2) to the sterilisation of cells in the female; (3) to the differentiation in size and function of sister-cells in the female, often involving changes in space-relations.—*M. H.*

Sieve-tubes.

Sieve-tubes of Pinus, Histology of. By Arthur W. Hill, M.A. (*Ann. Bot.* vol. xv., No. lx., p. 576).—The first mention of the sieve-tubes of Gymnosperms was made by De Bary in 1877, who described and figured those of *Encephalartos* and *Sequoia*. Those of the *Coniferæ* have since been examined and described by several botanists, but the conclusions at which they arrived do not always agree, and a good deal of uncertainty has existed in consequence on questions concerning the development and the character of the means of communication between adjoining sieve-tubes. The present research was therefore undertaken, first, with a view of finding out which of the views (here related in a valuable historical account) really agreed with the observed facts; and secondly, whether by the use of Gardiner's methods any fresh light could be thrown on the development and structure of the sieve-plate. As to the first point it is found that the results obtained by Russow harmonise in the main with those brought forward, for he saw that the mature sieve-plate is traversed by callus-rods which enclose strings of slime. "The callus has been thought by some writers to be the most important and essential part of the sieve-plate, for the rods of callus were considered as the actual connecting elements; but it seems to have been established beyond a doubt from the present researches that the slime-strings, which were first noticed by Russow, afford the true and only direct means of intercommunication between adjoining sieve-tubes. It remains then to be seen if explanation can be offered to account for the presence of the callus-rods, and whether any function can be assigned to these conspicuous and invariable associates of the slime-strings." The slime-strings of Angiosperms have always been regarded as important factors in the translocation of elaborated food materials, and there is no doubt, the author says, that the smaller ones of the sieve-plate of *Pinus* perform similar functions. Premising this, the explanation above alluded to is interesting, for it is likely that the callus which swells so easily may be a kind of spongy lining to the canals of each slime-string, and may regulate when necessary the dimensions of the pores of the active sieve-plates. These slime-strings of the mature sieve-plates, it may be observed, result from the conversion of the protoplasmic threads of the developing sieve-plate, so all-important for the transmission of stimuli from cell to cell, as well as for the passage of water and substances in solution. There is much of interest in this paper to which no allusion can be made. It is well and clearly illustrated by the author's drawings, and forms a valuable contribution to histological botany.—*R. I. L.*

Silver Fir 'Witch-broom' Fungus.

Silver Fir 'Witch's Broom': Life History of the Fungus which causes it. By Ed. Fischer (*Zeit. f. Pflanz.* xi. pp. 321–343; 4 figures; 2/1901).—An important contribution to the life-history of 'witch's broom' canker of Silver Fir. This disease, almost as destructive to timber of Silver Fir as the *Peziza* canker is to the Larch, is produced by the action of a parastic fungus—*Æcidium elatinum*—well known and described in the text-books since De Bary identified it in 1867. Æcidiospores are produced on the 'witch's brooms,' and infection of healthy Silver Firs by these has been often attempted, but without success, so that it was generally supposed, as De Bary suggested, that the fungus was one of the heterœcious Uredineæ and completed its life-history on some other substratum than the Fir; in other words, that it resembled rust or mildew of Wheat. E. Fischer, of Bern, who is experienced in the ways of *Uredineæ*, found opportunities of examining the development of 'witch's brooms' in certain tree nurseries. Suspecting the existence of another host-plant, he examined plants attacked by *Uredineæ* in or near the nurseries; amongst others *Stellaria nemorum* was found with uredospores and teleutospores of *Melampsorella caryophyllacearum*, DC., which has no known *Æcidium* stage. As the result of experimental infections in 1901, Fischer succeeded (1) in infecting young twigs of Silver Fir by the basidiospores (sporidia) produced from teleutospores off *Stellaria nemorum*, and in obtaining the early stages of 'witch's broom' canker; (2) in infecting *Stellaria* by æcidiospores from Silver Fir, and producing the *Melampsorella*. Successful infections were obtained on *Stellaria nemorum*, *S. media*, and *S. Holostea*. Tubeuf, of Berlin, recently announced the infection from the same source of *Stellaria media*, *S. nemorum*, *S. graminea*, and *Cerastium semidecandrum*. *Melampsorella* is known on species of *Stellaria*, *Cerastium*, and other *Alsineæ*, but whether infection of Silver Fir takes place from all these host-plants remains yet to be decided. The Silver Fir in Britain is generally a park tree, but in Germany &c. it is a forest tree, so that the discovery is important. The author suggests the removal of *Stellaria* spp. and other host-plants of the uredo- and teleuto-spore stages from nurseries where young Silver Fir is grown; in this way the source of infection—teleutospores—will be destroyed.—*W. G. S.*

Soils and Plants.

Sudetic Alps, Plant Formations of (*Beih. Bot. Cent.* bd. xi. ht. 6, pp. 418–435).—Herr M. Zeiske (Cassel) gives a brief but interesting account of the various formations, which he places as follows:—

1. Stone Lichen formation. *Lecanora*, *Lecidella*, *Parmelia*, *Gyrophora*, *Stereocaulon*, and other Lichens on bare rock.

2. Rock Moss formation. Wet or damp stone covered by Mosses such as *Grimmia sulcata*, *Racomitrium*, and *Gymnomitrium* species, &c.

3. Humus-covered rocks. *Arabis alpina*, Saxifrages, *Woodsia*, *Allosorus crispus*, &c.

4. Grass and moors of the higher summits. Grass-formation. *Nardus stricta* and *Festuca ovina*; moors of *Calluna vulgaris*, *Vaccinium Vitis-Idæa*, with *Helianthemum Chamæcistus*, *Carex hyperborea*, and other characteristic plants.

5. Meadows of which some are richly manured, whilst others are of natural herbage on stony and barren places. Characteristic plants are *Hieracium aurantiacum*, &c., for the first, and *H. nigrescens*, &c., for the second variety.

6. Bush or shrub formations. *Prunus Padus* v. *petræa*, *Rubus Idæus*, &c.; *Daphne Mezereum*, *Pinus montana* v. *Pumilio*, &c.

7. Streamsides and spring swamps. *Epilobium anagallidifolium*, &c.

8. Peat Mosses and moors. *Empetrum nigrum*, *Carex limosa*, &c.

9. Overflowed Mosses, &c. *Hypnum arcticum*, *Fontinalis*, *Lemanea sudetica*, &c., attached to the bed of the stream.

The author also clearly points out the connections between the various formations and the manner in which they overlap.—*G. F. S.-E.*

Anatomy of Utricularia.

Utricularia, Researches on the Anatomy and Development of the Bladders of. By Hans Meierhofer (*Flora*, vol. xc. 1902, pp. 84–113; pls. 2–10).—The anatomy of these curious organs is very fully described. The development of the bladders was traced on the winter shoots (propagula) and the growing points of the summer stem. Each may be compared to a hand with the fingers apposed; the hollowing of the palm and the elevation of the sides make it cup-shaped; and then the distal half turns in and forms the valve, which closes against an ingrowth from the wrist end. From development and comparison with other organs in different species it is certainly a modified leaf-lobe, or in a few cases a modified leaf.—*M. H.*

Root Growth.

Vicia Faba, Studies on Growth and Cell Division in the Root. By Blanche Gardner, B.S. (*Contr. Bot. Lab. Phil.*, vol. ii., No. 2, p. 150; 1901; pl. 18).—These studies were originally undertaken to determine the growth of the root under varied environmental conditions, but during the progress of the work several additional interesting lines of study have suggested themselves, as

(*a*) Daily periodicity of growth in roots.

(*b*) Relative growth of roots in different chemical solutions.

(*c*) Cell division.

A synopsis would require the use of the tables and three plates of diagrams in illustration.—*M. C. C.*

Electrical Test of Seed Vitality.

Vitality of Seeds, Attempt to estimate the, by an Electrical Method. By Augustus D. Waller, M.D., F.R.S. (*Ann. Bot.* vol. xv., No. lviii., p. 427).—For all practical purposes of horticulture the experimental method of sowing is no doubt the only one by which we should care to know anything of the vitality of seeds, but this electrical method is certainly one which appeals very strongly to the mind. This paper is under the head of "Notes," and is abridged from the paper in *Proc. Roy. Soc.* vol. lxviii. 1901, p. 79. Dr. Waller has been engaged in verifying whether "blaze currents" may be utilised as a sign and measure of vitality, but without limitation apparently to vegetable life. He has selected as a test case the vitality of seeds, and has chosen the Bean (*Phaseolus*) for convenience. By "blaze current" (a new term) is meant the galvanometrical token of an explosive change locally excited in living matter, and if this "blaze current" is in the same direction as the exciting current it is, in Dr. Waller's experience, proof positive that the object under examination is alive. The magnitude of the "blaze" reaction corresponds largely with the degree of vitality and to some extent is a measure of it. A boiled Bean gives no "blaze current" in either direction, and the comparison between the reactions of fresh seeds and the same seeds killed by boiling is unmistakable and invariable.—*R. I. L.*

Use of Water-excretion.

Water-excretion, the Significance to Plants of Organs effecting. By Wladimir Lepeschkin (*Flora*, vol. xc. 1892, pp. 42-60).—The function ascribed to these organs was that of preventing the injection of the intercellular spaces with water by root pressure during closure of the stomates, such injection being considered deleterious and interfering with the free interchange of gases in plant assimilation. In the author's first series of experiments he found that injection was rare, at most partial, and did not increase beyond its first appearance, when the water pores had been removed by cutting off the margin of the leaf, and after the wound had healed by cork and the vessels (which bled at first) closed by gum. In his second set of experiments he injected leaves with water under the air-pump, and found that their power of carbon assimilation was unchanged, the increased permeability of the saturated surface probably counterbalancing the diminution of the air surfaces within. He concludes that hydathodes have rather an inherited than a functional significance.—*M. H.*

Generative Process of Zamia.

Zamia, Spermatogenesis and Fecundation of (*U.S. Dep. Agr.* (*Bur. Pl. Ind.*), *Bull.* 2, pp. 7-92; pls. 7).—Mr. Herbert T. Webber gives a very complete account of the development, shape, and fertilisation phenomena in *Zamia floridana*, DC., and *Z. pumila*, L. Pollen is blown by the wind, enters between the scales, and is caught and drawn into the pollen-chamber by a special mucilaginous fluid. There are two small prothallial cells, or probably three, of which one is afterwards "resorbed." The first prothallial cell protrudes into the second till the latter appears to surround the former (cf. *Coniferæ*). Bodies resembling centrospheres (*blepharoplasts*) are formed in the cytoplasm. They are at first very small, and a few radiating filaments converge to them.

These bodies increase in size, are surrounded by a membrane, and become vacuolated; their kinoplasmic radiations take no part in spindle formation; they eventually break up into numerous granules. The cilia-bearing band of the spermatozoid is formed from the blepharoplast. The entire spermatid cell becomes a spermatozoid. The above-mentioned band is a helicoid spiral of five or six turns. The pollen tubes appear to produce part of the fluid in which the spermatozoids swim.

The mature spermatozoids are very large, being visible to the naked eye. The cytoplasm of the spermatozoid unites with that of the egg-cell, and their nuclei also unite.

The paper is of great interest to students of the nucleus, cytology, and centrosomes. The figures are exceedingly good; there is also a bibliography.—*G. F. S.-E.*

ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

Abnormalities, Some Plant. By G. H. Shull (*Bot. Gaz.* xxvii. No. 5. p. 343).—The following are described, fasciation in *Erigeron canadensis* and *Echium vulgare*, a double-bladed leaf of *Pelargonium* to which the petiole bore two perfectly formed blades united along a single vein, having their undersides opposed to each other. A leaf of *Hicoria* having a deeply lobed terminal leaflet, possibly due to the presence of a gall; abnormal forms of the petals of Sweet Pea; ditto of the sepals of *Clematis Jackmanni* showing cohesion, &c.; foliaceous sepals of 'Star of India' Clematis.—*G. H.*

Acacia spp. Experimental Stations. 1. Wairangi. Report by E. Clifton (*Dep. Agr. N.Z.*, *9th Rept.* p. 153; 1901).—The Wairangi station is the property of the Government, and embraces an area of 1,800 acres. The land was considered of the poorest description, and was originally commenced as a plantation for cultivating the Wattle for tanning and bark. Unfortunately, at that time, the particular variety of Wattle, or Acacia, the *Acacia decurrens*, was not recognised as the most valuable and suitable for that district; in consequence about 400 acres were sown with mixed seed, in which that of the comparatively worthless *Acacia dealbata* predominated. The bark of this variety not only contains a much less percentage of tannic acid, but the tree itself returns a much less weight of bark than *Acacia decurrens*. The purchasers show the difference in the actual price obtained from them: *decurrens* sold at £7 15*s.*; *dealbata*, or Silver Wattle, at £4 5*s.* Settlers now quite realise the importance of sowing the seed of the *decurrens*. In warmer districts, on the better land, the Golden Wattle (*Acacia pycnantha*) may be profitably grown. It produces the greatest percentage of tannic acid. Here it is caught by the frost, and does not grow to more than a large shrub. It is inclined to retain a large number of branches. The stems are seldom clear; the bark is more difficult to remove, and the process is more costly. *R. N.*

Acanthus arboreus. By C. Sprenger (*Gard. Chron.* No. 797, p. 221, fig. 70; 5/4/1902).—This fine species was first sent to Europe by Professor Schweinfurth from Arabia Petræa, and it appears to be one of the finest plants in the flora of that country. It is also found in parts of Egypt, and has proved to be hardy at Naples during last winter and is now in full flower there: it does not suffer from a slight frost, but the leaves fall, and the stems dry up at a temperature below 25 Fahr. It is an evergreen very spiny shrub growing to a height of nine or ten feet. The flower heads are long and cylindrical, the flowers are of a waxy white colour at the base and purple or carmine elsewhere. It is easily grown from seed, and should do well in a succulent house; it requires as much light as possible.—*G. S. S.*

Acclimatisation Experiments. By Prof. G. Roster (*Bull. R. Soc. Tosc. Ort.* 2, 3, 4, pp. 35, 67, 103; February, March, and April 1902).—These were conducted in the Garden Ottonella on the island of Elba. The garden is subjected to strong easterly winds, being more protected from the westerly winds blowing from the sea. The mean annual temperature of the island is 15·8°, that of winter 8·7°. Rain is scarce, having a mean annual fall of 600 mm., but so distributed as to leave a long period in spring and summer of absolute dryness modified by abundant dews. The prevailing winds in spring and summer are the N.W. and S., in winter the N. and E. As the soil of the garden is naturally hard, compact, stony, and poor in humus, containing a large proportion of silica, resulting from the disintegration of quartz and other rocks, it becomes necessary to mix good arable soil, leaf-mould, sand, and manure therewith, if Palms, Vines, and other plants are to be grown at all. The question of the mechanical and physical properties of the soil playing a more important *rôle* in the acclimatisation of plants than the chemical and petrographical properties do is next discussed, especially the varying power which different soils possess of inducing the circulation of heat, moisture, and gases; *e.g.* lime and magnesia appear to possess an influence in diminishing the calorific conductibility of the soil. Peaty soil exhibits the most, and sand the least, constant temperature of all. In this garden summer is found to be the best season for planting, as in autumn very heavy rains and gales prevail. Experience shows that young plants flourish better than old ones when planted out, especially Palms and other plants, which are used to a warm temperature. Giving artificial shelter to the plants is a mistake and unfair to acclimatisation tests. The wind is the great enemy of the Garden Ottonella. The plants which suffered from the mechanical action of the wind were the Palms: *Seaforthia elegans, Ptychosperma Alexandræ, Chamædorea, Howea, Rhopalostylis*; and *Musa Basjoo* (especially), *M. paradisiaca, M. sapientum*, and *M. Ensete*. Of those which proved indifferent to winds were: *Phœnix, Pritchardia, Brahea, Washingtonia robusta, Cocos* sp., *Jubæa spectabilis, Sabal, Latania borbonica, Livistona*, and all the Cycads. Those whose young leaves and shoots are affected by the salt winds are: Spiræas, *Tecoma grandiflora, Mina, Bosea Yervamora, Cuphea jorullensis, Bougainvillæa glabra, Brugmansia suaveolens, Mackaya bella, Pleroma vimineum. Cactaceæ, Amaryllidaceæ*, and *Liliaceæ* proved to be refractory to both violence and saltness of the wind. Those which, after three or four years' introduction, suffer from sun-heat, are: *Chamædorea* (especially), *Howea, Rhopalostylis, Seaforthia, Ptychosperma, Caryota.* Those which resist it are: *Phœnix* (especially), *Jubæa spectabilis, Cocos* sp., *Pritchardia filifera, Washingtonia robusta, Brahea, Chamærops, Rhapis flabelliformis, Rhapidophyllum Hystrix, Nannorrhops Ritchieana*, and all the Cycads. *Cocos Weddelliana* is very delicate and sensitive. Others which are sensitive are mentioned, such as *Musa, Coffea, Hoya, Pleroma, Dracæna, Mina.* The Palms most resistent to drought are: *Jubæa spectabilis, Phœnix sylvestris, Brahea Roezli, Chamærops humilis, Nannorrhops Ritchieana.* Cycads do not require much watering, except when forming young leaves. *Cacti, Liliaceæ, Amaryllidaceæ* require some watering in summer. Acacias withstand drought remarkably well. Then follows a list of plants which have done especially well; of those which hardly flourish at all, such as Bamboos and most Australian Palms; and of plants which have perished from cold or unknown causes.—*W. C. W.*

Aconite, Winter, Smut attacking. By William Carruthers (*Jour. R.A.S.* vol. lxii., p. 248, 1901).—An example of smut *Urocystis anemones* was sent from Cambridgeshire. It had attacked winter aconite (*Eranthis hyemalis*, Salisb.). This *Urocystis* has been observed on other plants of the order *Ranunculaceæ*."—*R. N.*

Adonis, Perennial. By G. Reuthe (*Garden*, No. 1583, p. 191; 22/3/1902).—There is not a single species or variety of *Adonis* that does not deserve to be cultivated. So states the writer of this article, and he proceeds to describe the perennial ones and to give much useful cultural and general information concerning them.—*E. T. C.*

Æranthus ramosus, Cogn. (Cogniaux in *Dict. Icon. Orch.*, Æranthus, pl. 2; 2/1902).—A curious species introduced from Madagascar in 1901 by M. Peeters, of Brussels. Flowers pendent, olive green.
C. C. H.

Æthionemas, Perennial Species of. By G. Reuthe (*Gard. Mag.* No. 2527, p. 212; 5/3/1902).—A descriptive account of the few species of *Æthionema* in cultivation by a writer who has collected them in a wild state and grows in this country. It is one of the best accounts of these exquisite Alpine flowers that have appeared in the journals.—*W. G.*

Agriculture and Free Trade in England. By A. Dulac (*Ann. Agr.* pp. 497–533; November 1901).—An able article on the economic conditions of production in England.—*C. H. H.*

Alabama, Plant Life of. By Ch. Mohr, Ph.D. (*Contributions from the U.S. National Herbarium*, vol. vi. 1901).—This work, of 846 pp. and index of 75 pp., contains an account of the distribution, modes of association, and adaptations of the flora of Alabama, together with a systematic catalogue of the plants growing in the State.

After a sketch of the history of the earlier botanical explorations of Alabama, the author deals with the general physiological features of the State, geologically considered.

The river systems are then discussed, and the climate, including temperature, rainfall, winds, and cloudiness.

Then follow the general principles of the distribution of plants, Humboldt's and Merriams' "zones" being described; the distribution of species as depending upon geological history; and plant formations and plant associations of Engler and Drude. This part concludes with Warming's new classification, followed by the present ecologists', viz. hydrophytic, xerophytic, halophytic, and mesophytic vegetations.

Then follows the general character of the Alabama flora. It stands in the number of species and varietal forms, as well as in the diversity of their characteristic associations, unsurpassed among those of adjoining regions, such being due to its diversity of topographical features.

Systematically considered, the volume refers to upwards of 2,500 species: 59 are Pteridophyta, 12 Gymnosperms, 707 are Monocotyledons, and 1,700 Dicotyledons. Of the families most abounding in species are: *Compositæ*, 303; Grasses, 289; Sedges, 140; *Leguminosæ*, 116; Labiates, 60; *Scrophulariaceæ*, 59; *Rosaceæ*, 54; *Umbelliferæ*, 46; *Ranunculaceæ*, 43; *Euphorbiaceæ*, 44; *Orchidaceæ*, 40. Orders having from 20 to 40 species are: *Polygonaceæ*, *Liliaceæ*, *Alsineæ* (of *Caryophylleæ*), Ferns, *Malvaceæ*, *Onagraceæ*, *Cupuliferæ*, and *Ericaceæ*.

Only three endemic plants are known: *Neviusia alabamensis*, *Croton alabamensis*, and *Trichomanes Petersii*. Hence the flora closely agrees with that of the adjoining regions.

There is an interesting relationship with Eastern Asia and Japan, first noticed by Asa Gray (*Mem. N.Y. Acad.*, vol. vi., Part 1, 1859). It is here most strikingly manifest in the arboreal and shrubby vegetation of the numerous genera of the catkin-bearing families, such as Walnut, Chestnut, Oak, Beech, Hazelnut, Ironwood, *Ostrya*, Willow, *Myrica*; and of conifers, such as Pine, Hemlock, *Chamæcyparis*, Juniper; to which may be added Elm, Mulberry, Lime, Pear, Plum, *Amelanchier*, Maple, Witch-hazel, *Rhus*, and Ash. This is increased by those confined to the south-eastern section of the continent, as *Magnolia* and *Illicium*, *Persea* and *Benzoin* of the Laurel family; Storax, *Catalpa*, &c.

One hundred and sixty genera, or nearly 26 p.c. of those indigenous in Alabama, belonging to 66 families, have their representatives in East Asia.

Only about 40 species are identical with those in East Asia, though many are closely allied to each other.

Not less than 290 genera, or 40 p.c., are represented in West Indies, Mexico, Central America, and more rarely in South America, as far south as Argentina.

One hundred families, with 230 genera, or 35 p.c., are common with the flora of the Mediterranean regions, while 55 species occur also in Western Europe.

The Sub-floras of Alabama.—As the climate is mild, with an abundant rainfall, the conditions are favourable for tree growth; hence forests constitute the most extensive of plant formations, from the mountain heights of the north to the shores of the Gulf; so that upwards of 50 p.c. of the State has original forest growth. Of 172 arboreal species, fifteen are introductions. The deciduous forests, marked by the prevalence of amentiferous trees, prevail in the northern part of the State. Of the thirty-one species of evergreen trees nearly all are distributed throughout the warmer temperate and subtropical regions of east North America.

The open-land flora is very limited, but the cretaceous plain abounds in certain composites, as species of *Lilium*, *Helianthus*, and *Erigeron*.

The swamp flora is mostly in the lower Pine region of the coast plain. Among the 227 species of vascular hydrophytes, 11 are pteridophytes, 139 species are monocotyledons, and 77 dicotyledons.

There are a certain amount of epiphytes, as among Orchids and Ferns; of saprophytes and parasites, as of *Orobanchaceæ*, species of *Cuscuta* and the ' American Mistleto ' (*Phoradendron flavescens*).

Droseras, Sarracenias, Pinguiculas, and Utricularias represent the insectivorous plants.

Plant Distribution of Alabama.—This is divided first into the Carolinian and Louisianian floras, and these are subdivided into various regions: as mountain, tablelands, Tennessee Valley, Lower Hill country, &c. In each of these lists as well as individual plants characteristic of them are given.—*G. H.*

Allamanda cathartica, L. (*Gartenflora*, p. 169, pl. 1497; 1/3/1902). A short description and coloured plate of this hothouse climber. The flowers are golden yellow, and the plants begin to bloom when three years old.—*J. P.*

Alpine House at Kew, The. By W. Irving (*Garden*, No. 1580, p. 136; 1/3/1902).—Early in the year, and in spite of the severe weather, this house contains many interesting and beautiful plants in flower, and in these notes the principal ones growing are described. An illustration is also given of the plants in flower in the house in February.—*E. T. C.*

Alsine validus, n. sp. By L. N. Goodding (*Bot. Gaz.* xxxiii. No. 1, p. 69).—This is separated from its nearest ally, *A. longipes*, by the many flowered cyme, wide-spreading pedicels, &c.—*G. H.*

Amaryllids, Three Fine. By G. Bornemann (*Die Gart.* p. 184; 18/1/1902; with illustrations).—*Crinum yemense* and *Hymenocallis caribæa*, also *Hæmanthus* 'König Albert,' are illustrated and well recommended.—*G. R.*

Ammoniacal Manures: Their Use on Calcareous Soils. By E. Giustiniani (*Ann. Agr.* pp. 462-486; October 1901).—*C. H. H.*

Amphicarpæa monoica, Recent Observations on. By Adeline Frances Schively, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii. No. 1, p. 20).—A continuation of a previous paper in the same publication detailing results of experiments on legumes and seeds of this species, showing variations produced by external conditions in legumes and seeds both of the aërial and subterranean type; and of a white variety observed in the neighbourhood of Strafford Station, Pa.—*M. C. C.*

Angræcum Eichlerianum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7813).—Nat. ord. *Orchideæ*, tribe *Vandeæ*. Native of Calaban. The sepals and upper petals are green, the broad and pointed lip being white with a yellowish-green colour within. It is 3 inches from the tip of the dorsal sepal to that of the lip, the spur being one inch in length, spindle-shaped, and green.—*G. H.*

Angræcum Scottianum, Rchb. f. (Cogniaux in *Dict. Icon. Orch.* Angræcum, pl. 7; 2/1902).—Introduced by John Kirk in 1878 from the island of Johanna. Flowers small, white with pale red spur.—*C. C. H.*

Antirrhinum anthracnose on Yellow Toad-Flax. By F. C. Stewart and H. J. Eustace (*U.S.A. Exp. Stn. New York, Bull.* 200, pp. 87–89, 1901).—The fungus of Antirrhinum anthracnose (*Colletotrichum antirrhini*), which was supposed to be confined exclusively to *Antirrhinum*, has recently been found on the common yellow Toad Flax. Since this weed may communicate the disease to *Antirrhinum*, care should be taken to exclude the Toad Flax from the neighbourhood of gardens where *Antirrhinum* is cultivated.—*M. C. C.*

Apple Orchard, Growing the. By Wm. B. Alwood (*U.S.A. Exp. Stn. Virginia, Bull.* 99).—Laying off the orchard; distances for planting; interspacing, establishing the position where the tree is to stand; digging the holes; preparing the trees for planting; setting the trees; selecting nursery stock; time of setting; pruning young trees; growth of pruned and unpruned trees; cultivating the young orchard, first and second years; high or low heading. Well illustrated.—*C. H. H.*

Apple Orchard, The Experimental (*U.S.A. Exp. Stn. Kansas*; January 1902).—Trial of budded trees with trees grafted on whole and piece-root, cultivation by plough, acmé harrow, and disc cultivators.

The great principle is that the soil should be stirred as soon, after each rain that softens the surface, as the ground is in suitable condition, to prevent the formation of crust and the resulting evaporation and to obtain the valued dust mulch.

Cow Peas considered the best cover crop for winter. Observations have been made as to the date of blossoming and investigations of the problems of pollination begun. Description of varieties of trees, habit of growth, bark on trunk, branches, twigs, foliage, bearing.—*C. H. H.*

Apple Rots in Illinois. By George P. Clinton (*U.S.A. Exp. Stn. Illinois, Bull.* 69; 10 plates; February 1902).

The Brown Rot (*Monilia fructigena*) in some years is a common cause of the rotting of summer varieties.

Soft Rot (*Rhizopus nigricans*) is more of a saprophyte than a parasite, and is a common cause of rotting in mature fruits.

Fruit Blotch (*Phyllosticta* sp.) appears at first as small dark coloured blotches of irregular shape scattered over the surface of the Apples. On these are seen the small pustules or conceptacles which contain the spores, which are oval (7–10 μ long). These will germinate readily in a drop of water. Later in the season the discoloured spots become enlarged, and more or less merged in extended and often slightly sunken areas, and the diseased tissue extended inward, so that sometimes the whole Apple is affected with dry rot. The fungus is distinct from *P. limitata* (Peck), and also *P. pirina* (Sacc.) and *P. prunicola* (Opiz.). So far as can be ascertained, the fungus seems to be a new species.

Black Rot (*Sphæropsis Malorum*).—This rot usually appears on green Apples only where injured in some manner, and commonly on windfalls.

Bitter Rot (*Glœosporium fructigenum*).— By far the most destructive of any of the Apple rots, and here fully described in its various phases. It begins to appear on the green fruit about July, when sporules are developed. In the fall, or succeeding spring, an ascigerous stage is produced as a saprophyte, and this has been named *Gnomoniopsis* *fructigena* (Clint.); the perithecia are often concealed by dark olive mycelial felt, the asci somewhat club-shaped (55–70 μ long), the sporidia sausage-shaped (12–22 × $3\frac{1}{2}$–5 μ). This stage is only developed on decayed fruits. Artificial cultures and experiments on infection are described fully. Old bitter-rot Apples lying on the ground or mummies attached to the tree are apparently the source of infection for the coming year, and these especially should be destroyed. Spraying for the early stage has been tried with more or less success. To be of service it should be commenced before the first appearance of the rot, and repeated until all danger is past.—*M. C. C.*

Apple Sawfly, The. By F. Martin Duncan (*Gard. Mag.* No. 2521, p. 113; 22/2/1902).—An illustrated account of this insect pest. Its life-history is given, as well as notes on the various ways of preventing its ravages. The codlin moth is also described, so that the difference between it and the Apple sawfly may be recognised.—*W. G.*

Apple Trees, The early Growth and Training of. By Charles A. Keffer (*U.S.A. Exp. Stn. Tennessee*; December 1901).—Most of the growth is made by July 1. The outermost branches make their principal growth in length earlier than do those nearest the trunk. The terminal shoots after June 30 grow less than the laterals. Pinching is employed to maintain symmetrical development in young trees: it causes the buds immediately below to become more mature and more certain to form branches than they otherwise would. The object of training is to get ample light to every part of the crown when the tree shall come into bearing, while securing the greatest possible strength in the branches.

C. H. H.

Apples, Classes of. By E. Bartrum, D.D. (*Gard. Mag.* No. 2518, p. 65; 1/2/1902).—A series of notes (continued in Nos. 2519 and 2520) upon Apples classified in groups such as the Calvilles or Colvilles, Rennets or Reinnettes, Pearmains, Russets, and so on. Dr. Bartrum discusses the subject in such a way that the articles are most interesting reading, giving historical notes on the sorts, their relative value from an edible standpoint and adaptability to various soils and localities, besides many interesting notes one does not find in the ordinary standard works on pomology. Dr. Bartrum should himself write a book on the subject embodying these fragmentary contributions on his favourite subject.

W. G.

Apples, Little-known. By E. Molyneux (*Garden*, No. 1582, p. 174; 15/3/1902).—There are certain varieties of Apples, exclusive of local ones, that are little known to Apple growers generally, and a number of these are given by Mr. Molyneux, together with valuable remarks as to their characteristics.—*E. T. C.*

Apples: Some Diseases of Trees and Fruit. By Dr. T. J. Burrill (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 438–446).—This is a valuable paper upon Apple scab, bitter, black, and brown rots, blight, brown gall, and rotten root. The author prefaces his paper with a short review of the growth of diseases in Apple orchards in this part of the United States and warns growers against neglect. For the scab the author recommends spraying with Bordeaux mixture. For the rots he points out that one spraying early in the year will not suffice. Further spraying must be carried out later in the season. For the blight the only really practical method of fighting the disease is by cutting away the infected parts. During the last half of June and July the trees should be inspected every week, and every vestige of the infection should be destroyed by cutting well below the affected parts. The author does not seem to be ready with remedies for brown gall and rotten root.

V. J. M.

Apricot Pulp for the London Market (*Agr. Gaz. N.S.W.* p. 262 ; February 1902).—Some months ago a shipment was made to the Agent-General for New South Wales of a consignment of thirty-six cases of Apricot pulp, which was placed in the hands of Messrs. W. Weddell & Co. for disposal. Concerning the report made by Messrs. Weddell, Mr. W. J. Allen, the fruit expert of New South Wales, states :— " The object in sending a shipment of Apricot pulp to the old country was to ascertain the opinion of experts there as to its quality, and also to find out whether it would sell at such a price as would warrant growers of this State catering for this trade. The report as to quality is highly satisfactory, and in the opinion of experts ranked fully equal to best Spanish, which is considered the best on the market. The comments as to the tins carrying full weight of unbroken fruit and with less water in than the best Spanish are, I consider, very favourable, as fruit in such condition can be used for canning as well as for jam-making, and is in consequence more valuable than broken watery pulp. Although the pulp sold at the highest price, still it would not pay New South Wales growers to put it up at that figure, as the price realised would not pay for the work—the picking, pulping, carriage, and commission—to say nothing of the value of the fruit."—*H. G. C*

Apricots, Pruning. By Alger Petts (*Gard. Mag.* No. 2517, p. 48 ; 25/1/1902).—Attention is directed to this subject, as the practice described by the writer differs from that usually followed in the pruning of Apricots. The system is that of summer and early autumn pruning instead of winter pruning, which the writer asserts conduces to gumming and loss of large branches, a failure to which the Apricot is peculiarly liable.—*W. G.*

Aquilegia Helenæ hort. By G. Arends (*Die Gart.* p. 211 ; 1/2/1902 ; with coloured plate).—The plant described and figured is the product of crossing *Aquilegia flabellata* with *A. cærulea.* The plant reminds one of a vigorous long-spurred *Aquilegia Stuarti* or *A. glandulosa.* A strictly perennial, vigorous, and free-flowering form, and not liable to disappear after two or three years' growing like *A. glandulosa.*—*G. R.*

Arachnanthe moschifera (*Orch. Rev.* p. 88 ; March 1902 ; fig.).—Particulars of this rarely seen species of Orchid and an illustration showing its quaint characteristics are given.—*H. J. C.*

Arauja graveolens. Anon. (*Gard. Chron.* No. 792, p. 139, fig. 42; 1/3/1902).—The seeds and seed pods of this plant are the subject of an interesting figure, which gives their details in a very clear manner and shows the curious way in which the seeds are detached by the tuft of hairs attached to them. An allusion is made to some confusion in the nomenclature of these plants.—*G. S. S.*

Aristolochia grandiflora and Aristolochia Gigas from Seed. By O. Zipperlen (*Die Gart.* p. 184; 18/1/1902).—From own seeds saved sown in March, they flowered in September 1901. Culture of these interesting showy species is much recommended.—*G. R.*

Aristolochia macroura Gomez × A. brasiliensis Mart. et Zucc. By J. Hölscher (*Die Gart.* p. 256; 1/3, 1902; with illustration). A most interesting article; treats the hybrid of a very distinct and free-flowering *Aristolochia* raised by Mr. E. Uhle from seeds distributed to different botanic gardens, of which a packet reached the Breslau Botanic Gardens. The seeds at once sown grew rapidly, and one of the plants was after a few months large enough for planting out in a greenhouse; the plant flowered the same year, but, being late in the season, rather imperfectly. The plant had to be cut back and wintered in a stove. The following summer it grew well, and produced flowers in great numbers, more so than in the species. E. Uhle describes this hybrid as being entirely intermediate between the parent plants, but more distinctly developed in some parts.—*G. R.*

Aroids, Malay. By H. N. Ridley (*Journ. Bot.* 469, pp. 34–38; 1/1902).—Descriptions of *Homalonema, Curtisii, argentea, falcata, propinqua, multinervis, mixta,* and *crassa, Schismatoglottis marginata, longifolia,* and *longicaulis,* and *Raphidophora lætevirens,* new Malayan species, with notes on other species.—*G. S. B.*

Ash Constituents of Plants: Their Estimation and their Importance to Agricultural Chemistry and Agriculture. By B. Tollens, of Göttingen (*U.S.A. Exp. Stn. Record,* vol. xiii., Nos. 3 and 4, 1901).—An excellent and lengthy treatise on the subject, a standard work.—*C. H. H.*

Asparagus of Cascine dell' Isola. By G. Papasogli (*Bull. R. Soc. Tosc. Ort.* 1, p. 23; January 1902).—The therapeutic properties of the plant as ascribed to it by various classical writers are cited, after which follows a discussion as to the value of the amide-crystal asparagin, seeing that this substance occurs in many other plants whose nutritive value it cannot enhance, in view of the fact that its nitrogenous constituent becomes reduced in the human organism to the condition of ammonium salts which pass off into the urine. Asparagus owes rather its high position as a favourite amongst vegetables to its delicious taste and perfume. It grows luxuriantly at Argenteuil in siliceous and calcareous soil, but it does not like clayey soils; but, as is proved by the state of things at the above-mentioned institution, the plants may be made, by means of facilities for proper aëration and hydration of the soil, amenable to cultivation in a clayey medium having a pebbly subsoil. The Asparagus grown at the Cascine is in great demand at the Florence market. It is greatly attacked by insects, such as May-bugs, cockchafers, mole-crickets, as also by snails. The former usually appear towards the end of May, laying their eggs on the filiform leaves, which hatch in four or six days, the larvæ feeding on the leaves and the parenchymatous tissues of the stalks. As regards the perfect insects the best remedy consists in shaking the plants over a vessel containing soapy water; but for the larvæ, which cling too tightly to the plant, it is best to use an insecticide.—*W. C. W.*

Aster Amethyst, of the class Pæony-flowered Aster and Aster 'Miss Roosevelt.' By Otto Putz (*Die Gart.* p. 257, 1/3, 1902; with coloured plate).—Evidently two very fine pink and blue coloured German Asters.—*G. R.*

Aster Tradescanti. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,825).—Nat. ord. *Compositæ*, tribe *Asteroideæ.* Native of eastern N. America. This is the original Michaelmas Daisy, first introduced prior to 1633 by J. Tradescant, gardener to Charles I., into his garden, Lambeth. There are two varieties: one with blue flowers, which A. Gray referred to *A. paniculatus*; the other (here figured) is white with yellow disc florets. *G. H.*

Aster Worms. By H. Friend (*Gard. Chron.* No. 796, p. 202; 29/3/1902).—In a long article on the small worm (*Enchytræus parvulus*) the author discusses the possibility of its being the larval form of a larger member of this genus, or of the two species (if so be that there are two) living together in symbiosis. No definite conclusion is come to, but the arguments in favour of both theories are given at length.—*G. S. S.*

Aubrietias. By G. G. (*Gard. Mag.* No. 2514, p. 3; 4/1/1902).—An instructive article describing the various kinds of Rock Cresses, their propagation and culture. The writer suggests various positions for these plants in rockeries, on vertical walls, and in borders. Their most important use is in wall gardening, which should be carried out in every garden where practicable. To the list of good kinds the writer should have added the variety 'Dr. Mules,' undoubtedly the richest and deepest purple of all.—*W. G.*

Azaleas. By G. G. (*Gard. Mag.* No. 2521, p. 114; 22/2/1902).—A descriptive account of the Azalea section of Rhododendron that are hardy in the open air. The writer traces the origin of the so-called Ghent Azaleas, but now the varieties are so numerous and so diverse in characters from interbreeding that it is a difficult matter to trace them to any particular parentage. By the introduction in recent years of more species, such as *A. occidentalis*, *Vaseyi*, *Schlippenbachii*, and others, hybridists may be able to extend the variation in colour, form, and growth into this valuable class of shrubs. Illustrations are given of *A. sinensis* (*mollis*) and American or Ghent Azaleas.—*W. G.*

Bachelor's Buttons? What is the (*Gard. Chron.* No. 788, p. 69; 1/2/1902).—This name has been given to no less than twenty different kinds of plants; the name appears very frequently in garden literature. The question is thoroughly discussed, and various old authors are quoted, but no very definite conclusion is come to.—*G. S. S.*

Bauhinia yunnanensis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7814).—Nat. ord. *Leguminosæ*, tribe *Bauhinieæ*. Native of China. This is a very graceful greenhouse climber. It flowers freely at Kew and at Cambridge. The flowers are pale pink in colour, the three perfect stamens carmine.—*G. H.*

Beans: Their History and Cookery: By H. Roberts (*Gard. Mag.* No. 2527, p. 217; 5/4/1902).—The writer of this article succeeds in giving a new interest to the prosaic subject of the Broad Bean and its usual accompaniment of bacon. He even invests it with additional value as an ornamental plant, which it undoubtedly is, though it is rarely seen in a hardy flower border. Why the ancient Egyptians should have considered the Bean an unclean thing and why it was held in high esteem by Greeks and Romans is unexplainable, and if correct the facts show the eccentricities of human nature. From the historic notes of the Broad Bean, its introduction into England, the allusion to it in Chaucer's writings, the article ascends or descends to the more practical uses of the Bean in the various ways of cooking it. Cooks and housewives should read this article. *W. G.*

Begonia 'Gloire de Lorraine,' Dwarf (*Rev. Hort.* p. 102; March 1, 1902).—A very dwarf form, compact, with very large flowers, is described as exhibited at the Florists' Club, Philadelphia.—*C. T. D.*

Begonia × Kyddii (J. H. Murray in *Amer. Gard.* xxiii. p. 150; 8/3/1902).—A handsome Begonia raised by D. Kidd for Mr. Weiland, of New Haven, Conn., between *B. Scharffiana* and *B. metallica*, and quite distinct from *B. Haageana*. Flowers many, in large clusters, rose-pink; males with two round and two narrow petals, females with five equal petals; peduncle erect, 1½ foot above the leaves.—*C. C. H.*

Berry Growing. By Geo. W. Williams (*U.S.A. St. Bd. Missouri Bull.* vol. i. No. 11; 1902).—Good description of American methods of growing Blackberries and Strawberries. When you can pick up a handful of earth and squeeze it into a mud-ball, it is too wet for hoeing. *C. H. H.*

Black Currant Mite, The. By W. E. B. (*Gard. Chron.* No. 790, p. 105; 15/2/1902).—An interesting résumé of a paper published in the Royal Agricultural Society's *Journal* of the life-history of this mite. The first notice of this pest was published in 1869 by Prof. Westwood in the *Gardeners' Chronicle*, and for many years the life-history of these mites was practically unknown, the minute size of the creature (it is invisible to the naked eye) rendering observations very difficult; but Mr. C. Warburton, with the assistance of Miss A. L. Embleton, has cleared up many points in its history, but at present there does not seem to be any satisfactory method of destroying this pest.—*G. S. S.*

Bitter Rot of Apples. By Professor T. J. Burrill (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 166–178).—Dr. Burrill, who is an authority upon this and kindred subjects, has here contributed a valuable paper. From laboratory experiments it seems that the spores of the fungus may send their germinal tubes into the unbroken skin or epidermis of the fruit within the space of eight to fifteen hours, and this quite without the aid of insects. In hot weather only three to five days will often suffice for a new crop of spores to appear.

The threads originating from the germinating *Glœosporium* spore penetrate deep into the flesh of the Apple, and where they go the pulp cells of the fruit are destroyed. The colour changes to brown ; other changes take place, and at last the crisp and juicy flesh becomes a tough, dry, and shrivelled mass. Flies and other insects are proved to be disseminating agents, and even rain-water splashes are shown to cause a spread of the disease. The whole paper is exceedingly interesting and well repays a perusal.—*V. J. M.*

Bone Meal, The Fertilising Action of. By Kellner and Böttcher (*Ann. Agr.* p. 441 ; September 1901).—Bone meal does not give as good a result on soil with much lime as superphosphate or basic slag, although it gives a better result on soil without lime.—*C. H. H.*

Botanic Gardens, Sydney, Records of the (*Agr. Gaz. N.S.W.* p. 195; February 1902).—An interesting article dealing with the history of these gardens, in which it is pointed out that the gardens in the old days were actively engaged in distributing economic and other plants of all kinds with the view of promoting colonisation and settling problems of acclimatisation.

The Sydney Botanic Gardens have for nearly a century been bound up with the material welfare of the colony, but much of their work has, of course, been for many years unnecessary by reason of the establishment of so many respectable firms of seedsmen and nurserymen. The following list of vegetable seeds is interesting as showing the sorts and varieties that were available in Sydney seventy years ago :—

BROCCOLI—
- Early White.
- Dwarf Liberian.
- Cream-coloured.
- Early Sprouting.

CABBAGE—
- Early Dwarf.
- Early Battersea.
- Imperial.

CELERY—
- Céleri tres blanc gros.
- Solid Red.

LETTUCE—
- Tennis Ball.
- White Dutch.
- Unions.
- Laitue de Malthi.
- Paris Cos.
- Marseilles.
- Belle Bonne.
- Large White Silesian.

RADISH—
- White Spanish.
- Black Spanish.

ENDIVE—
- Large-leaved Bavarian.
- Lettuce-leaved.
- French Curled.
- Common Curled.

GOURDS—
- Vegetable Marrow.
- Cobbels.
- Potiron Jaune.

MELONS—
- Gem.
- Kissing.

Large Gunnesk.
Water.
Harrison's Hybrid Cantaloupe.

TOMATOS—
Large Red.
Large Yellow.
Pear-shaped.

BASIL—
Common.
Bush.

HARICOTS—
De Soissons.
Scarlet Runners.
Princess.
Riz.
De Canada.
Dwarf China.
Cream-coloured.

MISCELLANEOUS—
Flanders Spinach.
Brussels Sprouts.
Seakale.
Asparagus.
Couve Tronchuda.
Early Cauliflowers.
Celeriac.
Dwarf Curled Kale.
Tall Curled Kale.
Green Curled Savoy.
Yellow Curled Savoy.
Kohlrabi.
Large Flag Leek.
Rampion.
Altrincham Carrot.
Early Horn Carrot.
Purple Egg Plants.

Then follows correspondence respecting the introduction of European forest trees into New South Wales, the Busby Vines, the introduction and distribution of economic plants to the Hunter River, &c., the supply of plants to Brisbane, Adelaide, Melbourne, and Hobart, &c.—*H. G. C.*

Bowenia spectabilis serrulata. By Ch. P. (*Rev. Hort. Belge*, xxvii. No. 12, p. 270; with photo).—A Cycad resembling a Fern, with elegantly dissected foliage, very useful for decorations. It is easy of culture, and is not subject to the attacks of insects.—*G. H.*

Brassavola Hybrids (*Orch. Rev.* p. 82; March 1902).—The whole of the hybrids—natural, artificial, and bigeneric—are enumerated, and are classed in proper order.—*H. J. C.*

Brassavola, "The Genus." By R. A. Rolfe (*Orch. Rev.* p. 65; March 1902).—A most interesting, useful, and comprehensive article is given, showing first the distinguishing characters of the genus, among which are included those species, *B. glauca* and *B. Digbyana*, which have been removed by Bentham to the genus *Lælia*. This will be of great interest to hybridists. The whole of the hybrids having *Brassavola Digbyana* as one of the parents—many of them will be found in the Certificate (Orchid Committee) list of the Royal Horticultural Society under the heading of *Lælia* and *Lælio-Cattleya*—will have to be transferred to *Brasso-Lælia* and *Brasso-Cattleya* if the writer's contention be adopted.
H. J. C.

Brunsvigia grandiflora. Anon. (*Journ. Hort.* p. 80; Jan. 23, 1902).—This handsome Cape Amaryllid, of which a portrait is given, grows in its home with its roots reaching down into soil perennially moist, but the bulbs and upper roots must be absolutely dry for nine months after flowering. The best plan is to let the pots stand about one-third their height in a saucer of moist sand, never watering the soil during their time of rest.—*C. W. D.*

Cabbage, Variety Tests of. By O. M. Morris (*U.S.A. Exp. Stn.*

Oklahoma, Bull. 52; December 1901).—A descriptive list of Cabbages, with yield for 1900 and 1901.—*C. H. C.*

Calathea crocata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7820).—Nat. ord. *Scitamineæ*, tribe *Maranteæ*. Native of Brazil. It flowered at Kew in 1901. The whole plant is 10 inches in height. The lanceolate leaves are green above, purple below; the petiole of the uppermost leaf being bright orange, as also are the bracts of the inflorescence.
G. H.

Calorhabdos cauloptera. By Sir J. D. Hooker (*Bot. Mag.* tab. 7800). Nat. ord. *Scrophularineæ*, tribe *Digitaleæ*.—Native of China. It flowered at Kew in 1900. It is remarkable for its four-winged stem. It is a slender erect herb, with terminal spiciform raceme, 6 to 8 inches in length. The flowers are dark red-purple, having two stamens only.
G. H.

Camassia. By S. Arnott (*Journ. Hort.* p. 119; Feb. 6, 1902).—A plea is made for the more frequent cultivation of these in mixed borders, as they require no special treatment and flower in May when border flowers are scarce.—*C. W. D.*

Campanulaceæ of Portugal. By A. X. P. Coutinho (*Bol. Soc. Broter.* xviii. p. 22, 1901).—A critical list of the Portuguese species of *Campanulaceæ*, numbering thirteen species, is given. This small number, as compared with that of sixty species indigenous to Spain, is said to be owing to the absence of elevated tracts of land in Portugal. *Specularia castellana* and *Jasione blepharodon* are among the rarest species, and the latter is considered as being probably only a form of *J. montana* or *J. corymbosa*.—*G. M.*

Campanula mirabilis. By M. Micheti (*Rev. Hort. Belge*, xxviii. No. 1, p. 9).—With two figures showing the rosette of leaves in a crevice of a rock and the plant when flowering, after which it dies.—*G. H.*

Campanulas, Dwarf. By H. E. Molyneux (*Garden*, No. 1584, p. 207; 29/3/1902; No. 1585, p. 225, 5/4/1902).—Amongst these are to be found species that grow as easily as weeds, even in foggy London; others there are that almost refuse to grow. These notes describe the experience of an amateur with the dwarf Campanulas in a London garden and the method he has found most suitable. The article is illustrated from photographs taken in the writer's garden.—*E. T. C.*

Canker and Gummosis in Fruit Trees. By F. P. Brzezinski (*Comp. Rend.* May 20, 1902).—The author's researches on "Canker," extending over seven years, go to prove that the fungus called *Nectria ditissima*, previously considered as the cause of this disease, is simply a saprophyte whose mycelium is incapable of attacking living tissue, and when present on cankered spots, which is by no means always the case, grows on the dead portions of tissue previously destroyed by other agents. In addition to the perithecia and conidia of this fungus, pycnidia and yeast forms, hitherto unknown, are recorded.

The origin of canker is, according to the author, due to the presence of bacteria. In all cases of canker veins of a yellowish, brown, or almost black colour spread from a canker wound into the sound wood for a distance of 30 cm. In the surrounding bark similar but shorter veins are also present. The plant-cells traversed by these veins contain numerous bacteria, which, when isolated, prove by inoculation experiments to be the true cause of the disease.

The bacteria of Apple-tree canker have the form of short rods divided into two geminate spheres, and stain readily with fuchsin, methylene blue, and Gentian violet. Cultures of this organism grow well in agar-agar and gelatine, which they liquefy.

The bacterium of Pear canker is not distinguishable from that of the Apple at first sight, but behaves somewhat differently in artificial cultures.

The roots of Apple and Pear trees often exhibit swellings of various sizes, and, although these never show canker-like wounds, they are considered to be caused by the same kind of bacterium forming canker on the branches.

Gummosis in the Peach, Apricot, Plum, and Cherry is also stated to be caused by bacteria which form veins similar in character to those present in the canker disease. The organism causing this disease differs from that of canker in forming colonies of a yellow-orange colour, and secretes in agar-agar transparent beads.—*G. M.*

Canker-worm. By C. M. Weed (*U.S.A. Exp. Stn., New Hampshire, Bull.* 85, October 1901; figs. 5).—The life-histories of two moths, *Anisopteryx pometaria* and *Paleacrita vernata*, the larvæ of which eat the leaves of Apples, are noted, and remedial measures suggested. Greasebanding and spraying with Paris green, Scheele's green, or arsenate of lead seem most effective.—*F. J. C.*

Cannas, The Crozy Strain of Floriferous. By S. Mottet (*Rev. Hort.* pp. 18–20; January 1, 1902).– A description of origin and development during twenty-five years.—*C. T. D.*

Canna, New Class called Sprenger. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* 3, p. 66; March 1902).—Flowers superior to any class of *Canna* hitherto known and cultivated, easily beating *Canna* Crozy and the Orchid-flowered kinds. The plant is very robust, not tall, with very broad, rounded, reddish or green leaves, inclined, and not rigid; flowering stems much branched with enormous erect spikes, each with forty or more immense flowers, which in size surpass those of the well-known variety Alemannia with Orchid-like flowers. They open at dawn and last much better than those of Crozy. They suffer neither from wind nor sun. The first to appear among the batch of seedlings was King Humbert I. This plant produced from May to July five stems, bearing 530 flowers; after flowering these stems were cut off and some superphosphate and potash was given the plant, which until the end of November produced as many more flowers, so that the whole number formed during the six months reached 1,073. The plant is sterile. Hitherto no seeds have been produced. It has already made a great impression both in France and the United States.—*W. C. W.*

Caoutchouc in Hippocratea (*Beih. Bot. Cent.* bd. xi. ht. 5, pp. 2–83, 358; plate).—Herr Felix Eugen Fritsch has examined twenty-three species of *Hippocratea*, forty-one species of *Salacia*, and one species of *Campylostemon*. He finds that indiarubber occurs in twelve species of *Salacia*, five species of *Hippocratea*, and in *Campylostemon*. The laticiferous system is like that of the *Apocynaceæ* and *Asclepiadaceæ*. The tubes are narrow and not much branched. These tubes occur in the ovule, under the nerve which traverses the raphe. The character of the latex is not the same in the different species. This, however, is but a small part of the paper, which contains a very detailed and thorough description of the histology of the genera mentioned.—*G. F. S.-E.*

Carnations, Seedlings for Winter-flowering. By Wm. Camm (*Journ. Hort.* p. 19; Jan. 2, 1902).—Carnation 'Riviera Market' is the best variety. Seed sown early in March, planted out in May, lifted and potted at the end of September, flower well all winter in a cool greenhouse.—*C. W. D.*

Carnations, Winter-flowering. By T. H. Slade (*Gard. Chron.* No. 788, p. 70; 1/2/1902).—In this article the names of the varieties best suited for winter flowering are given and the proper methods of growing them. Cuttings should be taken in February and grown in a temperature of from 55 to 60 degs., and given plenty of ventilation.

G. S. S.

Caruncle of Polygala. By Dr. Holzner (*Flora*, xc. 1902, pp. 343–4; 3 cuts).—This structure is an hypertrophy of the outer lip of the exostome on the side opposite the raphe.—*M. H.*

Caryopteris mastacanthus. By J. Keim (*Die Gart.* p. 196; 25/1/1902; with illustration taken at the "Neue Anlage," Mayence).—Few other hardy shrubs are as free flowering and lasting till the end of October. The handsome flowers are blue; only for sunny spots.—*G. R.*

Cattleya × Chamberlainiana, Rchb. f. (Cogniaux in *Dict. Icon. Orch.*, Cattleya, hyb.; pl. 17; 2/1902).—A garden hybrid raised by Seden for Messrs. Veitch & Sons, of Chelsea, in 1881, out of *C. Leopoldi* by *C. Dowiana*. Sepals and petals purple brown, tinted yellow and dotted with purple; lip amethyst purple lined with yellow at the base, distinctly trilobed.—*C. C. H.*

Cattleya Harrisoniana and C. Loddigesii (*Orch. Rev.* p. 44; February 1902).—The distinguishing features of the two species are defined, and should assist those perplexed in distinguishing the species.

H. J. C.

Cattleya superba, Hybrids of. By C. H. Curtis (*Gard. Mag.* No. 2515, p. 23; 11/1/1902).—Now that the hybrids of *Cattleya* and *Lælia* are becoming so numerous, a carefully compiled list such as this

may be useful to orchidists. The intricate parentage of the hybrids is given, but a less brief description would have added value to the account.
W. G.

Cattleya × Wavriniana, Cogn. (Cogniaux in *Dict. Icon. Orch.*, Cattleya hyb.; pls. 18; 2/1902).—A garden hybrid raised by M. Peeters, of Brussels, in 1900, out of *C. Warscewiczii* by *C. granulosa Schofieldiana.* Sepals and petals dark purple brown; lip side lobes yellow tinted purple; front lobe crimson purple.—*C. C. H.*

Cauliflower Forcing. By H. Harold Hume (*U.S.A. Exp. Stn. Florida, Bull.* 59; 2 plates; October 1901).—A careful, practical, and most complete manual of Cauliflower forcing for the market, embellished with full-page illustrations beautifully reproduced from photographs of two of the three kinds recommended as apparently most suitable for the purpose in Florida. These are 'Extra Dwarf Erfurt,' 'Early Snowball,' and 'Dry Weather,' and the bulletin impresses upon the grower that the better the seed the greater the chance of profit.

The bulletin recommends very liberal treatment and gives the analysis of the Cauliflower to show that the crop, planted as recommended, that is, 2 by 3, or 7,260 plants to the acre, would remove from the soil 56·62 lb. nitrogen, 79·69 lb. phosphoric acid, and 156·81 lb. potash per acre.

It follows that fertilisers must be supplied in larger amounts than this to allow for what must necessarily fail to reach the plants, or what they cannot take up.

The insect enemies to the crop in Florida are cut-worms and four species of Cabbage-worm—*Plusia brassicæ, Pieris rapæ, Pieris protodice,* and *Plutella macullicollis.* As a poisoned bait for the cut-worms the writer recommends bran mixed with enough Paris green to give it a greenish tinge, and enough treacle to make it sticky scattered in a small circle round each plant; and against Cabbage-worm he suggests Paris green or arsenate of lead, which can be applied with perfect safety to the consumer until the young plants begin to head. To make Paris green in solution stick to the plants he tells us to add dissolved soap, 1 lb. hard soap to 40 gallons of mixture; or it may be applied in the form of powder by mixing 1 lb. of Paris green with 40 lb. of flour. The powder may produce burning if too freely used, but a level teaspoonful of Paris green mixed with a quart of lime may be used instead without any such disadvantage.

To prepare arsenate of lead, dissolve 11 oz. acetate of lead and 4 oz. arsenate of soda in two or three gallons of water and dilute to 100 gallons for use.—*M. L. H.*

Cecidiological Notes: I. The Role of the Epiderm in Abnormal Swellings. By Ernst Küster (*Flora,* vol. xc. 1902, pp. 67–83; 4 woodcuts).—Though the epiderm is less influenced than fundamental tissue, it is in many instances under the gall-stimulus induced to form hairs &c., even to become many-layered by tangential division, in a manner having no relation to the normal behaviour of its cells. He recalls that in *Begonia* only does the epiderm take part in the formation of callus, and that its share in the production of intumescences is minimal. —*M. H.*

Celastraceæ, Review of the hitherto known Chinese Species. By Th. Loesener (*Engl. Bot. Jahrb.* xxx. pp. 446–474 ; 31/1/1902).—A critical revision of the Chinese species, which number sixty-seven, and are included in six genera, of which *Euonymus* contains forty-six and *Celastrus* fourteen species.

The author describes a number of new species and varieties, the majority of which were collected by Dr. Henry in Southern China.

A. B. R.

Centaurea nigra and C. Jacea. By H. and J. Groves (*Journ. Bot.* 472, p. 159; 4/1902).—A contention that these two British species, though separable by their phyllaries, are not so by the presence or absence of pappus.—*G. S. B.*

Chamædorea, Hybrid. By Wilhelm Haberman (*Gartenflora*, p. 70; fig. 9; 1/2/1902).—*C. Arembergiana*, H. Wendl., ♀, was crossed with *C. concolor*, Mart., ♂. The hybrid had the luxuriant growth and folded leaves of the mother with the hardiness of the father.

The seeds germinate after lying six months in the soil. Complaint is often made that the imported seeds of species of *Chamædorea* do not germinate. This difficulty is apparently not due to age, for the author kept seeds in sawdust for eighteen months and found them capable of germination at the end of that time. It may be due to the absence of an embryo in the seeds, where male and female plants do not grow in the same neighbourhood.—*J. P.*

Charts of the Geographical Distribution of certain Trees. By A. Engler, F. Pax, and P. Graebner (*Not. König. Bot. Berlin*, vol. iii. No. 28, p. 181 ; 1902).—An interesting series of five maps showing the distribution in space of the Yew, *Araucaria*, *Pinus*, of *P. Cembra* and *P. pumila*, and of the distribution of recent and fossil *Taxodium*.

H. M. W.

Cherry: Leaf Disease in the Cherry Orchards of Kent. William Carruthers (*Jour. R.A.S.* vol. lxii. pp. 241–246 ; figs. 1–6 ; 1901). "A leaf disease of Cherries was reported in December 1900 from several orchards in the county of Kent. In the early summer it affects the leaves and fruit simultaneously, rendering the latter unfit for market. In autumn and winter its presence is easily detected. The diseased leaves remain attached to the branches, as if the tree had been killed in full vigour of growth, just as the withered leaves remain on a branch that has been severed from its stem.

"The fall of the foliage in autumn is a normal process carried out by the living leaf, which forms at the point of its attachment to the branch a cicatrice that secures when completed the easy severance of the leaf from the branch, leaving a clear scar. The speedy and fatal injury to the leaf caused by the fungus prevents the formation of the cicatrice, and the leaf remains attached to the tree.

"A further characteristic of this disease is the shortening of the year's twigs which bear the diseased leaves. The internodes or joints between the leaves of these branches have scarcely been developed. The dwarfing of the branch is not due to any attack from a fungus, for no fungus is present in the tissues. The dwarfing is entirely due to the want of food consequent on the early death of the leaf. That this is the case is confirmed by the fact that some of the dwarfed branches have produced in the following year vigorous normal shoots."

The internal and external character of the diseased leaf is given, and various stages of the fungus (*Gnomonia erythrostoma*, Auerswald) are illustrated.

"The rapid spread of the disease in Altenland is traced to the overcrowding of fruit trees and to the presence of open ditches in the neighbourhood of the orchards, causing too much moisture, and so presenting conditions favouring the growth of parasitic fungi. While such adverse conditions should be remedied it is recommended, as the only method of stamping out the disease, that the diseased leaves should be gathered and burned."

Cladosporium epiphyllum.—A form of this fungus caused "little brown flecks" on the fruit. The growth of the fungus was entirely superficial, and the mycelium had not penetrated into the tissue of the fruit, but its growth was arrested. It is not a disease to cause any apprehension, and will probably disappear with the dead leaves.

Exoascus cerasi.—This fungus causes the disease known as "bull boughs" or "witches' broom." It is said to be rare in England.—*R. N.*

Chervil, An Experience in the Selection of the Wild. By Raymond Roger (*Rev. Hort.* pp. 192, 193; April 16, 1902; 1 woodcut). M. Philippe de Vilmorin has published the results of selection starting from the wild type of the wood Chervil (*Anthriscus sylvestris*) by the late M. Henri de Vilmorin and subsequently by himself. The wild plant has a long twisting fibrous root of acrid and disagreeable taste, and quite unfit for culinary purposes, but by careful selection of seed from 1874 to 1900 thick, fleshy, non-fibrous, tuberous, marketable roots have been attained, as illustrated. This, however, is at the expense of the plant's hardiness: it succumbs to temperatures which have no effect on its wild progenitors.—*C. T. D.*

Chinch Bug. By Chas. D. Woods (*U.S.A. Exp. Stn. Maine, Report for* 1901, pp. 182–184).—Chinch bugs during the summer of 1901 were doing considerable damage to the Grass crop in Western Maine. These insects are quickly killed by kerosene or kerosene emulsion, but it is essential that it be thoroughly applied.—*M. C. C.*

Chlorine for Buckwheat, Necessity of. By A. Mayer (*Ann. Agr.* p. 601; December 1901).—*C. H. H.*

Christophine or Chayote (Sechium edule, Swz.), The. A new vegetable for the Cape. By P. MacOwan (*Agr. Jour. Cape G.H.* vol. xx. pp. 92–102; with plate).—The paper is by the Government botanist, who states that "in 1895 M. Paillieux, a distinguished member of the French

Société d'Acclimatation, whose speciality was the introduction of new hardy esculent vegetables to Continental gardens, sent to me a dozen fruits of the plant whose name heads this article, hoping that its culture might be taken up at the Cape. They were distributed to several gardens here, with a brief note as to the very simple culture required. But if you want to have anything done which is contrary to established custom and routine you have to do it yourself mostly. In only one instance was the distribution followed by success. Mr. Eustace Pillans raised the plant, and in its second season had it climbing in profusion over a large trellis and showing a crop of ninety fruits. From this beginning a basketful was sent to the cuisine of the Civil Service Club, and another lot was exhibited in the window of a leading fruit dealer with an explanatory label. Certainly a message of thanks and approval came from the Club, but there the matter ended. Two or three other amateur gardeners now have the plant, but it is disappointing to find that it has not been taken by the purveyors of our vegetable market, and is only known to a few people as a curiosity. I dare say if we had on record the primæval history of the Cabbage or of the Turnip we should find that the man who first grew and ate the esculent novelties was similarly disappointed when he pressed them upon the attention of his prehistoric neighbours. They, no doubt, asked why they should venture to eat such new-fangled stuff when there was such an abundance of acorns to be had—a food which had stood the test of centuries, and had been eaten by their forefathers from time immemorial.

"But if we of the Cape have not as yet recognised the value of this succulent dainty—a sort of Squash that is not exactly a Squash but something far better, and which comes in season when the ordinary Squash has not begun to show a leaf above ground—other countries and colonies which have a climate somewhat similar to ours have done justice to it. With them the Chayote has come to stay, and puts in an appearance regularly upon the market. The United States Department of Agriculture has just issued a very complete monograph of all that is to be said about this valuable addition to the resources of our table, and there can be no doubt that the Gulf States and California will very shortly send it up to the eastern centres of population in large quantities. Algeria always forwards hundreds of tons of the fruit to Paris and London as a special winter vegetable, and it has begun to gain popularity in Queensland."

R. N.

Chrysanthemums. By W. Soutter (*Qu. Agr. Journ.* ix. pp. 569–560; December 1901).—General remarks on cultivation of the Chrysanthemum in Queensland. This is one of the chief autumn flowers, and can be grown in almost any part of Queensland.—*M. C. C.*

Chrysanthemums: How to Multiply a Sport. By H. Dauthenay (*Ann. Soc. Hé.* p. 188; Dec. 1901).—The following particulars are probably known to Chrysanthemum growers, but are new to some readers of the Journal. Cut off the flower down to the nearest leaf, then cut off to its base the stalk which bore it, then all the leaves of the stalk, leaving only a quarter of an inch of each petiole attached. Then lay the stalk flat in fine moist soil, covering it about a quarter of an inch and putting a cloth over it in a greenhouse or frame at a moist temperature from 52° to 56°. Rooted shoots will soon appear from the axil of each petiole, and the stalk may be cut up into little plants. Of course the same method may be used to multiply any Chrysanthemum.—*C. W. D.*

Chrysanthemum 'Madame Georges Mazuyer.' By E. Fierens (*Rev. Hort. Belge*, xxvii. No. 12, p. 265).—This is a Japanese hybrid, of cream-white colour, lightly tinted with lilac, disappearing when in flower. It is of a dwarf and vigorous habit.—*G. H.*

Chrysanthemums, New Japanese. By D. B. Crane (*Gard. Mag.* No. 2516, p. 32, 18/1/1902).—A descriptive list of about a score of new sorts of the Japanese section to which have been awarded certificates of merit. Taken with previous lists of new sorts, the present account shows the great number of novelties introduced yearly since the popularity of this section has been extended. This list is clearly descriptive and critical. *W. G.*

Chrysanthemums, October-flowering. By D. B. Crane (*Garden*, No. 1583, p. 193; 22/3/1902).—The early-flowering Chrysanthemums are to many more useful and valuable than the November-flowering ones, and a list of small flowered sorts which bloom during October will be welcomed. No less than twenty-one different varieties are here given, with full descriptions.—*E. T. C.*

Cider: its Production in the Department of Creuse. By V. Vincent (*Ann. Agr.* pp. 357–383; August 1901).—*C. H. H.*

Cineraria pentactina. By Sir J. D. Hooker (*Bot. Mag.* tab. 7799). Nat. ord. *Compositæ*, tribe *Senecionideæ*.—Native of South Africa (?). It is a slender climbing plant with sub-rhomboidal toothed leaves and small yellow heads with a five-flowered ray. It flowers regularly at Kew.—*G. H.*

Clematis. By A. Petts (*Journ. Hort.* p. 293; April 3, 1902; and p. 321; April 10, 1902).—A portrait of *C. florida* is given on page 321. It is impossible to make soil too rich for these. The intending cultivator must distinguish between the tall climbers like *C. Flammula* and herbaceous kinds growing three or four feet high, such as *C. integrifolia* and *C. recta*. Different modes of growing are described, especially training the climbing kinds round the margins of beds.—*C. W. D.*

Codlin Moth, The (*Carpocapsa pomonella*). By C. P. Gillette (*U.S.A. Dep. Agr., Div. Ent. Bull.* No. 31, N.S., pp. 5–22).—This exhaustive paper was given by the author as his presidential address before the members of the Association of Economic Entomologists held at Denver, Col., August 23, 1901. The author states that he found the insect double-brooded in the south as well as the north; a statement to which Dr. Howard took exception without further evidence.—*R. N.*

Colchicums, Spring and Autumn. By Ed. André (*Rev. Hort.* pp. 59–61; February 1, 1902; 2 woodcuts).—An interesting descriptive list of species. Bulbs may be shifted in July, replanting immediately four inches deep.—*C. T. D.*

Cold and Cool Storage Experiments. By Prof. J. C. Blair (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 65–89; plates).—This paper gives the results of experimental work which has been carried on by the Department of Horticulture in the State of Illinois. The objects of the experiments are stated to be as follows:—(1) Whether the construction of cold storage houses by the commercial grower of Apples is possible, and whether the amount saved will warrant the necessary outlay for building, &c. (2) Whether small growers can afford to insulate their cellars. (3) What temperature is best suited for the different varieties while in cold storage. The whole idea of the cold storage problem is of course to extend the selling period of fruit, and the author points out the necessity of careful attention to the picking and handling of the fruit before it is ready for storage.

The author proceeds to describe with detail, first, certain establishments visited; and secondly, plans and particulars for building, location, &c., of cold storage houses, which he illustrates with five carefully prepared plans in detail, showing measurements, &c. The cost of materials and labour is also given, but this perhaps will not be of so much value to those outside America. The Professor then gives details of location, cost, &c. of cold storage cellars.

The third object of the experiments, viz., the temperatures at which fruit should be stored, would seem to be of more universal interest, and although the experiments were not complete at the time of the paper under review, yet it seems to have been decided that 31 degrees was probably too low, as it often scalded, and so injured in selling qualities; 33, 35, and 37 degrees respectively are now being tried, the first two being most probably the best. *Cool* storage, as distinct from cold storage, seems to be placed at 45 to 52 degrees, *i.e.* approximately the earth's temperature.—*V. J. M.*

Colorado Potato Beetle. By Chas. D. Woods (*U.S.A. Exp. Stn. Maine, Report for* 1901, pp. 177–180).—In a series of experiments in 1901 it was found that three applications of Paris green at the rate of ½ lb. to the acre are sufficient to keep the vines free from the Colorado Potato beetle, provided the sprayings are made at such times as to have the poison on all the foliage when the bugs first hatch.—*M. C. C.*

Colour, Change of, in Flowers. A Sussex Naturalist (*Gard. Chron.* No. 790; 13/2/1902).—The author discusses the object and reason for some flowers during the short term of their existence changing colour, and mentions the names of many that do so, but the conclusion he comes to is not very satisfying.—*G. S. S.*

Conifers, Hybrid. By S. Mottet (*Rev. Hort.* pp. 161–164; April 1, 1902; 4 woodcuts).—Illustrating in part an interesting description of a number of hybrids, natural and artificial—*C. T. D.*

Coniothecium. "Recherches sur la Morphologie, le Développement, et la Position Systématique des *Coniothecium*." Par F. Guéguen

(*Bull. Soc. Myc. Fr.* xviii. fasc. 2, with 3 plates; 1902).—Experiments in cultivation of the conidia of *Coniothecium amentacearum*, in various media, are held to demonstrate the affinity of this species with *Fumago*, and through that with *Capnodium*. Hence that the forms known as *Coniothecium* are imperfect, or conidial conditions of *Capnodium*.

M. C. C.

Corn Culture. By. R. J. Redding (*U.S.A. Exp. Stn. Georgia, Bull.* 55; November 1901).—A series of nine experiments are described dealing with the cultivation of "Corn."

1. Shows that *two* or more medium or small ears are to be preferred to *one* large ear on a stalk.

1*a*. Is a comparison between the respective earliness of four varieties, and it tends to show that "early" varieties yield a higher average in bushels per acre than the later.

2. Deals with harvesting, and shows the benefit of cutting and shocking (either green or dry), thus using the stalks instead of leaving them in the field.

3. "Broad-casting" fertilisers *versus* "drilling." Given a liberal application of fertiliser, broad-casting appears to be best, in view of probable unfavourable seasons, but if the amount of fertiliser be limited, drilling is preferable.

4. "Top" ears or "bottom" ears for seed corn? Seems to prove that seed from "bottom" ears is the most likely to produce two-eared stalks, and is therefore to be preferred.

5. Planting on beds *versus* in water furrow.

The result of this experiment tends to show that "bed" planting is decidedly better in every way than planting in the water furrows, whether fertilised at time of planting or not, especially if, as often happens, the weather is very wet after planting.

6. "Deep" *versus* "shallow" planting.

Although this experiment yielded a somewhat inconclusive result, it would seem to show that deep planting is preferable to shallow.

7. "Thorough" *versus* "ordinary" preparation of Corn land. This experiment gave unexpected results in that it failed to sustain the current belief that "thorough" preparation of the soil justifies the increased expenditure by a large increase in the yield.

8. More or less frequent tillage. The differences were not great, but were in favour of giving three furrows at a time every three weeks, rather than one furrow at a time every week, or two furrows every two weeks.

9. "Nitrogen test on Corn" was undertaken to determine whether Corn shows a preference for any particular form of nitrogen.

Dried blood, nitrate of soda, and cotton meal were used as sources of nitrogen. The differences were inconsiderable, but the general average of four years of experiment gave the order of preference as above.

As the Corn shows no very decided preference for either, the farmer will probably be guided in their use by their respective cost. The experiment shows, however, that it is not expedient to fertilise Corn liberally with commercial fertilisers.—*C. H. C.*

Corydalis thalictrifolia. By Sir J. D. Hooker (*Bot. Mag.* tab. 7830).—Nat. ord. *Fumariaceæ*, tribe *Fumarieæ*. Native of China. It is one of the largest species in China. It flowered in the rock garden at Kew in 1901. The leaves are trisect, resembling those of *Thalictrum*. The flowers are yellow, an inch long, with a long spur.—*G. H.*

Cotyledon, South African Species of. By S. Schönland and E. G. Baker (*Jour. Bot.* 469, pp. 9–23; 471, pp. 89–94, tabs. 431–435; 1/1902 and 3/1902).—Descriptions of *C. Beckeri, virescens, Galpini, Whitei, Woodii, Flanagani* in the first instalment, and *C. Alstoni* in the second, all new South African species, with descriptions of previously known forms and plates from photographs of Haworth's types of *C. undulata, crassifolia, coruscans, tricuspidata*, and *rotundifolia*.

G. S. B.

Crinum Johnstoni. By Sir J. D. Hooker (*Bot. Mag.* tab. 7812).—Nat. ord. *Amaryllideæ*, tribe *Amarylleæ*. Native of British Central Africa. "It is clear," writes Sir Joseph, "that Tropical Africa is the head-quarters of the genus, as it has yielded nearly forty species." It is intermediate between *C. latifolium* and *C. longifolium*. It has flowered freely in the succulent house at Kew. The flowers are umbellate, the perianth is slightly tinged with pink, being 3 inches long, and the green tube about 4 inches in length.—*G. H.*

Currant Anthracnose, An Epidemic of. By F. C. Stewart and H. J. Eustace (*U.S.A. Exp. Stn. New York, Bull.* 199; 1901).—During the past season the Currant crop in the Hudson Valley has been seriously injured by anthracnose, causing numerous small dark brown spots on the leaves, which turn yellow and fall. Currant canes were quite generally defoliated early in the season, and the exposure of the ripening fruit to the sun brought about sun-scald and a loss of nearly one-half the crop on some plantations. It is recommended that Currants be sprayed with Bordeaux mixture regularly every season in the affected districts.—*M. C. C.*

Cyclamen persicum, Old Corms of. By E. Hambro (*Garden*, No. 1587; 19/4/1902).—A note of a system of culture that has been followed with wonderful results. The corms, instead of being dried off every year, were really never dried off at all, but grown on every year.

E. T. C.

Cyclamen (persicum) splendens giganteum hybridum. By C. Stoldt (*Die Gart.* p. 366; 3/5, 1902; with coloured plate).—Herr Stoldt, the first German specialist and hybridist, who has perhaps single-handed done more than any other grower of Cyclamens to improve and popularise these fine greenhouse plants. It is this gentleman who claims the superiority of German Cyclamens over English. In a well-written article he gives a history of the different forms raised by him.

G. R.

Cyclamen persicum, Sweet-scented. By W. I. (*Journ. Hort.* p. 163; Feb. 20, 1902).—The cultivation of this flower has developed size at the cost of fragrance. Messrs. Sutton are now trying by selection to restore a fragrant strain.—*C. W. D.*

Cyclamens of Dresden, The Frilled. By Franz Ledien (*Garden*, No. 1580, p. 139; 1/3/1902).—An account of a relatively new race of frilled—not fringed—Cyclamens raised in the nursery of Mr. Alwin Richter at Dresden. It appears that the one parent type, *C. persicum giganteum*, was imported from England some twenty years ago. It has taken twenty years to fix the frilling so as to obtain an average of 60 per cent. of the seedlings true.—*E. T. C.*

Cypripedium × Edmund Rothwell (J. E. Rothwell in *Amer. Gard.* xxiii. p. 138; fig. 33; 1/3/1902).—A new hybrid raised by Mr. Rothwell, of Brookline, Mass., between *C.* × *nitens* (*Sallierii*) *Hyeanum* and *C. Hookeræ*. Generally intermediate in form. Fowers yellow, unspotted; petals suffused with purple; a decided improvement over both parents. The figure shows the hybrid with its parents.—*C. C. H.*

Cypripedium, Hybrids, Seedlings. By F. W. Moritz (*Die Gart.* p. 205; 1/2/1902; with illustration).—Several distinct and beautiful forms of *Cypripedium* raised and grown by the well-known celebrated German hybridiser, Herr C. Ansorge, of Klein-Flottbeck, near Hamburg, are figured and described, and a sketch shows a whole house in bloom. The more noteworthy forms described are *Cypripedium villosum* × *insigne* var. *maculatum*; *C. insigne* var. × *Spicerianum*, *villosum* × *Spicerianum*, *insigne* var. × *villosum*; *C. insigne* var. *Mooreanum* × *Spicerianum* var. *giganteum*.—*G. R.*

Cypripedium × Imschootianum (*Amer. Gard.* xxiii. p. 103; fig. 25; 15/2/1902).—Originally raised in Europe, but now repeated by Mr. J. E. Rothwell, of Brookline, Mass. A vigorous grower (four years and ten months from pollination to flowering); flower intermediate between its parents.—*C. C. H.*

Cypripedium × purum (A. J. Loveless in *Amer. Gard.* xxiii. p. 189; fig. 43; 22/3/1902).—A hybrid flowered in 1901 by Mr. Loveless, of Lenox, Mass., and recorded as *C. superbiens* × *C. callosum Sanderæ*. Dorsal sepal white lined green; petals green shaded purple with brown spots; lip purple. This variety should be named *Paphiopedilum* × *Moussetianum purum*.—*C. C. H.*

Cyrtopodium palmifrons. By Sir J. D. Hooker (*Bot. Mag.* tab. 7807).—Nat. ord. *Orchideæ*, tribe *Vandeæ*. Native of Brazil. It was discovered by Warming in the forest of Lagoa Santa. It flowered at Kew in 1901. The specific name refers to the resemblance of the leafing stem to an Arecoid Palm. The flowers are borne on a many-flowered panicle, about an inch broad. Sepals are lemon-coloured, spotted with rose-pink. The petals are also lemon-coloured.—*G. H.*

Dahlias (*Gard. Mag.* No. 2528, 12/3/1902).—This number of the *Gardeners' Magazine* is devoted mainly to Dahlias of all descriptions, their culture, classification, description. Articles are given on the Dahlia industry and the raisers and distributors of Dahlias. Portraits are given of the men who have become prominent as raisers of Dahlias. The number is of special value to lovers and growers of the Dahlia.—*W. G.*

Dahlias, How to grow. By W. Soutter (*Qu. Agr. Journ.* ix. pp. 558, 559; December 1901).—This short communication describes the characteristics of a show flower—Pompoms, Cactus Dahlias—with remarks on cultivation, containing nothing of novelty or special interest. *M. C. C.*

Dahlias, Cactus, for 1902. By H. Kohlmannslelmer (*Die Gart.* p. 181; 18/1/1902).—If illustrations are right, these new German Cactus Dahlias, such as 'Sühnenprinz' (rich purple), 'Gartenbaudirector Geitner' (salmon), would be good Cactus forms. More decorative are 'Lotte Kohlmannslelmer,' pure white; 'Hildegard Weimar,' mauve-coloured; 'Freund Hesdörffer,' brick-coloured.—*G. R.*

'Daisy,' Shasta (L.B. in *Amer. Gard.* xxiii. pp. 24, 25; figs. 5, 6; 11/1/1902).—A new hardy perennial of great merit, raised by Mr. Luther Burbank, of Santa Rosa, by combining the American, European, and Japanese species allied to *Chrysanthemum leucanthemum* and selecting the offspring through a series of years.

The plant is about two feet high, and bears an abundance of pure white flowers, which are four inches across.—*C. C. H.*

Darkness, Development of Flowers in. By M. Beulaygue (*Ann. Agr.* p. 384; August 1901).

1. Flowers developed in darkness are generally later in opening than those in light.
2. The colour is usually less bright; some are entirely discoloured.
3. The flowers are usually smaller, but the stems often more developed than in light.—*C. H. H.*

Delphiniums, Two Red. By Jules Rudolph (*Rev. Hort.* p. 70; February 1, 1902).—*Delphinium cardinale* described as a good scarlet, lax inflorescence, and *D. nudicaule*, clear scarlet flowers in bunches. Sow the first in April–May in cold frames, in which they are wintered, planting out in March–April. Flowers July–August. The second is sown in March and flowers in July–August; can also be sown in September, wintered in frames, and planted out in spring; perennial and nearly hardy, but may be treated as an annual.—*C. T. D.*

Dianthuses, Alpine. By G. Reuthe (*Gard. Mag.* No. 2529, p. 247; 19/4/1902).—These beautiful rock garden plants are the subject of an able article by a practical grower, who describes the most beautiful and important species, with hints upon their culture. The writer, who has collected the plants in their native homes, speaks of twenty acres of *D. alpinus* growing in the short Grass, yet we find in England that it is this Alpine gem that causes anxiety to keep in health a tuft a few inches square. Mr. Reuthe could no doubt tell a great deal more than he does about the peculiar likes and dislikes of Alpine Dianthuses when under culture.—*W. G.*

Disa Hybrids. By G. Bornemann (*Gartenflora*, p. 113; pl. 1496; 1/3/1902).—A coloured plate and brief description of *Disa langleyensis* (*D. racemosa* × *D. tripetaloides*) and *Disa Veitchii* (*D. grandiflora* × *D. racemosa*). *D. langleyensis* has bluish-green leaves and small carmine-purple flowers; *D. Veitchii* has bright green leaves, and the flowers are larger. The upper cup-like petal of each flower is pale rose, the two lower ones being magenta-carmine.—*J. P.*

Distremmena marmorata. By L. Kitzenberg (*Die Gart.* p. 293; 22/3, 1902; with figure).—Described as a very destructive insect, increasing quickly. Imported with dried Cycas stems from Japan. At present very little is known about the habit of this insect.—*G. R.*

Double Fertilisation of Monotropa uniflora, L. By K. Shibata (*Flora*, vol. xc. 1902, pp. 61–66; pl. 1).—The union of the second male nucleus may take place with the upper "polar nucleus" before it fuses with the lower, or it may join them as they meet; or, again, it may (when the temperature is lower) fuse with the secondary nucleus produced by their fusion. In the beautiful mitotic figures of the endosperm no centrosomes were seen.—*M. H.*

Drosera, The Outer Seed-coat in German sp. of. By Dr. Holzner (*Flora*, xc. 1902, pp. 342, 343; cuts 1–4).—That of *D. rotundifolia* is lax, open-mouthed, distant from the inner, contains air, which facilitates dissemination by breezes, and enables it to float (as long as a month) on water. The outer seed-coat of *D. intermedia* is appressed to the inner and seed, but each cell is prolonged at its centre into a short hair-like tube filled with air at maturity.—*M. H.*

Drosera filiformis and D. intermedia, Observations on some Hybrids between. By J. Muirhead Macfarlane, D.Sc. (*Contr. Bot. Lab. Phil.* ii. No. 1, 1898, p. 87, pl. 12).—This paper consists of a detailed comparison of plants of *Drosera filiformis* and *D. intermedia* with those of another species with which they were found growing amongst the Pine barren swamps of New Jersey, and transplanted to the University Botanic Garden. The supposed hybrid between the two species, and here called *Drosera hybrida*. Histological investigation of the three forms demonstrates a minute blending in all parts of the hybrids of the histological peculiarities of *D. filiformis* and *D. intermedia*.

In this, as in some other hybrids studied, certain parts or organs tend rather more towards one parent than the other. The balance of development throughout in the present case is evidently towards *D. intermedia*, yet the apparently prepotent parent is the smaller and more delicate species.—*M. C. C.*

Economic Entomology, Experimental Work in. By J. B. Smith (*U.S.A. Exp. Stn., New Jersey, Bull.* 155; 1/1902).—A pamphlet of seventy-two pages, giving an account of the work done in the experimental orchard attached to the station in controlling insect pests and studying their habits. It also gives a plan of the experimental orchard.

F. J. C.

Economic Plants of Samana, Historical Notes on. By W. Harris (*Bull. Bot. Dep. Jam.*, new series, vol. viii. part 9, p. 129; part 10, p. 154; part 10, p. 161).—The author gives an account of the trees as mentioned in 1622 by Dr. Heylin. In 1672 Rd. Blome gave an account of the fruits, herbs, and roots. Then follows an account of the Pineapple, probably brought by the Spaniards from Tropical America, though it appears on the coat of arms as if it were a natural product. Various accounts written in the seventeenth century are quoted, as well as later reports on the varieties cultivated in Jamaica at the present time. The best methods of cultivation are also described. In the second article Bananas are considered; the varieties are named. In the third the Mango is treated of. The author gives some account of the history, varieties, and their order of merit.—*G. H.*

Edgeworthia chrysantha, Flowers of. By Gustavo Mattei (*Bull. R. Soc. Tosc. Ort.* 1; p. 16, January 1902).—The flowers have a singular and rare biological history. Each flower passes through two quite distinct stages: a first stage, in which it is fertilised exclusively by bees of medium size, including the common hive bee; and a second stage, in which *Sphingidæ*, especially *Macroglossa stellatarum*, are the sole fertilisers; these latter only visit curved and whitish flowers. During the first stage the anthers of the superior whorl have not dehisced, while at the second stage this has taken place, and the style is less bent and more elongated.—*W. C. W.*

Edible Fungi. "La Vente des Champignons sur les Marchés des différentes Villes d'Europe." Par M. Emile Perrot (*Bull. Soc. Myc. Fr.* xviii. fasc. 2; 1902).—This purports to be a record of the various species of edible Fungi which are offered for sale in the markets of the different cities of Europe. Also of the regulations in force for general protection, with suggestions as to the means which should be generally adopted for public protection, and measures for general instruction in popular mycology, and a knowledge of edible and poisonous species. The countries which are included in this memoir are Germany, Austro-Hungary, Belgium and Netherlands, France, Britain, Italy, Russia, and Switzerland. In some countries twenty or thirty species are recorded, or even more, whilst in Great Britain it is stated that the only species is *Psalliota campestris* (the equally common *Psalliota arvensis* being forgotten), and, rarely as an exception *Lepiota procera*, *Tricholoma personatum*, some Morels, and a large quantity of Truffles imported from France.—*M. C. C.*

Embryo Sacs, On the Development of. By R. E. B. McKenny, B.Sc. (*Contr. Bot. Lab. Phil.* ii. No. 1, 1898, p. 80; plate 11).—Plants of *Scilla hyacinthoides*, var. *cærulea*, *S. campanulata*, *Lilium tigrinum*, and *L. candidum* furnished the material for study. The writer has observed most of the stages as described by Mottier during spindle formation. At no period in the cell history is a centrosome visible.

M. C. C.

Entomology, Economic, in Ohio. By F. M. Webster (*U.S.A. Stn. Hort. Soc. Ohio*, pp. 117–140; 1901).—Among other insects mentioned in this report the Willow and Poplar curculio (or weevil) (*Cryptorhynchus lapathi*), an insect common in Europe, Siberia, and Japan, is noted as a new pest in Ohio, attacking Willows, Poplars, and Birches. The following interesting note also appears: "It is rather strange, but nevertheless true, that a species of insect will seem to take on a new food habit over the entire country at about the same time. . . . The Colorado Potato beetles this summer took to Tomatos, not only in Ohio, but in other States and in Canada. We have known that they would attack the Tomato, but last year there seemed to come over them a sudden mania in that direction, as if the fact had been telegraphed all over the country. . . . One of our common cutworms attacked Carnations in greenhouses. . . . When I came to report the matter as out of the ordinary, as indeed it was, I found the complaint was almost general, and everywhere equally unusual."—*F. J. C.*

Entomological Notes and Inspection Report for 1901 of Illinois State. By S. A. Forbes, State Entomologist (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 142–154).—*The Cankerworm.*—The cankerworm has made such steady and rapid increase in this State and elsewhere that special investigations have been made with reference to it and with a view to discovering the best means of combating it. As the author points out, giant Elms of many years' growth—the pride of the owners and an ornament to the town—may be injured beyond remedy or completely destroyed by these insignificant insects if they are allowed to work unhindered for two or three years. The loss thus inflicted is not a pecuniary one merely, for the value of an old Elm is not to be counted in dollars and cents.

A clue to the control of the cankerworm is to be found in its life-history and in the peculiar character of the female moth. The eggs are laid as a rule in March or April in irregular masses, commonly concealed under pieces of loose bark and the like, and they hatch from about mid-April to the end of May. They reach full size in three or four weeks. Then they enter the ground to the depth of two to five inches, change to the pupa state, and come forth as an adult moth in the following spring or earlier. The male moth is a rather thin-winged delicate-looking creature, while the female is wholly without wings. Two remedies are available, the one applying to the orchard and the other to the large shade trees. In the orchard a thorough spraying of arsenic or Paris green will destroy the cankerworm. Two sprayings may be necessary, as the eggs do not seem to hatch all at once. The first should be applied shortly after the opening of the leaf buds and the second in about ten days. For large trees bands impassable by the female should be placed around the trunks early in spring, the object being of course to prevent the mother moth from going up the tree to deposit eggs. The band may be six inches wide and made of heavy wrapping paper smeared with a thick layer of printer's ink or of tar thinned with oil.

Green Fruit Worms.

These are light green caterpillars marked with three cream-coloured stripes, and attack young Apples when about the size of a Pea, often eating a large part of the fruit away. They will also attack Pears, Plums, Currants, &c. One caterpillar will spoil several Apples one after the other, doing this work in May and early June. The parent moths fly only at night and are attracted by lights. The insects pupate under ground, the eggs being laid in early spring and hatching in a few days.

They are subject to poisoning with the arsenical spray, but after they have begun their attacks upon the fruit it would seem that they can only be reached by jarring the trees and catching the insects on sheets or screens.

A new Apple Insect.

This new discovery, which has been given the name of the Apple flea-weevil (*Orchestes pallicarnis*), is a minute black beetle—one of the snout-beetles; that is, having the front of the head drawn out into a slender beak, somewhat like that of the curculio. It jumps like a flea by means of powerful hind legs. Its complete life history is not known, but it evidently passes its whole life cycle on the tree. The beetles when they come out feed upon the under surface of the leaf, eating round holes.

The Pear-leaf Blister in Nurseries.

The author wishes to emphasise the fact, which seems not generally known to nurserymen and orchardists, that this mite (*Phytoptus pyri*) may be destroyed in winter either by spraying infested nursery stock with kerosene in some suitable form or by fumigating the trees with hydrocyanic acid gas. The microscopic mites pass the winter alive among the scales of the buds of trees infested the previous year.—V. J. M.

Epiphytes. From a lecture given by R. A. Rolfe, A.L.S. (*Orch. Rev.* p. 102 ; April 1902).—One of the most instructive and interesting papers ever published in this work. It is a pity the whole lecture as given to the Kew Gardeners' Mutual Improvement Society is not given. The notes are so full of interesting matter in respect to epiphytal plants.—*H. J. C.*

Eremophila calycina. By S. L. Moore (*Journ. Bot.* 469, p. 28 ; 1/1902).—Description of a new species, allied to *E. Duttoni*, collected by Mrs. Capt. Grey near the head of St. Vincent's Gulf.—*G. S. B.*

Eremurus robustus. By C. Crusius (*Die Gart.* p. 157 ; 4/1 1902). *Eremurus robustus*, collected at first by the Russian botanist P. P. Semenow in the Himalayas at an altitude of 2,000–3,000 metres, and described by Dr. Regel as *Henningia robusta.* Full particulars of culture, with illustration.—*G. R.*

Erythronium obtusatum, n. sp. By L. N. Goodding (*Bot. Gaz.*

xxxiii. No. 1, p. 67).—Closely related to *E. grandiflorum*, but has pale yellow and purple-tinged flowers.—*G. H.*

Erythroniums. By S. Arnott (*Gard. Mag.* No. 2520, p. 99; 15/2/1902).—The Dog's Tooth Violets are described, and interesting historical notes are added in connection with the type species *E. Dens-canis*, one of the oldest of English garden flowers, and still unrivalled in beauty among the many new species that have come to us from Western America during recent years. The list of species seems to be complete, and the article embodies a great deal of information about these beautiful bulbous plants.—*W. G.*

Eucalyptus Gunnii, var. **montana.** By Sir J. D. Hooker (*Bot. Mag.* tab. 7808).—Nat. ord. *Myrtaceæ*, tribe *Leptospermeæ*. Native of Tasmania and Victoria. It was discovered by Sir J. D. Hooker in 1840. It was called Cider-tree from the agreeable sap.—*G. H.*

Eucalyptus pastoralis. By S. L. Moore (*Journ. Bot.* 469, p. 27; 1/1902).—Description of a "White Gum" from Adelaide River, North Australia, collected by Rev. T. S. Lea in 1886.—*G. S. B.*

Eugenia Banksii. By J. Britten and S. L. Moore (*Journ. Bot.* 469, pp. 26, 27; 1/1902).—Description of a species collected at Endeavour River, Queensland, by Banks and Solander, to be figured in plate 122 of Mr. Britten's "Illustrations of the Botany of Captain Cook's Voyage." *G. S. B.*

Euphorbia jacquiniæflora als Winterblüher. By G. Besoke (*Die Gart.* p. 175; 11/1/1902).—The best of this genus as a winter blooming plant and especially as a pot plant. The showy flowers are bright antimony-red-coloured.—*G. R.*

Exacum Forbesii. Anon. (*Gard. Chron.* No. 789, p. 93; fig. 32; 8/2/1902.)—This new species is a native of Socotra, and is a perennial greenhouse shrub, of bushy habit, about a foot in height: it bears racemes of purple blossoms ½ inch in diameter, with prominent yellow anthers. It obtained an Award of Merit when exhibited by Messrs. Veitch & Co. at the Royal Horticultural Society on January 14.—*G. S. S.*

Exorrhiza Wendlandiana. By Sir J. D. Hooker (*Bot. Mag.* tab. 7797).—Nat. ord. *Palmæ*, tribe *Areceæ*. Native of the Fiji Islands. It was discovered by Dr. Seemann in 1861. It flowered at Kew in February 1901. Its height to base of leaves is 16 feet, but attains 60 feet in its native country.—*G. H.*

Experiment Station Work (*U.S.A. Dep. Agr. Farm., Bull.* 144, pp. 1–22).—Experimental work in various directions result here in: 1st, a plea for rotation of crops on scientific grounds, the practice being apparently not universal in America. 2nd, a recommendation for certain soils of Thomas or basic slag. 3rd, a suggestion that much better commercial results would follow the use of glass for forcing Lettuces for the New York market in North Carolina instead of the plant-cloth at present universal. 4th, an article showing that it appears to be more advantageous to the trees to irrigate South Arizona orchards in winter than in summer, while the practice possesses this great advantage, that in the former season water is plentiful and can be administered in really satisfying quantities, while in summer the available supplies are at best scanty; and 5th, a tabulated comparison of the results of scientific hybridisation and selection among native varieties of Grape, undertaken with the view of producing or preserving kinds which shall be desirable in themselves and adapted to resisting disease and adverse conditions of climate. *M. L. H.*

Farmyard Manure. By Malpeaux and Dorez (*Ann. Agr.* pp. 353–356; August 1901).—A discussion of the relative advantage of ploughing in the manure at once, or after leaving it spread on surface for some time. The balance is in favour of quickly ploughing in the manure.

C. H. H.

Farmyard Manure, Fermentations of Nitrogenous Matters in. By Dehérain and Dupont (*Ann. Agr.* pp. 401–427; September 1901). An important paper of some length which requires to be consulted *en bloc.—C. H. H.*

Fasciation in Sweet Potato. By Henry S. Conard, A.M. (*Contr. Bot. Lab. Phil.* vol. ii., No. 2, p. 205; 1901; pl. 19).—The common Sweet Potato as grown about Philadelphia produces fasciated vines very plentifully. It has been suggested that an excess of nitrogenous fertiliser (ammonia) in the soil seems to increase the amount of fasciation. At any rate, the evidence seems strong in favour of the view that fasciation in this plant is connected with high nutrition.

Along with the ordinary fasciations there appear in the Sweet Potato, as in other fasciated races, various peculiar malformations, such as split or dichotomous branching, split fasciations, and especially that remarkable condition which has been termed "ring fasciation."

Then follows a detailed description of ring fasciation as it has occurred in *Peperomia*, as described by H. de Vries; and also in *Veronica longifolia.* Also two doubtful cases of ring fasciation in *Sempervivum*, and two fasciated Sweet Peas reported by C. P. Qualch.—*M. C. C.*

Female Flowers of some Juglandaceæ, The. By G. Karsten (*Flora*, xc. 1902, pp. 316–333; pls. 12).—The species studied were *Juglans regia*, *J. cordiformis*, *J. nigra*, *Pterocarya fraxinifolia*, *Carya amara*, *C. tomentosa.* Two embryo sacs are often found, both fully developed, one behind the other, separated by vegetative cells. There would appear to be an abundant "sporogenous" tissue. The pollen tube enters the nucellus by the outer integument. *J. nigra* and *regia* are remarkable for the equivalence in size of the synergids and oosphere, the tardy union of the polar nuclei (possibly sometimes not effected, and one only mating with the male nucleus), the abundant sporogenous tissue. He recalls the close analogy between *Gnetum* and Angiosperms demonstrated by recent observers; and, with Eichler, places *Juglandaceæ* among the lowest of the latter, perhaps on a level with *Piperaceæ*.

M. H.

Fern-prothallium, an Alga-like. Note by A. P. W. Thomas, University College, Auckland, N.Z. (*Ann. Bot.* vol. xvi., No. 61, p. 165; March 1902).—"The prothallium (of *Schizæa bifida*) is quite unlike the ordinary types of Fern-prothallia, and is strongly suggestive of an *Alga*. A good specimen has the form of a soft-looking, round green cushion, from a quarter to half of an inch in diameter. Erect green filaments can be seen projecting above the general surface even with the naked eye. . . . Filamentous prothallia are already known in *Trichomanes*, and, as is well known, small more or less filamentous prothallia occur in many Ferns when spores are sown too thickly. But these starved filamentous prothallia bear male organs only. The prothallia of *Trichomanes* are incompletely filamentous. . . . The prothallia of *Schizæa*, however, are *completely filamentous throughout*, not only the antheridia, but also the archegonia being produced on filaments." The author describes his observations at some length.—*R. I. L.*

Fertiliser Analyses, Autumn, 1901. By B. W. Kilgore, State Chemist, Illinois (*U.S.A. St. Bd. North Carolina*, vol. xxiii., No. 2, February 1902).—A short paper on fertilisers used by farmers on fall crops for comparison of the relative values. The following are amongst the substances mentioned and described: "Water-soluble Phosphoric Acid," "Reverted Phosphoric Acid," "Water-soluble Ammonia," and "Organic Ammonia." The ammonia included under the last heading is such as that in cotton-seed meal, dried blood, fish scrap, &c. These materials are insoluble in water, and before they can feed plants they must decay and have their ammonia charged by the aid of the bacteria of the soil to nitrates, similar to nitrates of soda. They are valuable then as plant food in proportion to their content of ammonia. A table of valuations for 1901 is given.—*V. J. M.*

Fig, the Cultivation of. By Numa Schneider (*Rev. Hort.* pp. 143-145; March 16, 1902).—General culture and descriptive list of ten varieties recommended.—*C. T. D.*

The Fig. By R. H. Price and E. A. White. (Bull. No. 62; 12 photo plates. *Texas Agric. Exp. Stn.*, 1902).—Very little has been done in Texas along the line of commercial Fig cultivation, the Fig being only grown as yard or lawn trees.

In some sections of Texas attempts have been made to dry the Fig, but owing to the unfavourable climatic conditions at those places this has been unsuccessful. The authors treat briefly of the early history of the Fig, its varieties included under three classes: *Caprifigs*, *Smyrna Figs*, and *Adriatic Figs*. They are also arranged under the three colours: brown, yellow, and black, with descriptions of each variety.

This brochure also deals with propagation, soils and fertilisers, planting, cultivation, insects and diseases, pruning, picking, marketing, canning, and evaporating.—*G. H.*

Figs, Fertilisation or Caprification of. By H. Hitier (*Rev. Hort.* pp. 85, 86; February 16, 1902).—A description of the life-career of *Blastophaga grossorum* as followed by Dr. Trabut and explained by M. Bouvier to the Société Nationale d'Agriculture. The wild Fig bears three crops in the year. In each one the fruit is inhabited by *Blastophaga*, thus: (1) A summer generation, developed in the spring and maturing in June; (2) an autumnal one, which is developed during the summer; and (3) a winter one, starting late in autumn and maturing in the early spring. The winter Figs contain only female flowers with a short style, and in which the ovum is replaced by a male or female Blastophaga, which passes the winter in this retreat and develops completely. The vermiform males issue first and make their way to the fruits containing the still captive females, which eventually after fecundation escape and take flight to the spring Figs, within which they deposit an egg against the embryo ovum. This egg hatches and the seed embryo forms the food of the young *Blastophaga*. On quitting the summer Fig the females traverse the male flowers then open near the orifice of the fruit, and transfer subsequently the pollen to the female autumn flowers, which are thus fertilised. In the Mediterranean region, where the wild Fig grows, the autumn Figs cannot set or ripen without being fertilised, and as these cultivated Fig trees only bear female flowers they must perforce be fertilised from some outer source, *i.e.* by the wild Figs and the agency of the Blastophaga. Hence the method pursued, which is extremely ancient, and is called "caprification." As the *Blastophaga* has been introduced into California and acclimatised there, the difficulty of fertilisation no longer exists, and a large trade in Smyrna Figs has been established.—*C. T. D.* (See also p. 241.)

Flower Buds. By E. S. Goff (*U.S.A. Exp. Stn., Wisconsin, Report*, 1901, pp. 304–316; 16 figs.).—The investigations recorded in this report were carried out with a view to discovering (1) the time of flower formation in the Currant, Gooseberry, and Cranberry; (2) the variation in the period of flower formation between different varieties of Apple growing in the same orchard; (3) the influence of irrigation upon the formation of flower buds in the Apple in time of drought; and (4) the extent to which flowers are formed the season before their expansion in those fruit plants in which no flower buds can be distinguished in autumn.

The author found that the flowers were beginning to be formed within the bud of the Pomona Currant by July 8, in the Black Currant by August 3, and on October 30 the White Currant showed many flowers, but little differentiation of parts. In the Downing Gooseberry flowers were well started by August 30, while on October 30 the ovules had begun to form. (The weather was warm and unusually dry, so that the formation of flowers was possibly hastened.)

In the Cranberry the young flowers were not observed until September 16, while by October 10 the calyx and corolla were distinctly visible.

It has been previously proved that flowers may be formed in the buds of the Hoadley Apple until frost sets in (see Reports of Wisconsin Exp. Stn., 1899, pp. 289–303, and 1900, pp. 266–285), but the investigations on other varieties seem to show that there may be considerable variation in the period at which the Apple flowers begin to form.

It was found that abundant watering during a period of extreme drought and heat did not perceptibly influence the time of appearance of the first flowers in the Gideon Apple, although these did not appear until eight weeks after the watering had commenced. Nor did the watering perceptibly affect the percentage of swelled buds that formed flowers. It did, however, affect perceptibly the percentage of buds that swelled, and also the amount of growth beneath the buds on the fruit spurs. The tree that was not watered promises to bear the better crop.

The author found that, notwithstanding the fact that no flower buds can be distinguished in autumn in the Quince, Raspberry, Blackberry, and Grape, yet the flowers are really formed during the season before their expansion. *F. J. C.*

Flower Growing in South New Mexico. By Francis E. Lester (*U.S.A. Exp. Stn. New Mexico Bull.*, 40, November 1901; 9 plates).—A message of hope from a garden enthusiast to fellow-sufferers from the climate of South New Mexico, where it seems to be commonly reported that flowers will now grow. The author of this essay apparently makes them grow, and gives photographs of garden groups and of single blooms to illustrate his triumphs. The chapter of accidents taught him to sow annuals in the autumn, and loving care and a habit of introducing chiefly garden counterparts of native wild flowers have done the rest.

M. L. H.

Fritillaria askhabadensis. J. G. Baker (*Gard. Chron.* No. 798, p. 237, fig. 74; 12/4/1902).—This Fritillaria is interesting as being a second species of the sub-genus *Petilium*, of which hitherto only one species was known ('The Crown Imperial'): it differs from our old favourite by the flowers being smaller and the segments of a different shape. Their colour is a pale yellow slightly tinged with green. This species is a native of the Trans-Caspian province of Russia, and was found near the town of Askhabad in calcareous soil at an elevation of about 3,300 feet.—*G. S. S.*

Frost, Effects of, in the Winter of 1900–1901 in the Botanic Gardens at Montpellier. By M. Daveau (*Ann. Soc. Hé.* p. 156; Oct. 1901).—We are surprised to hear that the following were amongst others killed by minima not exceeding 22 deg. Fahr. at four feet from the ground at Montpellier: *Frankenia lævis, Lavatera arborea* *, *Rhododendron ponticum, Alyssum spinosum, Solanum jasminoides* *, *Cistus salvifolius.* Those marked * survived in a neighbouring garden where the minima were lower, but of shorter duration.—*C. W. D.*

Fruitarians and Chinese, Nutrition Investigations among. By M. E. Jaffa, M.S. (*U.S.A. Dep. Agr. Off. Exp. Stn., Bull.* 170;

1899–1901).—A rather inconclusive report on the probable sufficiency and advantages of a purely fruitarian or vegetarian diet. The first series of investigations was made with a family belonging to the stricter sect of fruitarians, that is, rejecting not only milk and eggs, but all cooked food and all cereals, and living entirely on fresh and dried fruit, olive oil, honey, and nuts. By chemical analysis this dietary is shown to be seriously deficient, according to the received American standard, in protein, carbohydrates, and fuel value; but as the only family under observation consisted of two under-sized women, taking only light exercise, and of three children, and as all these seemed to enjoy ordinary health, it would be hardly fair to conclude either that the undeveloped condition of the youngest child was due to insufficient nourishment, or that the foods provided would be enough for a man taking severe exercise. The cost of living under the above conditions works out almost exactly at what has been proved to be the average expenditure per day of the ordinary American in comfortable circumstances, even including the cost of the fuel he needs to prepare his food, whereas the fruitarians devoured theirs raw, and it must be remembered that this was in California, where fruit is plentiful, and in late summer, when it is at its cheapest.

The report further gives the result of careful analyses of the food values of three different groups of Chinese settled in America and answering to our professional class, artisan class, and labourer class.

The inquiries were started under the usual impression that Chinese live almost exclusively on rice; but as on investigation it turned out that though some of their foodstuffs were national and unknown to Americans, the diet of these emigrated Chinese, at all events, was almost identical in cost, variety, and proportion with that of the corresponding classes in America, these results also seem to point no particular moral.—*M. L. H.*

Fruit Culture. By W. Munson (*U.S.A. Dep. Agr. Maine Bull.* vol. i. No. 1; March 1902).—*Pruning*—Trees on a warm southern slope, freely exposed to the winds, require much less pruning than do those in a cool sheltered location which is lacking in sunshine. Plenty of light is essential to the production of highly coloured fruit. If the trees have been long neglected and require heavy pruning, do not remove all the wood the first year. Removal of a portion of the top, and so distributing the food gathered by the roots to a smaller number of branches, tends to produce rapid growth and a renewed vigour of the tree. The removal of too much at one time will start the growth of water-sprouts and defeat the very purpose in view. The time of year at which the cut is made has little effect on the readiness with which the wound heals. Wounds should be covered immediately with a coat of paint to keep out moisture and spores. The best season for pruning in Maine is said to be on warm days from January to May.

Regrafting.—Young trees may be retopped by grafting in a single season, a tree eight or ten years old in two years, and one of twenty or more years in three seasons. The best method of top grafting is not to make a few limbs the basis of the new top, but to remove a larger number of small limbs ranging from one to two inches in diameter. The split should be made in a horizontal position, so that the scions should not be

one above the other. Grafting wax: 4 lb. resin, 2 lb. beeswax, 1 lb. tallow. Spraying calendar and formulas. Farm statistics of the State.
C. H. H.

Fruit Culture at our State Farms. By S. C. Voller (*Qu. Agr. Journ.* ix. pp. 548–551; December 1901; 4 plates).—This communication is chiefly concerned in describing the methods of pruning fruit trees as adopted at the state farms, with sixteen different figures from photographs of trees before and after pruning.—*M. C. C.*

Fruit Industry of California, Statistics on the. By E. S. Holmes (*U.S.A. Dep. Agr.* (*Div. Stat.*), *Bull.* 23; 1901).—This industry started by the Franciscan monks at their mission stations has increased to about 16,000,000 trees in bearing, 14,000,000 non-bearing, acreage under fruit 610,000 acres. Of this area 157,000 acres are under Grape, 116,000 Prune, 80,000 Peach, 40,000 Apricot, 53,000 Orange, 80,000 Olive, 23,000 each Almond and Apple, 22,000 Pear, 8,000 Cherry, 4,500 Fig, 20,000 Walnut. These fruits thrive well in most parts of California. Next to Grapes, Prunes are more extensively cultivated than any other fruit. The yield is very heavy, trees in full bearing yielding annually from 150 to 300 lb. of green fruit each. Apples thrive phenomenally well along the coast where the temperature is not too high, in the mountain countries. Oranges and Lemons are profitably grown along the foot hills of the Sierra Nevada Mountains from San Diego to Tehama County, a length of over 700 miles and a width of three to thirty miles. Statistics follow as to the number of bearing and non-bearing trees in each county, also shipments by rail and sea. About 520,000 tons of fruit were shipped by rail and sea in 1900.—*C. H. H.*

Fruit Packing. By H. T. Martin (*Gard. Mag.* No. 2530, p. 262, 26/4/1902).—A series of notes (continued in the following number) upon the proper mode of packing fruit, a very important matter to most gardeners. The instructions given appear to be thoroughly practical and clearly stated, and include remarks upon all fruits grown in English gardens. Wood wool and paper shavings as packing material seem to be most favoured by the writer for the packing of soft fruits excepting Strawberries, for which he uses the soft leaves of *Malva crispa*, grown specially for the purpose.—*W. G.*

Fruit Soils and Fruit List of Virginia. By Wm. B. Alwood (*U.S.A. Exp. Stn. Virginia, Bull.* 98).—Blacksburg, Montgomery County, Virginia. Apples, Pears, Quinces, Peaches, Plums, Cherries, Blackberries, Raspberries, Currants, Gooseberries, Strawberries, and Grapes, comparing varieties as to colour, quality, season, use, origin, as to suitability in five different districts, with remarks.—*C. H. H.*

Fruit Trees, Propagation and Planting of. By W. L. Howard (*U.S.A. St. Bd. Missouri Bull.* vol. i. No. 11; 1902).—Good description of raising Apple seedlings and root grafting, also cleft grafting and budding, well illustrated.—*C. H. H.*

Fruit Trees, The Summer Pinching of. By Alger Petts (*Garden*, No. 1586, p. 235; 12/4/1902).—There is a great difference of opinion upon the subject, while it is doubtful if many amateurs understand the principles and also the practice of this operation, so important to the fruit-grower.—*E. T. C.*

Fruit Trees, Training of. By George Bellair (*Rev. Hort.* pp. 129–131; March 16, 1902).—Four woodcuts and an interesting article illustrating mode of pruning and treatment for trellis training on several systems.—*C. T. D.*

Fruit Trees, Reports on. By S. H. Fulton (*U.S.A. Exp. Stn. Mich., State Agr. College, Hort. Dep., Bull.* 194, December 1901).—A series of notes on new varieties of fruit trees and bushes which have been tried on the station grounds, with results also of experiments in remedies for some of the diseases to which fruit trees are liable, as, for instance, that 1 oz. of liver of sulphur to three gallons of water was used to prevent mildew in Gooseberries, the first application being made on May 1, and followed by others at intervals of ten days till the fruit ripened.

A series of experiments in spraying Peach trees for leaf-curl with copper sulphate solution in different strengths and at different dates showed that it made no difference whether the trees were sprayed in autumn or early spring, but spraying after April 26 was less and less efficacious. The strength tests showed no difference in effect between mixtures of 1 lb. copper sulphate to 200 gallons of water and 1 lb. sulphate to 20 gallons.

One year's experiments also showed no difference between trees pruned in spring or autumn or early winter. The best English Gooseberries for home and market are given as 'Chautauqua,' 'Columbus,' 'Keepsake,' and 'Lancashire,' and the best American ones as 'Downing,' 'Pearl,' and 'Red Jacket.' 'Cumberland' is said to be a new variety of Raspberry, in all respects worthy of the high praise which has been given to it. 'Garden Royal' and 'Hubbardston' are specially recommended among Apples, and 'Paragon' almost enthusiastically among Chestnuts. 'Montreuil,' a little-known variety of Duke Cherry, is pronounced unsurpassed for culinary purposes, while 'Tartarian' among Bigarreaus is mentioned as one of the most profitable market varieties grown.

M. L. H.

Fruits and Seeds, Statistical Information concerning the Production of, in certain Plants. By John W. Harshburger, Ph.D. (*Contr. Bot. Lab. Phil.* ii. No. 1, p. 100; 1898).—Consists mainly of tables showing the number of perfect fruits and of abortive fruits, in a series of examinations on *Arisæma triphyllum*, *Rhododendron nudiflorum*, *Cornus florida*, *Staphylea trifolia*, *Hibiscus Moscheutos*, *Xanthium canadense*, *Yucca filamentosa*, and *Pimpinella integerrima*.

The relative ratios established in these tables between the perfect and abortive seeds and fruits give some idea as to the success of the act of pollination and fertilisation.—*M. C. C.*

Fumigation in Orchards and the San José Scale. By F. A. Sirrine (*U.S.A. Exp. Stn., New York, Bull.* 209; December 1901).—It seems from the experiments recorded in this pamphlet that there is no danger to trees by fumigation with potassium cyanide except when done in bright sunlight, when the leaves had begun to expand, or when the charge of chemicals was too great. Black folding tents gave the best results. Such tender trees as the Peach, so long as they are dormant, can be safely treated with 2½ oz. of KCN (98 %) per 100 cubic feet for a period not exceeding 30 minutes. The results also show that fumigation may be depended upon to exterminate the San José scale on medium-sized orchard trees in small areas; ½ oz. KCN per 100 cubic feet is sufficient, but more should usually be used. The author recommends the following proportions for use:—

1 part by weight of potassium cyanide.
1 „ volume of sulphuric acid.
2 „ „ water.

The paper concludes with descriptions of apparatus used, details of fixing tents, and reccords of experiments showing the time taken for chemical action to take place under varying circumstances between the sulphuric acid and potassium cyanide. The paper is well illustrated with plates and figures showing details of construction of the tents and means of employing them, &c.—*F. J. C.*

Fungicides, Effects of, on Foliage. By S. M. Bain (*U.S.A. Exp. Stn. Tennessee Report*, 1901, p. 9).—The botanist at the above station has been investigating experimentally the effects of fungicides on foliage, and a full report on the subject is promised. In the meantime it is said that while Peach foliage showed itself very sensitive to the poisonous effects of Bordeaux mixture used alone a subsequent spray of milk of lime prevented all bad effects, and probably a reversing of the order of applications would be followed by even better results.—*M. L. H.*

Fungicides, Insecticides, Spray Calendar (*U.S.A. Exp. Stn., Mass., Bull.* 80; 3/1902).—This bulletin contains recipes for making spray solutions, recommends them for use against the attacks of various pests, and gives a calendar showing the time to spray for each particular purpose. Very useful for the locality in question.—*F. J. C.*

Fungi, Economic and other. A collection prepared for distribution by Flora W. Patterson (*U.S.A. Dep. Agr., Bull.* 8, 1902).—This is a list consisting of 543 members of parasitic fungi, for the most part with enumeration of their hosts and localities, to facilitate the exchange of specimens between the different bureaus and stations in the United States.—*M. C. C.*

Fungi of the Netherlands (*Beih. Bot. Cent.* bd. xi. ht. 8, pp. 523-541).—Herr C. A. T. A. Oudemans (Arnheim) gives a list of the Fungi discovered, and, in addition, a Latin diagnosis of seventy-five new species, which are here described for the first time. These consist of *Mucronella* (1 sp.), *Clavaria* (2 sp.), *Lycoperdon* (1 sp.), numerous Ascomycetes, *Sphæropsideæ*, *Melanconieæ*, *Mucedineæ*, *Dematieæ*, *Stilbeæ*, and *Tubercularieæ*.—*G. F. S.-E.*

Fungi: Index Bibliographique. "Des Principaux Mémoires de Mycologie parus en 1901" (*Bull. Soc. Myc. Fr.* xviii. fasc. 2; 1902).—A very useful enumeration of the books, memoirs, and contributions to the study of mycology, which were published during the year 1901.
M. C. C.

Galanthus Alleni. By W. Irving (*Garden*, No. 1581, p. 157).—A description, with illustration, of this rare and handsome Snowdrop, which was sent to Mr. Allen, the well-known Snowdrop enthusiast, from Austria in 1883 by Herr Gusenus.—*E. T. C.*

Genistas. By G. G. (*Gard. Mag.* No. 2518, p. 69; 1/2/1902).—A descriptive account of a few species that can be grown in the open air in these islands, but which are not hardy in all parts. Half a dozen species are described, and the list might be extended to include the pretty *G. radiata*, *G. sagittalis*, and *G. virgata* from Madeira, the last-named being the only species that will thrive and flower well under the shade of trees, and is especially valuable as flowering in late summer when so few open-air shrubs flower. It is also known as *G. elata.*—*W. G.*

Germination, Influence of Manures on. By G. W. Hicks (*Ann. Agr.* p. 385; August 1901).—Chloride of potash and nitrate of soda used at one per cent. mixed with soil injured germination considerably. Phosphatic and calcareous manures are much less harmful, and if not in too large a quantity have no action. Chemical manures should not come in contact with the seed. Manures are most harmful to the young stems coming out of the seed before they emerge from the soil. It seems probable that no manure used in agriculture aids germination.—*C. H. H.*

Ginseng Culture. By the Editor (*Qu. Agr. Journ.* x. pp. 121–122; February 1902).—The cultivation of Ginseng (*Panax Ginseng*) for its root is recommended for tropical or subtropical countries. An authority quoted states: "My lowest estimate on an acre planted in Ginseng, and allowed to grow for five years, at the price it is sold to-day, is £7,000 for roots alone, besides the seed crop."—*M. C. C.*

Gladioli, Culture of. By Rev. H. H. D'ombrain (*Garden*, No. 1585, p. 222; 5/4/1902).—The experience of one who has grown the gandavensis section of *Gladiolus* for forty-five years, who considers their cultivation a puzzling matter, and who proceeds to give much sound and interesting information on the subject.—*E. T. C.*

Graft, Curious Result of a. By H. Danthenay (*Rev. Hort.* pp. 16–18; January 1, 1902).—One woodcut depicting two neighbouring Apple trees at Bougival, with adjoining branches inarched either naturally by contact or artificially, not recorded which. Subsequently to the union one of the trees when in full leaf and fruit was snapped off at the ground line (probably at the original grafting point) in a storm. It was raised and supported on a flat stone beneath the trunk, and not only did it not flag, but it retained its foliage and its fruit continued to grow, though it was solely dependent upon the roots of the other tree and the nourishment derived through the one connecting branch. For fifteen years since the two trees have flourished, the rootless one bearing foliage to its base and behaving in every way as a perfect tree.—*C. T. D.*

Grafting Experiments, Note on some. By R. H. Biffen, M.A., Cambridge (*Ann. Bot.* vol. xvi., No. 61, p. 174; March 1902).—This note is suggestive to gardeners, who have many opportunities of making similar experiments. The author writes: "The following results are the outcome of a series of experiments to test the possibility of obtaining improved varieties of cultivated plants by employing the process of grafting. The experiments of Daniel seem to show conclusively that the stock and scion mutually affect each other, and that in some cases, at all events, the changes so induced become hereditary (Daniel, *Ann. d. Sci. Nat.* 1898, p. 1). So far my experiments have not been carried on for a sufficient time to reach this stage, but as they confirm several other points brought out by Daniel and introduce new ones they are of interest." The author details his methods and says that the most successful grafts were obtained by using seedling plants, with from three to six leaves, both for stock and scion. Experiments with Beets, *Tropæolum majus* and *T. canariense* (properly called *T. peregrinum*), Radishes, various *Cruciferæ*, and *Leguminosæ* are described, and it is then said that "this series of experiments confirms Daniel's results that the effect of grafting is often to dwarf the plants, retard their flowering season, and in some cases render them far more liable to the attacks of animal pests. None of them, though, show any visible signs of the scion and stock affecting each other. This, however, is well shown in a series of Potato grafts. The operation was performed by paring off a thick piece of skin containing an eye or a shoot an inch or two long from one Potato and binding it tightly over a similarly shaped pared patch on another tuber; all the other eyes were then destroyed, leaving only the scion to develop. One set of Potatos (A) had thin smooth green skins and numerous deeply sunken eyes, while the other (B) was readily distinguished by its thick rough brown skin and its few shallow eyes. A was grafted on B, and B on A. The resulting crop of tubers was the same in each case. From one and the same plant tubers of type A and B were obtained (often with their characteristics much exaggerated; *e.g.* the russet skin cracked so as to resemble a truffle on the eyes exceedingly deep &c.), and tubers one end of which resembled A, the other B. In many cases there was a sharp constriction between the A and B ends, but in some the yellowish-green skin gradually passed over into the rough corky skin, and the tubers were regular in shape. In every case the 'rose-end' (distal end) of the tuber was of the A type, and the heel (proximal end) of the B type. Tubers in which the two types were blended never occurred." If halved transversely each portion was thus indistinguishable from one of its parents, and both parents were represented by each tuber. These results are so remarkable that interest in further experiments can but be aroused.

R. I. L.

Grafting Experiments, New. By H. Lindemuth (*Gartenflora*, p. 12; 1/1 1902).—*Solanum erythrocarpon* was grafted on *Solanum*

Lycopersicum and the grafted specimens grew more rapidly and luxuriantly than ungrafted specimens. The author has observed the same with *Physalis* grafted on the Potato, *Arabis albida* on species of *Brassica*, and *Solanum auriculatum* on *S. tuberosum*. Certain plants, he maintains, can be more rapidly obtained and more beautiful and luxuriant specimens procured by grafting them from seeds or ordinary cuttings.

The Wallflower was grafted on Red Cabbage, *Abutilon Thompsoni* on *Althæa narbonensis*, *Abutilon Thompsoni* on *Sida Napæa*, and *Petunia hybrida* on *Nicotiana glauca*.—*J. P.*

Grafts, Heterogeneous. By Raymond Roger (*Rev. Hort.* pp. 166, 167 ; April 1, 1902).—A number of grafts between quite different orders are quoted, *e.g.* Haricot Bean on Ricinus, Sunflower on Melon, Cabbage on Tomato, Potato (Topinambour) on Cherry, Chrysanthemum on Tomato, Coleus on Achyranthus, Aster on Phlox, *Cineraria maritima* on Tomato, Coleus on Tomato, Maple on Ash, &c., in all of which the junction was sound and durable. M. Daniel, the authority for these, considers the generic affinities to be of less importance than analogous size, vigour, and vegetative habits or anatomical character, analogy of tissue, and similarity of alimentary needs. The possibility is suggested of such grafts affecting the seed of stock and scion, and thus leading to unexpected variations.—*C. T. D.*

Grafting Monocotyledons. By Raymond Roger (*Rev. Hort.* pp. 37–38; January 16, 1902).—M. Lucien Daniel has succeeded in grafting on *Vanilla* and *Philodendron*. Success depends upon the extent of contact surface, which must be large and obtained by very oblique severance.—*C. T. D.*

Grape-growing for Everybody. By E. A. Riehl (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 136–142).—The author in his short article treats the subject from a popular point of view, and wishes every one to try Grape-growing. He advocates the planting of young and thrifty vines not over one year old, and says they should be cut down to the ground first season, half the wood being cut away second season. Spraying with Bordeaux mixture and autumn pruning is also described.—*V. J. M.*

Grape Fruit Rots. By Henry Tryon (*Qu. Agr. Journ.* x. pp. 211–214 ; two plates ; March 1902).—The Dematium fungus rot is attributed to the attacks of *Exobasidium vitis* or *Dematium pullulans*. This disease differs from sun-scald in the fact that the berries are never fissured, their contents shrinking instead of increasing in volume. It may occur on any part of an affected bunch, and not on its exposed face only. The diseased berries contrast with those surrounding them, which remain green and intact, by exhibiting a reddish-brown coloration, with the surface puckered with conspicuous folds, indicating a shrinkage of their contents. The berries longest affected become of a deep chocolate hue. At the same time the main axis and branches constituting the bunch become brown or shrunken.

This disease was first described in Australia by D. McAlpine in 1896, and then called by him "Aureo-grape rot"—and attributed to *Aureo-*

basidium vitis var. *tuberculatum*—but now regarded as an *Exobasidium*, and a stage of the development of *Dematium pullulans*.—*M. C. C.*

Grapes, Coulure or Non-setting of. By E. H. Rainford (*Qu. Agr. Jour.* x. pp. 41–42; 2 plates; January 1902).—Coulure appears under two different forms, one, the failure of the flower to set the fruit in all or part of the cluster; another, in which the fruit sets and increases in size, shortly to fall off the bunch in greater or less quantities, as the attack may be severe or mild. The causes of this serious defect are two, constitutional and accidental.

Constitutional coulure is attributable either to defective sexual organs of the flower or to degeneration of the plant. The cause of this class of coulure is, apparently, cultivating the vine in badly drained land.

Accidental coulure is caused by (1) adverse meteorological conditions at flowering time, (2) too great a vigour of vegetation, (3) fungus attacks of the flower and immature berries.

Fungus attacks may be by anthracnose or oidium. In the latter case treatment with sulphur and lime is recommended.

In the case of coulure due to abnormal climatic conditions nothing can be done but to take it as philosophically as possible.—*M. C. C.*

Grasses, Ornamental, for Bouquets. By Jules Rudolph (*Rev. Hort.* pp. 95–97; February 16, 1902).—Six woodcuts, with an interesting descriptive list of decorative species suitable for association with flowers in floral arrangement, especially in a dried state, and therefore permanently useful.—*C. T. D.*

Gunnera, Contributions to our Knowledge of the Genus. By Hans Schnagg (*Flora*, vol. xc. 1902, pp. 114–160; 28 woodcuts).—A very full and conscientious study chiefly of the anatomy of this interesting and isolated genus. The ovule becomes completely adnate to the walls of the ovary, and the micropyle closed by the dovetailing of the cells that bound it when young. The nuclear divisions in the embryo-sac are irregular and multiple after the first four have been formed in the usual order. Two of these nuclei pass to the upper pole, one dividing to form the small synergids, the other simply enlarging to form the oosphere. Several—as many as five are figured—fuse to form the endosperm-nucleus. Endosperm formation is not parietal, but limited to the basal part of the embryo-sac, and possibly the antipodals (6–7) take part in it. The enlargement of the embryo-sac with its contents determines complete absorption of nucellus and integument. The reserves in the endosperm are aleurone-grains, each nearly filled by a large cubical crystal. Despite the enormous differences of size of the vegetative organs in the several species of the genus there is no *general* corresponding differences in the absolute size of their histological elements. But *G. chilensis* has much the biggest vessels.—*M. H.*

Habenarias, Hardy. By G. R. (*Die. Gart.* p. 330; 12/4, 1902). Of this genus of hardy terrestrial Orchids twenty species are described and cultural notes given.—*G. R.*

Habenaria Lugardii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7798).—Nat. ord. *Orchideæ*, tribe *Ophrydeæ*. Native of Bechuanaland. It bears two large orbicular leaves and racemes of white flowers, having spurs some 8 inches in length. It flowered at Kew in February 1899.

G. H.

Hæmanthus diadema. By A. V. D. H. (*Rev. Hort. Belge*, xxviii. No. 1, p. 13; with col. pl.).—It bears a large umbel 8 inches across in full flower of scarlet flowers.—*G. H.*

Hazels, The Witch. By D. K. (*Journ. Hort.* p. 180; Feb. 27, 1892).—Four kinds of this genus (*Hamamelis*) are described, and as they flower in winter their bright yellow at that season is attractive and ornamental.—*C. W. D.*

Heating Greenhouses, Early Treatises on. By W. Roberts (*Gard. Chron.* No. 791, p. 121; 22/2/1902).—In this article the history of heating plant houses is dealt with, and the author quotes a number of books &c. which appeared at the end of the eighteenth and the beginning of the nineteenth century, in each of which apparently a different system of heating was advocated. One of the earliest papers in which heating greenhouses is mentioned is one published in the "Philosophical Transactions" in 1694; but it seems that as late as 1721 glass was not used in the construction of greenhouses.—*G. S. S.*

Helenium Hoopesii. By S. Mottet (*Rev. Hort.* p. 109; 1 woodcut; March 1, 1902).—Highly recommended as a robust hardy garden flower, large yellow multi-rayed stars, floriferous, about three feet high.

C. T. D.

Helianthus, Floral Transformations of. By J. Fr. Favard (*Rev. Hort.* pp. 139–142; March 16, 1902).—Seven woodcuts, mainly illustrating distinct varieties of *H. cucumerifolius*, single, semi-double, double, and dwarf. An interesting series.—*C. T. D.*

Helichrysum, Some African Species of. Anon. (*Gard. Chron.* No. 784, p. 4, fig. 1; 4/1/1902).—In the *Gardeners' Chronicle* of Nov. 10, 1900, a new species belonging to this genus, named *H. Gulielmi*, by Prof. Engler, was figured. Prof. Engler in his paper mentioned another species (without naming or describing it) as allied to *H. formosum*. This is supposed to be the species now figured, which, however, is apparently not a new species, but a variety of *H. Gulielmi*.—*G. S. S.*

Helichrysum Volkensii. Anon. (*Gard. Chron.* No. 794, p. 169, fig. 50; 15/3/1902).—This African species is a native of the Kilma-njaro Mountain, where it grows in "the highest zone of vegetation": it is a plant of shrubby habit, the stems and branches densely covered with white shaggy hairs. The flowers are about 1¼ inch in diameter, the outer bracts are bright rose-coloured, the inner ones white. It was flowered by Mr. Gumbleton.—*G. S. S.*

Hellebores. By J. W. Barr (*Journ. Hort.* p. 205; March 6, 1902).—A portrait is given of *Helleborus colchicus*. The stalked Hellebores of the

H. orientalis type, known as Lent Roses, are noted, and the best mode of cultivating them, which was especially studied by Mr. Peter Barr in his Tooting nursery, is described. Their botanical names are difficult to assign and not trustworthy, as a large proportion of the best varieties are hybrids.—*C. W. D.*

Hemigenia Pritzelii. By S. L. Moore (*Journ. Bot.* 469, pp. 28, 29; 1/1902).—Description of a new species, E. Pritzel's No. 196, allied to *H. rigida*, from the Darling Range, in Wellington District, West Australia.
G. S. B.

Hibiscus Scotti. By Sir J. D. Hooker (*Bot. Mag.* tab. 7816).—Nat. ord. *Malvaceæ*, tribe *Hibisceæ*. Native of Socotra. This is a small tree with large yellow flowers, with a crimson base to the petals.—*G. H.*

Hieracia of Chili (*Beih. Bot. Cent.* bd. xi. ht. 8, pp. 552–558).—Herr F. W. Neger (Munich) gives an interesting sketch of the distribution and also new descriptions of four Chilian species of this genus.
G. F. S.-E.

Hop and its English Varieties, The. By John Percival (*Journ. R.A.S.* vol. lxii. pp. 67–95; figs. 1–22; 1901).—The author deals with the structure and varieties of the Hop, and gives a number of excellent photographic illustrations. The only two distinct species of Hops known are the Japanese Hop (*Humulus japonicus*, Sieb. et Zucc.), a native of China and Japan; the other, our ordinary Hop (*Humulus lupulus*, L.), is a native wild plant distributed all over Europe. The former is of no value for brewing purposes, but is grown as an ornamental climber in gardens. The seedlings of few plants vary so much as those of the Hop, and this in spite of the fact that it is a species which has not been subject to hybridisation. The varieties discussed are: 'Hobbs's Early' (density=6); 'Prolific' (density about 6); 'Meopham' (density=5); 'Henham's Jones' (density=7); 'Brambling' (density=7); 'White's Early' (density=7); 'Amos's Early Bird' (density about 8); 'Bennett's Early Seedling' (density=6); 'Rodmersham or Mercer's Hop' (density=7½–8); 'Cobb's Hop' (density=7); 'Canterbury White Bine' (density about 7); 'Cooper's White' (density=6¾–7); 'Fuggle's Hop' (density=7); 'Old Jones's Hop' (density=7–8). The term "golding" or "goldings" is generally applied by Hop merchants and factors to the best class of Hops such as the 'Canterbury' and 'Farnham Whitebines' &c. The "density" of a Hop, taken in conjunction with the shape of its bracts, is the best means for distinguishing and classifying the different varieties.—*R. N.*

Horse-chestnuts, Æsculus and Pavia. By W. J. Bean (*Gard. Chron.* No. 795, p. 187; figs. 57, 58, 59, and 60; 22/3/1902).—Descriptions are given of nine species which are in cultivation, three of which are figured. It is said that all the species are "noteworthy for their beauty of foliage, standing perhaps pre-eminently in this respect as a genus of hardy trees." All are gross feeders and like a rich moist soil. They are best propagated from seed. The common Horse-chestnut is by far the best as a park or avenue tree, as none of the others in this country approach it in size. *Æ. indica* has very striking foliage, the leafstalks are a rich red colour, and the leaflets are sometimes a foot in length, and vary from seven to nine in number. *Æ. parviflora* has long slender racemes of small pinkish white blossoms, with darker stamens which are nearly twice the length of the flower.—*G. S. S.*

Horticulture in Maryland (*U.S.A. Hort. Soc. Maryland*, vol. iv.; 1901).—A perusal of this report gives an excellent idea of the general state of horticulture in Maryland, U.S.A., and especially of the supervision exercised over the nurseries in the district in order that the dissemination of insect pests and fungoid diseases should be checked. Local inspectors are appointed in each district who report to the chief of the department any outbreak of disease, &c., among plants, who at once investigates the matter and initiates measures towards its suppression. Some of the subjects dealt with at the annual meeting are noted under their proper headings.—*F. J. C.*

Horticulture, Laws relating to (*U.S.A. St. Bd. Agr. Missouri*; March 1902).—Purposes of the fruit experiment station.—Appointment of manager and inspector (must be scientists and graduates of some scientific college).—Board of Trustees.—Request by five residents for manager and inspector to examine cases considered infectious and dangerous to the neighbourhood.—Duty of manager on receipt of petition to go to locality, give aid and instructions as he may think best for the prevention, cure, or eradication of the diseases or insects with which he may find the plants infected, and request said petitioners to report to him, in writing, the result of the treatment prescribed.—Proceedings when trees &c. are found to be diseased, and the disease or insects are liable to spread, order if cannot be cured to dig up and burn at cost of contingent fund of the said experiment station.—The manager or inspector has the right to enter and inspect fruit trees and plants on any premises.—Protection of fruit trees entering the State from another country or State.—All trees, bushes, scions, cuttings, and buds to be inspected by a State or experiment station entomologist.—*C. H. H.*

Hunnemannia fumariæfolia. By M. Micheli (*Rev. Hort.* p. 112; March 1, 1902).—Woodcut and coloured plate depicting a very beautiful Poppy-like flower with finely cut foliage. It is a native of Mexico, and though an old plant as regards introduction appears to have dropped undeservedly out of cultivation. Evergreen and all but quite hardy. Blooms freely from June to frosts, and flowers very persistent. Sow seed in autumn or spring, preferably in the open, with winter protection; nearly related to *Eschscholtzia.* Both description and illustration fully justify cultivation.—*C. T. D.*

Hybridisation, Experiments in Plant. By C. C. Hurst (*Orch. Rev.* p. 45, February 1902).—A clear and interesting practical illustration showing clearly how Mendel's law might be applied in the production of species.—*H. J. C.*

Hybrids, Maize, especially Xenia. By C. Correns (*Bot. Zeit.* No. 1, pp. 10, 11; 1902. Review of monographs in *Bibliotheca Botanica*, published by Chr. Luerssen, Stuttgart, 1901, Part 53; 3 plates). The reviewer points out that further experiments by the author demonstrate that Mendel's law becomes extremely difficult to establish generally, a practical infinity of exceptions occurring owing to patent and latent varietal peculiarities and liability to vary anew. A difficulty is also found in defining what is a character, and the author's opinion is that it is as yet too early to accept the Mendellian law as a branch of exact science.—*C. T. D.*

Hybrids, Pea.—On the Mode and Period of Separation of Characters in Hybrids of the Pea Family. By C. Correns (*Bot. Zeit.* Nos. 5, 6, pp. 65–82; March 1902).—A comprehensive exposition of the Mendellian theory of character separation, and discussion of varying views of himself and Strasburger.—*C. T. D.*

Hydrosimetes, The: An Apparatus for Supplying Plants with Water under Constant Pressure. By J. W. Moll (*Flora*, xc. 1902, pp. 334–342; 2 cuts).—The working of this apparatus can only be understood by reference to illustrations; its utility to the physiologist is obvious.—*M. H.*

Hypericophyllum: A Revision of the Genus, with Notes on certain allied Genera of Compositæ. By N. E. Brown (*Jour. Linn. Soc.* vol. xxxv. p. 120, with a figure of *H. scabridum*).—There appears to have been much confusion with the species belonging to this genus, and the identity of the genus itself, owing to the scarcity of material. From careful examination of the specimens at Kew, the author proposes to restore the four genera, *Jaumea*, Pers., *Espejoa*, DC., *Chætymenia*, Hook. and Arn., and *Hypericophyllum*, which had for some time been united with the genus *Jaumea*, Pers., to their former position, and a key is given to their distinctive characters, and a brief description is given of each of the five species of *Hypericophyllum*.—*G. S. S.*

Impatiens grandiflora. By Sir J. D. Hooker (*Bot. Mag.* tab. 7826).—Nat. ord. *Geraniaceæ*, tribe *Balsamineæ*. Native of Madagascar. It is by far the largest-flowered Balsam discovered. It flowered at Kew in 1900. The leaves are 6 inches long and bullate. The flowers from 2½ to 3 inches long, bright rose-red with crimson stripes.—*G. H.*

Impatiens psittacina. By Sir J. D. Hooker (*Bot. Mag.* tab. 7809). Nat. ord. *Geraniaceæ*, tribe *Balsamineæ*. Native of Burma. It is a compact plant, growing to 2½ feet in height, very floriferous, the flowers, lilac with a crimson spur, "resembling a cockatoo." It was raised from seed and flowered at Kew in 1900.—*G. H.*

Incarvillea Delavayi. By S. Arnott (*Journ. Hort.* p. 146; Feb. 13, 1902).—This is said to be quite hardy and perennial in Dumfries, and it is very easily raised from seed, which it ripens plentifully.—*C. W. D.*

Indigofera, Notes on. By D. Prain and E. Baker (*Journ. Bot.* 470, pp. 60, 67 ; 2/1902 ; and 471, pp. 136–144 ; 4/1902).—An attempt to elucidate the synonymy, pre- and post-Linnæan, of the indigo-yielding species.—*G. S. B.*

Influence of different Kinds of Manure on the Quality of Starch. By Ch. Guffroy (*Ann. Agr.* p. 442 ; September 1901).
C. H. H.

Influence of Light, Altitude, Moisture, and Temperature on the Growth of Plants. By M. Charabot (*Ann. Agr.* p. 383 ; August 1901).—Richness in scent of Lavender increases with altitude, dependent on more light, drier air, and lower temperature ; the first two factors act in the same direction, the last has a contrary action. Dry air favours the formation of scent, while it makes the chlorophyll action more active.
C. H. H.

Insecticides and Fungicides: Chemical Composition and Effectiveness of certain Preparations. By J. K. Haywood (*U.S.A. Dep. Agr., Farm. Bull.* 146, pp. 1–15 ; 1902).—This paper is a digest of a somewhat elaborate study of the various insecticides found in the American markets, clearly setting forth the desirability of ascertaining the composition and value of such compounds before purchasing.—*R. N.*

Insecticides, Nature and Use of certain. By J. L. Philipps and H. L. Price (*U.S.A. Exp. Stn. Virginia, Bull.* 97).—These poisons are divided into food or internal poisons, contact poisons, tracheal poisons. Of the mineral food poisons Paris green is the best known of arsenical poisons (an aceto-arsenite of copper, with about 58 per cent. arsenious acid). Safest to add lime in, say, twice the volume to avoid possibility of burning foliage. Used at the rate of 1 lb. to 100 gallons for Apple, 1 lb. to 300 gallons for Peach. London purple, a by-product in manufacture of aniline dyes, varies in composition, is an arsenite of calcium used in like proportion as Paris green with twice the weight of fresh slaked lime. There are several other forms of arsenic used. Among the best are green arsenoid, or Scheele's green, an arsenite of copper, with about 62 per cent. arsenious acid, used as Paris green : being more finely divided and bulkier remains in suspension better, and costs less. Arsenate of lead, no fear of injuring foliage, but costs more than Paris green ($7\frac{1}{3}$ oz. acetate of lead dissolved in one pailful of warm water, in wooden pail, $2\frac{2}{3}$ oz. arsenate of soda in a second pail : when dissolved pour together into 100-gallon tank of water and stir briskly). Nitrate of lead may be used instead of acetate of lead, thereby saving in cost, yet equal in value.

Of vegetable poisons hellebore is employed : 1 oz. to 1 gallon water, or sprinkled diluted with equal parts of lime or flour and dusted on the foliage whilst wet. Used for Gooseberry and Currant caterpillars.

Of the contact poisons paraffin has been used alone for San José and other bark lice, also mechanically mixed with water at 20 per cent., but it was considered that soap solutions were superior.

Paraffin emulsion : $\frac{1}{2}$ lb. whale-oil soap dissolved in 1 gallon of water, add 2 gallons paraffin, churn whilst hot; will keep indefinitely if sealed; for use dilute with 10 to 25 parts of water for aphids and tender caterpillars.

Soap wash: 1 lb. whale-oil soap in 10 or 20 gallons of water. For scale insects, 1 lb. to a gallon water. Apply warm (135° Fahr.) during dormant season. Soap wash at 1 lb. to 12 gallons of water on Peas took at rate of 12 lb. soap per acre to spray.

Alkali wash: Potash solution in dormant season. Destroys eggs of aphis. Use at strength of three degrees on a Beaumé acid spindle.

Sulphate of copper: 2 lb. to 50 gallons of water. Good winter wash for orchard trees.

Tobacco decoction: ½ lb. tobacco stems or leaves boiled in each gallon of water, diluted five to ten times for aphis.

Tracheal poisons include: Pyrethrum, using 1 oz. to a gallon of water, or dusted over plants mixed with two to four times its bulk of flour or lime; tobacco fumigation; tobacco vapour; carbon bisulphide; and hydrocyanic acid gas.—*C. H. H.*

Iris Kæmpferi. By Otto Bailiff (*Journ. Hort.* p. 323; April 10, 1902).—Plant in spring in rich soil well exposed to the sun, and saturated with water all the growing time. Seedlings do far better than divisions. Selected names are given. They do very well in Cheshire planted in ornamental ponds of which the water level is constant, with a few inches of water over the crowns all the year.—*C. W. D.*

Iris pelogonus, n. sp. By L. N. Goodding (*Bot. Gaz.* xxiii. No. 1, p. 68).—Its nearest ally is *I. missouriensis*, differing in size, colour, and width of leaves, &c.—*G. H.*

Iris spuria in Lincolnshire. By E. A. Woodruffe-Peacock (*Journ. Bot.* 471, pp. 101, 102; 3/1902).—A record of this species apparently wild at Huttoft, known for at least a century.—*G. S. B.*

Iris, Winter-flowering. By Jules Rudolph (*Rev. Hort.* pp. 43, 44; January 16, 1902).—With woodcuts of *I. reticulata* and *I. persica* and cultural instructions. Potted October-November and kept in frames; matted in severe frosts. When buds appear transfer to greenhouse, when they flower in eight to twelve days. After flowering, when frosts are over, plant out, and lift in July for replanting in autumn.
C. T. D.

Irrigation in the United States. By Professor Elwood Mead (*U.S.A. Dept. Agr.* (*Office Exp. Stn.*), *Bull.* 105; June 1901; illustrated). A comprehensive pamphlet on the above subject, being the testimony of Professor Mead before the U.S. Industrial Commission. "His testimony presents a review of the irrigation situation in the U.S., including not only the arid region of the West, but also the humid section of the South and East, where in two States alone more land has been brought under irrigation during the past five years than in any single State in the arid region during the same period.

"The practical aspects of extending public aid to irrigation, either through the State or national Governments, is also dealt with briefly but in some detail."

The connection between the irrigation question and the State and national legislation gives this testimony much importance.—*C. H. C.*

Jarring for the Curculio on an extensive Scale in Georgia, with a List of the Insects caught. By W. M. Scott and W. F. Fiske (*U.S.A. Dep. Agr., Bull.* 31, N.S., pp. 24–36 ; 1902).—The curculio here treated of is a species of weevil. There is no British representative that is in the same way injurious to fruit. The "jarring" operations were carried on by eleven gangs of five hands each. Each gang was supplied with an outfit consisting of two sheets stretched over light wooden frames, six by twelve feet in dimensions, and a pole eight feet long padded with rubber on one end, which served as a "bumper." With eleven pairs of sheets about 40,000 trees were treated in a day. It required sixty hands to operate the eleven pairs of sheets, and the cost for labour amounted to $25 per day. The results were highly satisfactory, reducing the curculio attack to about four per cent., while the fruit in an untreated orchard amounted to about 40 per cent. of the entire crop. A list of 325 species of insects is also given.—*R. N.*

Jasminum Maingayi. By Sir J. D. Hooker (*Bot. Mag.* tab. 7823). Nat. ord. *Oleaceæ*, tribe *Jasmineæ*. Native of Penang. It flowered at Kew in 1901. The leaves are 3–4 inches long, entire. It has terminal cymes of rather large white flowers, the segments of the corolla being from eight to ten.—*G. H.*

Johnson Grass. By Carleton R. Ball (*U.S.A. Dept. Agr.* (*Bur. Pl. Ind.*), *Bull.* 11, 1901 ; illustrated).—This report deals with the plant known as 'Johnson Grass' (*Andropogon halepensis*), which, while sometimes used as a hay and fodder crop (chiefly in the Southern States), becomes a serious pest in grain fields and Cotton plantations. It is chiefly troublesome in Texas (where a law against it is in operation), New Mexico, Arizona, California, &c. Its origin, distribution, dissemination, control, and methods of eradication are fully dealt with.

C. H. C.

Kalanchoë somaliensis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7831).—Nat. ord. *Crassulaceæ*. Native of Somaliland. It flowered at Kew in 1901. The inflorescence is a branching panicle with white flowers, the tube of the corolla being $2\frac{1}{2}$ inches long.—*G. H.*

Lachnanthes tinctoria, Nomenclature of. By J. Britten (*Journ. Bot.* 469. pp. 23–5 ; 1/1902).—A demonstration that this plant is correctly known as *Gyrotheca tinctoria*, and that it was introduced by Fraser in 1788.—*G. S. B.*

Lælia × Lindleyana purpurea, Cogn. (Cogniaux in *Dict. Icon. Orch.*, Lælia, pl. 10A ; 2/1902).—A remarkable variety imported by M. Madoux, of Anderghem, from Santa Catherina, Brazil, and first flowered in 1901. It is generally supposed to be a natural hybrid between

Brassavola tuberculata and *Cattleya intermedia*. This is partially confirmed by the unequal pollinia of the hybrid, *i.e.* four large and four small, in two series. In that case the hybrid should be called *Brasso-Cattleya* × *Lindleyana* (see *Orch. Rev.* 1902, p. 83). The sepals and petals of this rare variety are green, spotted with purple rose; lip rich crimson purple with pure white base.—*C. C. H.*

Lælio-Cattleya × Bowrialbida (Oakes Ames in *Amer. Gard.* xxiii. p. 12; 4/1/1902).—A new hybrid raised by Mr. E. O. Orpet, of South Lancaster, Mass., between *Lælia albida* and *Cattleya Bowringiana*. Intermediate in structure, inclining generally to *L. albida*; flowers lilac-red; lip darker, with three orange-yellow keels on a creamy ground colour. *C. C. H.*

Larix Kæmpferi. By Alessandro Pirotta (*Bull. R. Soc. Tosc. Ort.* 1, p. 15; January 1902).—This plant is remarkable for seeding freely and giving rise to great numbers of young plants all round the parent tree. It is a native of Northern China. Several dozen planted in a shrubbery at Mt. Mottarone, 1,300 mètres high, passed through one of the severest winters in good condition. It appears able to adapt itself to any kind of soil, and would probably be found highly useful, in view of the great germinative power of the seeds, for clothing hillsides where man's labour is of but small avail. It is the most ornamental of all Larches, of moderate vigour and pyramidal form; the leaves are longer and broader than in the common species. The cones are erect, about 7 cm. long and 6 cm. broad, with scales diverging like those of an Artichoke head, to which, on a smaller scale, it bears no slight resemblance. The seeds, along with their wings, are exactly the same size as the scales. It was introduced into Europe in 1856 by Robert Fortune, but was first made known to Europeans by Engelbert Kæmpfer about 1700. According to Fortune, the tree is often met with in Chinese gardens, usually in a dwarf condition; and about 1854 he found some specimens in the neighbourhood of a Buddhist monastery, in the western part of the maritime province of Che-Kiang, lying directly south of Shanghai. These specimens possessed stems about 35 to 40 metres high, with a diameter, 60 cm. from the ground, of 1¼ metre.—*W. C. W.*

Leaf Mosses, The Biology of. By Friedrich Stolz (*Flora*, vol. xc. 1902, pp. 305–315, posthumous, edited by K. Giesenhagen, of Munich). The regretted author died on an Alpine expedition. His completed "Druckreife" MS. has been lost, and the present article is founded on the figures and on notes).—Water passing up the stem of *Polytrichum* follows the capillary spaces within the sheathing bases, and from these passes to the leaf tips by the slits between the vertical lamellæ, which act like the slit of a pen. Internal conduction is very incomplete and slow. When the leaf is dry the margins close in over the lamellæ, and the leaf is vertical, closely appressed to the stem; when wet the margins unfold, the base of the leaf bends away downwards at a sharp angle, and becomes convex above from base to tip, the laminæ being passive during the process. Stolz has worked out the mechanism in detail and studied the effects of glycerine and alcohol, which are curiously different, though both are dehydrating media.—*M. H.*

Liatris pycnostachya. By Carl Räde (*Die Gart.* p. 169 ; 11/1/1902). The illustration shows a large group on the Margaretheninsel at Buda-Pest (Hungary), well and rightly recommended as one of the best perennials for a fairly moist spot. The colour of the flower is violet, disposed in spikes flowering downwards, and not upwards, as in most spicate flowers.—*G. R.*

Lilacs, New Hybrid. By Louis Henry (*Rev. Hort.* pp. 40, 41 ; January 16, 1902).—Coloured plate of *S. Bretschneideri* and *S. Josikæa*, with description. Two distinct forms derived from same parents by inverse crossing.—*C. T. D.*

Lilium giganteum. By. E. Jenkins (*Garden*, No. 1585, p. 220 ; 5/4/1902).—Possibly of no Lily grown to-day are particulars of practical cultivation more widely welcomed than of this fine species, and the conditions upon which much of its successful flowering depends are here detailed. Aspect is taken as being the most important of the primary considerations. A position reached by the morning sun as late as possible is best.—*E. T. C.*

Lily, Fertilisation of. By M. Jules Burvenich (*Rev. Hort. Belge*, xxvii. No. 12, p. 266).—The writer observes that many Lilies fail to set seed though artificially pollinated, as, e.g., *Lilium croceum* ; but when it was pollinated by pollen brought from some distance success followed.
G. H.

Limnocharis emarginata, Embryological Study of. By J. G. Hall (*Bot. Gaz.* xxxiii., No. 3, p. 214 ; pl. 9).—The author traces the development of the ovule from its first beginning as an excrescence from the wall of the carpel, as in *Butomus*, with complete development. Each stage is figured.—*G. H.*

Liparis tricallosa. By Sir J. D. Hooker (*Bot. Mag.* tab. 7804). Nat. ord. *Orchideæ*, tribe *Epidendreæ*.—Native of the Malay Peninsula and Sulu Archipelago. It was discovered by Mr. Burbidge. The sepals are lemon-yellow, the petals and striations of the lip are lake-red. It first flowered with Mr. Bull in 1879.—*G. H.*

Lycaste brevispatha. By R. A. R. (*Orch. Rev.* p. 113 ; April 1902 ; fig.).—Historical and other interesting particulars are enumerated.
H. J. C.

Lythrum rivulare. By E. Koehne (*Journ. Bot.* 470, pp. 68, 69 ; 2/1902).—A suggestion that this species is a form of *Nesæa sagittifolia*, with a synopsis of the eight known species, all South African, of the section *Salicariastrum* of the genus *Nesæa*.—*G. S. B.*

Macaroni Wheats. By M. A. Carleton (*U.S.A. Dep. Agr.* (*Bur. Pl. Ind.*), *Bull.* 3 ; December 23, 1901 ; 12 plates ; 1 map).—A full and instructive account of the efforts which the Department has been making since 1864, but more particularly for the last three years, to introduce the cultivation of certain varieties of hard Wheat into America.

The name of Macaroni Wheats has been fixed upon to denote the kinds with which they have been experimenting, and which are all varieties of *Triticum durum*, *Triticum polonicum*, and *Triticum turgidum*. They were introduced principally from South Russia, but some came from Algeria and Chile, and one variety, that known as Wild Goose Wheat, is said to have originated with a few grains found by a hunter in a wild goose's crop in Canada. The cultivation of it there has spread so that three and one-third million bushels have been shipped from Canada to Marseilles between March 1, 1891, and the date of this bulletin, to be used in the manufacture of macaroni. The problems which the Department set itself to solve were, first, to find a class of Wheat suitable for cultivation over portions of the American great plains which from drought and the alkaline nature of the soil were obviously not adapted to ordinary bread Wheats, and then to provide a ready market for the unusual crop thus produced.

A careful comparison of soil, climate, and rainfall revealed that almost identical conditions with those of large portions of the great plains prevailed in East Russia, from the latitude of Kazan to the Caspian Sea, but extending eastward even beyond the Siberian boundary into the Khirghis Steppes; this being precisely the region from which the macaroni manufacturers of Italy, France, and Spain draw their immense supplies of hard Wheat necessary for the successful preparation of the semolina to be afterwards converted into macaroni, spaghetti, &c.

As an experimental proof of the accuracy of the comparison, it is stated that since 1864, when some of the variety known as Amantha Wheat was imported by the Department and distributed in Texas and Dakota, it has been seen that hard Wheat would flourish and resist what would have been absolutely unfavourable conditions to ordinary bread Wheats. These early efforts at its introduction proved fruitless, however, as it seemed impossible to obtain a market for the crop. American bakers had not learnt to make bread of it; American millers and elevator men refused to handle it together with other kinds; the native macaron makers had not yet discovered the reason of the inferiority of their manufacture to the foreign article to be in their use of soft Wheat; and no market abroad had yet been opened up.

All this, however, the Department has set itself to alter, while encouraging the growth of the Wheat in a belt of country stretching southwards through North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. Already the native macaroni manufacturers are using it; millers and elevator men are adapting themselves to it; and in time, with the help of the American consuls in France and Italy, the Department expresses the hope that American hard Wheat will almost entirely oust the Russian and Canadian exports.—*M. L. H.*

Mahogany. On the occurrence of the meliaceous genus *Pseudocedrela* (Harms) in the Togo region &c. By H. Harms (*Not. König. Bot. Berlin*, vol. iii. (1902), No. 28, p. 167).—The only species (*P. Kotschyi*, Schweinf.) so far known to the author comes from Abyssinia &c., and from the incomplete material to hand he thinks the Togo plant is the same.

But the most interesting part of the paper is comprised in notes on other kinds of Mahogany-yielding trees in Africa.

The best-known African Mahogany is furnished by *Khaya senegalensis* (Juss.) of Senegambia and West Africa, and the author thinks the species of *Khaya* yielding East African Mahogany may be different.

But there are several other *Swietenioideæ* in Africa which furnish Mahogany woods, of which *Entandrophragma angolense* (Welw.), DC., *E. Candollei* (Harms), and *E. Casimirianum* (Wild. et Dur.) of the Cameroon and Congo regions are mentioned, as well as *Wulfhorstia spicata* (DC.) in South-west Africa, and *W. ekebergioides* (Harms) from the Zambesi.

A still incompletely described form from Usamtara appears to be another *Entandrophragma*, and attention is drawn to the importance of obtaining specimens.

In conclusion the author describes a new species of *Khaya*, *K. euryphylla* (Harms) from the Cameroons, making a third Mahogany of this genus, the other two being *K. senegalensis* (Juss.) and *K. anthotheca* (Welw.), the latter from Angola.

In reading this paper one is struck with the importance of having more complete information regarding these African Mahogany trees, as also with the increasing tendency to widen the connotation of words like "Mahogany," "Cedar," &c., in different countries; in Australia, for instance, the word "Mahogany" is applied to timber of various species of *Eucalyptus*, trees belonging to the *Myrtaceæ*, a natural order of quite different affinities from *Meliaceæ*, much as "Cedar" is applied to wood from certain Conifers (*Juniperus Cedrus*), as well as to that from *Cedrela* (*Meliaceæ*).—*H. M. W.*

Maize: A Study of the Fertile Hybrids produced by crossing Teosinté and Maize. By John W. Harshberger, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii., No. 2, p. 231, pl. 22; 1901).—The Teosinté is described to be known in Mexico under that name, and botanically as *Euchlæna luxurians*. It is grown as a fodder plant in most warm countries, seldom flowering when planted in Europe.

Professor Segura, director of the School of Agriculture, City of Mexico, has carefully cultivated the plant, and obtained seeds, by hybridising with the common Maize, which correspond with those of *Zea canina*, so called by Watson, which latter is therefore a hybrid between *Euchlæna luxurians*, otherwise *Euchlæna mexicana*, and the common Maize. The question is raised, whether *Zea Mays* is a true species, or a cultivated race or variety of *Euchlæna mexicana*. Or, is Indian Corn a species of *Euchlæna* closely related by consanguinity to *Euchlæna mexicana*? These questions can only be answered by the discovery of the wild plants concerned in the problem of the origin of Maize.

M. C. C.

Manures, Chemical.—Do they exhaust the Humus of Soils? By K. de Vries, of Groningue, Holland (*Ann. Agr.* p. 443; September

1901).—Heer de Vries says it is a mistake to consider that farmyard manure is the origin of humus to the soil, nor does the exclusive use of chemical manures fatally impoverish the stock of organic matter in the soil.

C. H. H.

Manures, Chemical, Value of. By F. Shrivell (*Journ. Hort.* p. 80; Jan. 23, 1902).—Abstract of a lecture given at Bristol:—For fruit phosphates mixed with dung give the best results; for herbaceous borders and lawns about 14 lb. of basic slag mixed with 9 lb. of kainit to each hundred square yards put on the borders in autumn, on the Grass in spring.—*C. W. D.*

Manures in the Garden. By W. Y. N. (*Garden*, No. 1584, p. 206; 29/3/1902).—Happy indeed is the gardener who is able to get a good supply of animal manure; but many are not in that position, and are obliged to resort to artificial manures. These practical notes upon the various artificial manures most generally used, their values, when they should be applied, &c., should prove of use.—*E. T. C.*

Masdevallia elephanticeps. By Sir J. D. Hooker (*Bot. Mag.* tab. 7824).—Nat. ord. *Orchideæ*, tribe *Epidendreæ*. Native of New Grenada. It has been cultivated at Kew for twenty years, and is remarkable for the fetid odour of the flowers. These are 3–4 inches long, with a coriaceous perianth, green suffused with purple.—*G. H.*

Meehan, Thomas. Anon. (*Journ. Bot.* 469, pp. 38–41; 1/1902).—Life and portrait.—*G. S. B.*

Megaclinium leucorhachis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7811).—Nat. ord. *Orchideæ*, tribe *Epidendreæ*. Native of Lagos. The dilated flattened rachis of the inflorescence is about 9 inches in length with distichous small yellow flowers. It flowered at Kew in 1902.

G. H.

Melaleuca spicigera. By S. L. Moore (*Journ. Bot.* 469, p. 25; 1/1902).—Description of a new West Australian species.—*G. S. B.*

Meliosma myriantha. Anon. (*Gard. Chron.* No. 785, p. 30, fig. 9; 11/1/1902).—This plant has been recently introduced from Japan. Though in no way allied to the Spiræas, the branching panicles covered with innumerable small blossoms give it much the appearance of a member of that genus. It may prove hardy in sheltered positions, and is likely to take a prominent place in greenhouses.—*G. S. S.*

Minkelersia biflora. By Sir J. D. Hooker (*Bot. Mag.* tab. 7819).—Nat. ord. *Leguminosæ*, tribe *Phaseoleæ*. Native of Mexico. It flowered at Kew in 1900. The leaves are trifoliate. The flowers are 1½ inch long, pale red-purple. The tips of the keel petals are spirally coiled as in *Phaseolus*.—*G. H.*

Mistleto. By Oct. Bruneel (*Rev. Hort. Belge*, xxviii. No. 1, p. 5). This is an account of the history and customs of England, &c., in connection with this plant. It was known to Theophrastus, and entered into the religion of the Druids in Gaul and Britain.—*G. H.*

Montrichardia aculeata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7817).—Nat. ord. *Aroideæ*, tribe *Philodendreæ*. Native of West Indies and Amazon River. This is a noble aroid forming thickets in moist places near the sea. It is 8 feet high at Kew, and flowered in 1900 and 1901. The leaves are a foot long, hastate, with pale yellow midribs and nerves; the spathe and spadix are pale yellow.—*G. H.*

Moschosma riparium. Anon. (*Gard. Chron.* No. 791, p. 122, fig. 35; 22/2/1902).—This labiate shrub is a native of South Tropical Africa. It has very numerous small cream-coloured flowers in erect panicles, and would be useful in stoves or warm greenhouses during the winter.—*G. S. S.*

Moss. Ephemeropsis Tjibodensis, Goeb., Diagnosis of. By Max Fleischer (*Ann. Jard. Bot. Buit.* vol. xvii. p. 68; 2 plates; 1900).
P. G.

Moss Flora of Hartz Mountains (*Beih. Bot. Cent.* bd. xi. ht. 6, pp. 359–367).—Herr L. Loeske publishes a list of localities of the rarer Mosses and Liverworts discovered by him in a fortnight's excursion from Goslar to Thale.—*G. F. S.-E.*

Mosses of the Baden Black Forest (*Beih. Bot. Cent.* bd. xi. ht. 8, pp. 546–551).—Herr Th. Herzog (Freiburg i/B.) gives a general account of Mosses and their distribution in the valleys of St. Wilhelm and Oberrieder.—*G. F. S.-E.*

Mountain Districts in Landscape Gardening. By W. Lange (*Die Gart.* p. 301; 29/3/1902; with illustrations of rock formation useful for the building of rockeries).—Sketches from the Granitic Brocken, the sandstone rock of the Regenstein, both of the Central German Harz Mountains are given.—*G. R.*

Musa oleracea. By Sir J. D. Hooker (*Bot. Mag.* tab. 7802). Nat. ord. *Scitamineæ*, tribe *Museæ*.—Native of New Caledonia. It is unique in having a large underground tuber, replete with starch, which is eaten by the natives. It has "eyes" like a Potato, so can be propagated by division. The inflorescence has long bracts, glaucous purple externally, and red within. It flowered at Kew, 1900.—*G. H.*

Nemesia, African. By Ph. L. de Vilmorin (*Rev. Hort.* pp. 14, 15; January 1, 1902).—Woodcut and coloured plates showing very pretty forms, with cultural directions.—*C. T. D.*

Nephrolepis exaltata Piersoni (*Amer. Gard.* xxiii. pp. 151, 153; figs. 34, 35; 8/3/1902).—A new and handsome Fern, which originated in 1899 with Mr. F. R. Pierson at Tarrytown, N.Y., as a sport from the well-known Boston Fern, *N. exaltata bostoniensis*. The pinnæ of the main rachis are subdivided into perfect miniature fronds.

It has all the vigour and hardiness of the Boston Fern, and is at the same time much more graceful. It is interesting to note that the sport first showed itself at the base of the frond only, but three years' isolation and selection served to increase it, until it now covers the whole frond except at the apex.—*C. C. H.*

Nymphæa, Hardy. By Max Hesdörffer (*Die Gart.* p. 337; 19 4, 1902; with illustrations).—All the best hardy species and hybrids are mentioned, and specially the French hybrids are for their vigour and hardiness recommended.—*G. R.*

Odontoglossum × Duvivierianum burfordiense. By R. A. Rolfe (*Orch. Rev.* p. 59; February 1902).—Interesting particulars of this rare natural hybrid are recorded.—*H. J. C.*

Odontoglossum grande Pitteanum (Cogniaux in *Dict. Icon. Orch.* Odontoglossum; pl. 13A; 2/1902).—A remarkable form which appeared 1899 with Mr. H. T. Pitt, of Stamford Hill. The chocolate brown markings of the type have completely disappeared, leaving the flower two delicate shades of yellow and brown with white lip.— *C. C. H.*

Odontoglossum × Rolfeæ (*Orch. Rev.* p. 57; February 1902; fig.). Interesting historical particulars are given of this choice and beautiful hybrid Odontoglossum.—*H. J. C.*

Odontoglossum × Wattianum Hardyanum. By R. A. Rolfe (*Orch. Rev.* p. 62; February 1902).—Interesting particulars are here given of the plant exhibited by Baron Sir H. Schröder at the R.H.S. Meeting on January 14 last; the distinguishing features from the original are clearly pointed out.—*H. J. C.*

Oncocyclus (Iris), New Hybrids of. By Dr. Attilio Ragionieri (*Bull. R. Soc. Tosc. Ort.* 4, p. 114; April 1902).—In the spring of 1895 pollen of *O. susianus* was transferred to the female organs of *O. atropurpureus*, this method of procedure being adopted for the reason that the former plant hardly ever sets perfect seed in the writer's garden. The excellent crop of seeds produced by the fine capsule were sown in the autumn. In the succeeding spring of 1896 not one of the seeds had apparently germinated. The seedlings did not appear until the spring of 1897, when it was found that the young leaves sprang from small underground rhizomes, the result of a purely hypogæal germination of the previous year. The writer remembers to have read of a similar phenomenon occurring in the case of certain Liliums in England. Of ten plants thus obtained six eventually flowered, the first flower appearing in 1900; the other varieties flowered in 1901. The characters rendering them superior to their parent are the following:—Flowering occurs 10–15 days earlier under the same conditions of soil, position, &c.; they are more resistent to disease and produce a greater abundance of flowers. The genus as a whole does not like much manure, flourishes rather in sandy soils and the detritus of old ruins. Excess of moisture, especially in a stagnant condition, should be avoided. Culture in the open air, against a wall exposed to the south or east, is preferable. The writer finds it beneficial to take up the rhizomes as soon as the leaves wither, and keep them until October in a dry but not too warm room. The outer segments of the flower are recurved, furnished with hairs towards the base, with a large black-purple spot in the centre, the ground colour being grey, veined, and punctated with dark purple. The inner segments are erect, of a fine bright rose colour, veined, and punctated with a deeper rose. The petaloid segments of the pistil possess the same colour distribution as the outer perianth segments, but with a deeper tone. In its dimensions and appearance the plant holds the mean between *O. susianus* (than which it is slightly smaller) and *O. atropurpureus.*—*W. C. W.*

Onion Culture. By W. H. Jordan and F. A. Sirrine (*U.S.A. Exp. Stn., New York, Bull.* 206 ; 12/1901).—The experiments were conducted with a view to finding out the value of commercial fertilisers in Onion culture. The manures were applied at the rate of 0, 500, 1,000, 1,500, and 2,000 lb. per acre. The result is thus stated :—"The crops were limited more by other conditions than by the extent of the plant food supply. With the best conditions of season and water supply the smallest amount of fertiliser supported the maximum crop." Again : "The use of quantities above 500 lb. per acre was attended by danger of financial loss."—*F. J. C.*

Onions, Commercial Fertilisers for. By W. H. Jordan and F. A. Sirrine (*New York Agr. Exp. Stn., Bull.* No. 206, December 1901).—The fertiliser used annually for three years contained 4 per cent. nitrogen, 8 per cent. phosphoric acid, and 10 per cent. potash. The fourth year the potash was changed to 5 per cent. The quantities used each year on the five plots were : none, 500 lb., 1,000 lb., 1,500 lb., and 2,000 lb. per acre respectively.

It was found that the best economic results were obtained by an application of 500 lb. per acre.—*J. P.*

Orange Conference (*Bull. Bot. Dep. Jamaica*, ix. Parts 1 and 2, pp. 1–25).—This conference was arranged by the Board of Agriculture on December 4, 1901, His Excellency the Governor presiding. The subjects for discussion were on the various phases of the growth of the Orange. The following points were discussed. Mr. W. Fawcett, Director of Public Gardens, took a survey of the various organs, roots, stems, leaves, flowers, and fruit. Mr. Levy discoursed on varieties. The propagation and treatment were dealt with by Hon. T. H. Sharp. These papers were followed by a discussion dealing with such points as nursery treatment, drainage, tillage, pruning, irrigation, and insect pests, with the remedies for each species respectively.—*G. H.*

Orange in the Southern United States, On the Selection of Stocks for the. Anon. (*Agr. Jour. Cape G.H.* vol. xix. No. 13, pp. 831–836 ; 1901).—This article is an extract from the Report (U.S. Department of Agriculture, Division of Pomology, Bulletin No. 4. Washington, 1891) on the Relative Merit of various Stocks for the Orange, with notes on *mal di goma*, and the mutual influence of Stock and Scion.—*R. N.*

Orchard Management, Weak Places in. By — Morrill (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 111–118).—Some useful hints are here given to those interested in the planning and management of orchards. Care in planning at the beginning is specially advocated. The author concludes with some remarks on such troubles as the San José scale and aphis.—*V. J. M.*

Orchard Notes. By C. F. Austin (*U.S.A. Exp. Stn. Alabama*; December 1901).—Observations as to the prevalence of Apple leaf rust (*Rœstelia*) on a large number of varieties of Apple, Red Astracan and Gravenstein included among those free from rust in that season. Spray thoroughly with Bordeaux mixture: 6 lb. copper sulphate, 6 lb. fresh lime to 50 galls. water, had no effect upon the disease. List of varieties most attacked by green aphis, as in the case of rust; the varieties that are resistent to the attack of the insect are becoming fewer every year. The indications are that there are no varieties that we can say are perfectly resistent to the attacks of this insect.

The growing of Apples is a very difficult problem so far South, and without spraying a great percentage of the Apples are more or less rotten before they are ripe.

Trials of Cherries, Japan Walnuts, Peaches of different races (Persian, Punto, North and South China, Spanish). Times of blossoming of Peaches and Plums follow. Example of record:—

Notes on the Blossoming of Plums, 1901.

Varieties	March 4	March 9	March 15	March 26	April 6	April 11	Condition of crop in 1901
Burbank (Japanese)	Buds show white	Buds opening	Full bloom	Fallen	—	—	Very light
Chas. Downing (American)	—	—	Buds swelling	Buds opening	Nearly full bloom	Blossom falling	Full

C. H. H.

Orchard Soils, Preparation and Management of. By Dr. W. K. Jacques (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 128–136).—This paper deals with the choice of sites for orchards, preparation of the soil, conservation of moisture, &c. In the author's view the site of an old forest is an ideal place for planting an orchard. Fruit trees growing on poor land cannot resist disease like those having the benefit of a rich soil, says the author. The paper cannot fail to interest those in a position to choose from different sites for the planting of an orchard.—*V. J. M.*

Orchid Growing in Belgian Leaf Soil. By G. (*Garden*, No. 1586, p. 243; 12/4/1902).—Many Orchids thrive better in this soil than in any other. The new hybrid *Phaius*, for instance, grows in it in an extraordinary way. This new compost for Orchids is discussed in a practical manner.—*E. T. C.*

Orchids, Leaf-mould for. By W. H. Young (*Gard. Mag.* No. 2521, p. 159; 15/3/1902).—The advantages and disadvantages of using leaf-mould in the culture of Orchids is discussed by the writer, a practical Orchid grower. He describes his successes and candidly acknowledges his failures, due, as he says, to mistreatment. This seems to be a subject worthy of extended experiment, as it appears to be such a rational system of culture if the imitation of natural conditions of growth in native habitats is the proper course to follow in cultivation. Those who have seen tropical Orchids growing wild can attest the fact that decayed vegetable growth usually accumulates about the finest-developed plants. Carefully conducted experiments in this direction would be of great value.—*W. G.*

Orchids, Nomenclature of Hybrid. By L. Cappe-France (*Orch. Rev.* p. 38 ; February 1902).—Numerous queries in respect to the classification of hybrid Orchids being raised, it is also interesting to note the facts given of the variability of the hybrids in the third and fourth degrees—hybrids between hybrids. It is a further proof that "Mendel's law" cannot be applied on the lines laid down to Orchid hybrids. In *Orch. Rev.* p. 107, April 1902, other particulars on this subject will be found.—*H. J. C.*

Orchids: their Culture in Leaf Mould. By L. P. De Laughe-Vervaene (*Gard. Chron.* No. 785, p. 26 ; 11/1/1902).—In this paper the author discusses the requirements of Orchids as regards air and moisture, the amount of nourishment they should derive from the material in which they are grown, and the values of the composts in which they are usually grown. He condemns these as failing in the purpose for which they are used, and describes his method of growing the plants in leaf mould.—*G. S. S.*

Orchids, Variation of Secondary Hybrid. By C. C. Hurst (*Orch. Rev.* p. 74 ; March 1902).—The writer endeavours to bring the numerous varieties of the same secondary cross within the scope of "Mendel's law" in a most instructive manner.—*H. J. C.*

Osmundaceæ, Anatomy of. By J. H. Faull (*Bot. Gaz.* xxxii. No. 6, p. 381 ; plates, 14–17).—The author describes the minute anatomical structure of the stems of several species of *Osmunda* and *Todea*, dissenting from the view that the family is anomalous in its vascular structure ; but different species exhibit degenerations from the type.
G. H.

Paint in the Garden Landscape, Green (*Garden*, No. 1583, p. 185 ; 22/3/1902).—Green paint to the ordinary workman means a hard bright crude colour, the harder and brighter the better. Such a colour is not only unpleasant in its own vulgar garishness, but is painfully unbecoming to any foliage that is brought near it. This article, whilst condemning green paint of this class, gives a useful solution to the paint problem.—*E. T. C.*

Pansies, A Plea for. Anon. (*Journ. Hort.* p. 364 ; April 24, 1902).—We have a full page of Pansy flowers. Open but sheltered situations and light rich soils are essential, and they cannot be well done without skilled attention.—*C. W. D.*

Palms: On the Sowing of Seeds. By D. Gauthier (*Rev. Hort.* pp. 116, 117; March 1, 1902).—Directions for sowing various species and their subsequent treatment.—*C. T. D.*

Parasitic Flowering Plant. Rhopalocnemis phalloides, Jungh. A morphological-systematical (*sic*) study. By J. P. Lotsy (*Ann. Jard. Bot. Buit.* vol. xvii. p. 73; 12 plates; 1900).—An account of the histology and morphology of the flowers of this balanophoraceous plant, and an emended description of the plant.—*P. G.*

Paris Green Analysis. By L. L. Van Slyke and W. H. Andrews (*U.S.A. Exp. Stn., New York, Bull.* 204; 12/1901).—The presence of water-soluble compounds of arsenic in Paris green is seriously objectionable owing to the fact that soluble arsenic compounds injure foliage. The standard suggested in America is, "It shall not contain arsenic in water-soluble forms equivalent to more than $3\frac{1}{2}$ per cent. of arsenious oxide." The other substances estimated were total arsenious oxide, copper oxide, and arsenious oxide in combination with copper. The general result of the analysis showed a very good quality on the American markets, the average water-soluble arsenious oxide being only 1·28 per cent. and the arsenious oxide in combination with copper 55·98 per cent.
F. J. C.

Passiflora ambigua. By Sir J. D. Hooker (*Bot. Mag.* tab. 7822). Nat. ord. *Passifloreæ*, tribe *Passifloreæ*. Native of Nicaragua. It flowered at Kew in May 1901. It may possibly be a hybrid. The flowers are 5 inches in diameter. The sepals are pale pink and the petals white dotted with rose-purple. Corona is nearly 2 inches long, red banded with white, the filaments being violet.—*G. H.*

Paths, Garden (*Garden*, No. 1588, p. 265; 26/4/1902).—It is seldom that one does not see something connected with garden paths that is open to criticism. The proper width of paths with regard to position and surroundings, their drainage, flagged paths, &c., are described and suggestions made in connection therewith.—*E. T. C.*

Pea, The Sweet. By R. Dean (*Garden*, Nos. 1580 and 1581, pp. 150, 159).—The history of the Sweet Pea from 1817, when the first striped variety appeared, and on the raising and introduction of new varieties. The garden culture of the Sweet Pea is also detailed, such items as sowing, watering, &c., receiving special attention. A selection of twelve of the very best varieties is given.—*E. T. C.*

Peach Culture. By R. Morrill (*U.S.A. Hort. Soc. Illinois*, 1901, pp. 93–108).—An interesting paper on this subject, chiefly from a commercial grower's standpoint. The author emphasises the fact that a proper balance must be kept between root and top of tree. A Peach tree has a tendency to grow more top and produce more blossoms and Peaches than it can support without devitalisation. The balance must be preserved by careful culture of the soil without mutilation of root at the proper time, and the tree should be trimmed severely. A tree carefully cultivated, fertilised, thinned, and trimmed never suffers from June drought and will stand the cold weather better. The author deplores cultivation and pruning out of season.—*V. J. M.*

Peach Mildew (Sphærotheca pannosa). William Carruthers (*Jour. R.A.S.* vol. lxii. p. 247 ; 1901).—Reported from Kent. It is related to the Hop mildew. " Sprays used for Hop mildew would destroy that on the Peach tree, but the solution should be weaker, or it would damage the more tender foliage of the Peach."—*R. N.*

Peaches: Imperfect Fertilisation. By F. C. Stewart and H. J. Eustace (*U.S.A. Exp. Stn. New York, Bull.* 200, pp. 89-93 ; 4 plates ; 1901).—It has been observed that imperfectly fertilised Peaches may attain considerable size and remain hanging on the trees till September. In such cases this trouble may be mistaken for the " little Peach " disease by persons unfamiliar with the latter. However, in the " little Peach " disease the pit is of normal size and provided with a well-developed kernel, whilst in cases of imperfect fertilisation the pit is abnormally small and has no kernel, or at least only a partially developed one. This difference will enable any one to distinguish readily between the two troubles.—*M. C. C.*

Peaches, A New Strain of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* 4, p. 101 ; April 1902).—The Peach was introduced into Italy and cultivated in the first century of the Christian era. Neither Cato, Varro, nor Cicero mentions it, but we know something of it from Pliny and Columella. Nectarines, or hard Peaches, seem to have been first introduced: they are to-day very common in South Italy, Sicily, and Sardinia. The very fine Neapolitan Peaches have existed in Naples since Pliny's time, and have always kept constant when grown from seed. The writer thinks that the famous *Chrysomela* of Pliny's time was not a Quince but a true Peach. The true Peaches, with sweet soft pulp, easily separating from the stone, came from South France, where the original forms were first introduced from their native land, Asia. France is the home of the true Madeleines. It is not certain where Nectarines originally came from, perhaps introduced by the Saracens who settled in Palermo in 831. The writer several years ago came across a new variety or race of Nectarines in Palermo and South Italy which is very perfect and otherwise interesting, and will be called 'Nubian,' as he is convinced that the Saracens brought it from Africa. The pulp does not very easily separate from the stone, but is exquisite, juicy, and refreshing, and ripens rather late. He has introduced it into Florence.—*W. C. W.*

Pear 'Comtesse de Paris.' By C. Jokisch (*Gartenflora*, p. 42 ; fig. 7 ; 15/1/1902).—A good dessert winter Pear, of medium size, lasting till January. The tree is hardy and forms a good pyramid.—*J. P.*

Pear, Cross-fertilisation of. By W. S. Ross (*U.S.A. Hort. Soc.*

Illinois, 1901; pp. 409–412).—A careful paper fully describing this subject. Mention is made of 'Keiffer,' 'Garber,' 'Le Conte,' 'Conklin,' and 'Duchess.' For practical purposes the 'Garber' and 'Duchess' are recommended for cross-fertilisation.—*V. J. M.*

Pears with Salmon-coloured Flesh. By Charles Baltet (*Rev. Hort.* pp. 106, 107; March 1, 1902).—A description of several varieties. 'Prince Imperial,' 'Calebasse Tongard,' 'Georges Délébecque,' 'La Vendéenne,' 'Madame Verté,' 'Colmar Dumortier,' 'Madame Hutin,' and 'Josephine de Malines' are selected from others as the best.—*C. T. D.*

Pelargoniums, New, large-flowered. By Max Bürger (*Gartenflora*, p. 57; pl. 1495; 1/2/1902).—Five new Pelargoniums are figured and described.—*J. P.*

Pentstemons. By C. Wolley-Dod (*Gard. Mag.* No. 2,520, p. 100; 15/2/1902).—Following a paragraph on the origin of the florist's *Pentstemon*, Mr. Wolley Dod gives a special note on the beautiful *P. Menziesii*, undoubtedly among the finest of the species suitable for border culture. It is one of the shrubby section, but, unlike the rest, is less capricious in this country if grown in a light soil. It certainly is a plant that should be taken in hand by the hybridist, as from its constitution and habit the crossing might result in a new race suitable to this country and climate. A good illustration of a well-developed plant of *P. Menziesii* is given.
W. G.

Persimmon, The Japanese (*Diospyros Kaki*). By R. L. Watts (*Bull. Bot. Dep Jamaica*, ix. Parts 1 and 2, p. 26).—This is an abstract from "Bulletin on Persimmons: Agricultural Experiment Station of Tennessee." The author deals with its native distribution and distribution by cultivation. It has been much improved by the Japanese, and many varieties have been produced, the fruit varying very greatly in shape and colour. The flavour also varies considerably. He then discusses the uses of the fruit, the cultivation, transplanting, pruning, and thinning.
G. H.

Petroleum and other Insecticides, Further Notes on. By E. P. Felt (*U.S.A. Dep. Agr., Div. Ent. Bull.* No. 31, N.S., pp. 49–51; 1902). A short report on some further experiments with crude petroleum. No suggestions are given likely to be of service to horticulturists in this country. An abstract on these experiments was given in a previous number of this Journal.—*R. N.*

Phylloxera of the Vine. By F. T. Bioletti (*U.S.A. Agr. Exp. Stn., California, Bull.* 131; 5/1901; 4 figs.).—This bulletin gives a brief description of the insect and the injuries it causes and suggests remedies. (1) Treatment of the soil with carbon bisulphide. (2) Submersion of the roots for about a week at first and later for thirty-five to forty days while vines are dormant. (3) Planting in sand. (4) The planting of "resistent" vines—the most important method.

The following table gives the resistance offered to phylloxera by various vines, 20 being the highest and 0 the lowest (the most susceptible).

Species (Wild Vines)		Cultivated Varieties and Hybrids	
Vitis rotundifolia	19*	Gloire de Montpelier (Riparia)	18
V. vulpina (riparia)	18	Riparia × Rupestris, 3,300	18
V. rupestris	18	Rupestris Martin	18
V. Berlandieri	17	Rupestris St. George	16
V. æstivalis	16	Riparia × Solonis, 1,616	16
V. Labrusca	5	Solonis	14
V. californica	4	Lenoir	12
V. vinifera	0	Isabella	5

* Of no use for grafting *V. vinifera* vars. upon.

F. J. C.

Philodendron calophyllum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7827).—Nat. ord. *Aroideæ*, tribe *Philodendreæ*. Native of Brazil and Guiana. It is remarkable for the deep brilliant carmine colour of the interior surface of the spathe, which is edged with white. It flowered at Kew in 1901.—*G. H.*

Photography, The Importance to the Landscape Gardener. By C. C. Schneider (*Die Gart.* p. 194 ; 25/1/1902).—The author recommends the fixing of beautiful spots in nature of the forest, stream, valley, and mountain by photographic sketches, to be imitated or reproduced in parks and gardens. Still better, however, for the experienced landscape gardener is also a good knowledge of drawing or sketching in conjunction with photography. Some artistical sketches are given of a Birch group, with stream ; a corner of the park at Buch, near Berlin ; a cascade in the Thuringian Forest ; and a corner of a Roman ruin in the park at Schönbrunn, near Vienna.—*G. R.*

Pickling Olives. By F. T. Bioletti (*U.S.A. Exp. Stn., California, Bull.* 137 ; 12/1901).—Experiments on pickling Olives in various ways are detailed in this bulletin. The process recommended is that of steeping the fruits, which should be only just changing colour, in a 2 per cent. solution of potash lye, avoiding any exposure to air during this preliminary process, then placing successively in 2 per cent., 4 per cent., and 8 per cent. solutions of brine, allowing each to act for 48 hours to 72 hours, and finally storing in barrels filled to the bung with 12 per cent. brine.—*F. J. C.*

Pine Cone, Morphology of. By H. C. Cowles (*Bot. Gaz.* xxxiii. No. 2, p. 157 ; pl. 8).—The author discusses the disputed nature of the so-called carpellary scale and comes to the conclusion it is an outgrowth from the chalaza of the ovule, so that "the microsporangial and megasporangial cones are strictly homologous, and in the latter the sporophyll enlarges or remains small just as the chalazal development of the megasporangium with a scale is less or more pronounced.—*G. H.*

Plant Cytology, Current Problems in. By J. M. Macfarlane *Contr. Bot. Lab. Phil.*, vol. ii., No. 2, p. 183 ; 1901).—This address treats the subject under the following heads:—Morphological Cytology, Nuclear Substance, Physiological Cytology, Evolutionary Cytology, Experimental Cytology, Ecological Cytology, and Taxonomic Cytology.—*M. C. C.*

Plant-drying, Instructions for. By C. Curtis, F.L.S. (*Gard. Mag.* No. 2527, p. 216; 5/3/1902).—This subject is not altogether foreign to horticulture, as it is often useful to know how to dry plants in a proper way suitable for herbaria. Mr. Curtis has been a practical plant collector in many countries, and knows by experience how valuable is the knowledge of how to do the process properly. In this article he gives minute details of his method, and one can see that he is anxious to tell all he knows about the matter. Many gardeners travel, and if true to their calling they will instinctively desire to collect specimens of plants they do not know, and in this article they will find all the information they require about the proper way of proceeding.—*W. G.*

Plants used by the Indians of Mendocino County, California. By V. K. Chesnut (*Contributions from the U.S. National Herbarium,* vol. vii. No. 3; U.S. Dep. of Agric., Div. of Bot.; 1902).—This is an account of some 400 plants, with Latin and Indian names, used by the natives, and the purposes to which they are applied. It is interspersed with numerous photos of plants, of natives collecting them, &c., as well as some of their manufactures, as baskets and works of art; also of the methods of grinding and preparing acorns for food, and are of liliaceous edible bulbs. The work concludes with a classified list of economic plants ranged under a large number of headings.—*G. H.*

Platyclinis filiformis, Benth. (Cogniaux in *Dict. Icon. Orch.* Platyclinis; pl. 1; 2/1902).—An "inconspicuous" but graceful species from the Philippines, introduced by Mr. Bateman in 1841. Flowers pale green, minute, borne in long pendent racemes.—*C. C. H.*

Platyclinis glumacea, Benth. (Cogniaux in *Dict. Icon. Orch.* Platyclinis; pl. 2; 2/1902).—This species was discovered in the Philippines by Cumming in 1839, and first flowered in Europe by Messrs. Loddiges in 1841. Flowers small, in pendent racemes, white shaded pale yellow, sweetly scented.—*C. C. H.*

Plectranthus Mahonii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7818).—Nat. ord. *Labiatæ*, tribe *Ocimoideæ*. Native of British Central Africa. It flowered at Kew in November 1900. The flowers are very numerous, violet blue.—*G. H.*

Plum, The Beach, viewed from Botanical and Economic Aspects. By Prof. J. M. Macfarlane (*Contr. Bot. Lab. Phil.* vol. ii., No. 2, p. 216; pls. 20, 21; 1901).—The Beach Plum (*Prunus maritima*) is abundant along the coast regions of the Eastern States, from Virginia to New Brunswick. Grows ordinarily to a height of 5 or 6 feet, occasionally from 10 to 12 feet. Important lines of variation shown by the fruit in (*a*) colour, (*b*) weight, (*c*) size and shape, (*d*) consistence, (*e*) taste, (*f*) time of maturation.

Features specially commending it for cultivation are its constant growth amid loose open sand, and in proximity to or in immediate contact with the sea.

Along the sea front many thousands of quarts are gathered annually, which are used in part as a delicious table fruit, but in larger part are converted into jelly preserves. A considerable trade in the fruit exists along the Cape Cod and Plymouth coasts.

By judicious cultivation and selection it is certain that many and finer varieties might be secured, since the plant in the wild state has already developed so favourably.

Experiments are still in progress towards the solution of these problems.—*M. C. C.*

Plums, A Chat about. By E. Bartrum, D.D. (*Gard. Mag.* No. 2515, p. 20; 11/1/1902).—In this number Dr. Bartrum commences an interesting article (continued in No. 2516) upon Plums, a subject with which he is evidently thoroughly well acquainted. He bases his comments upon the Chiswick Reports, which he critically discusses, and various useful hints occur in his remarks, and particularly in regard to the value of certain sorts in small gardens or in localities near towns. A separate paragraph is devoted to the Bohemian Plum 'Reine Claude' or 'Comte d'Althann,' a dessert Plum of high merit, which from one of its names is apt to be confused with the older 'Reine Claude de Bavay,' which is quite distinct from the Bohemian. Notes on American Plums are given, and also on Damsons.—*W. G.*

Plums, Japanese. By W. Watson (*Garden*, No. 1585, p. 221; 5/4/1902).—Japanese Plums have been brought into notice by our American cousins who grow them largely. When they were first tried in the United States they were condemned on account of the tenderness of the tree and the poor quality of fruit. It is clear that the evidence was insufficient, and luckily it was not considered conclusive. Probably we shall find the objections against them in this country to be unfounded. They possess some characteristics which the best garden Plums do not, productiveness, freedom from disease, &c. and the best of them compare well in quality with the common Plums.—*E. T. C.*

Plums, Varieties and Culture. By Arthur Bryant (*U.S.A. Hort. Soc. Illinois*, 1901; pp. 181–186).—From this paper it would seem that the cultivation of Japanese and native varieties has been very great in the United States. The most formidable obstacles experienced in Illinois State have been the curculio and rot. For the former the author recommends spraying, also spreading sheets under the trees and jarring the insects off; for the latter disease spraying with Bordeaux and thinning of the fruit at an early date.—*V. J. M.*

Podocarpus, Gametophytes and Embryo of. By W. C. Coker (*Bot. Gaz.* xxxiii., No. 2, p. 89, pls. 5–7).—The author treats of the pollen sac, grain and tube, the female prothallium, archegone, and embryo, as well as the affinities of *Podocarpus*, with literature.

G. H.

Polyanthus, The Gold-laced. By R. Dean (*Garden*, No. 1582, p. 177, 15/3/1902).—How very difficult it is to raise a really fine variety of the Gold-laced Polyanthus from seed is well known to those who are in the habit of raising seedlings. Although it is possible to raise a thousand seedlings from the best blood, not one may be up to the mark of quality of, say, 'Cheshire Favourite.' The characteristic qualities of the Gold-laced Polyanthus are given, as well as names of some of the best varieties and cultural instructions.—*E. T. C.*

Poppy, Harlequin. By. F. W. Oliver (*Gard. Chron.* No. 797, p. 223, fig. 71; 5/4/1902).—A description is given of curiously coloured flowers of a Poppy (*Papaver Rhœas*): some were of the usual red colour, some were white, and two were red and white. These flowers were half red and half white. "One outer petal and the adjacent halves of the inner ones were red, the other outer petal with the halves of the inner ones adjacent to it were white." The seeds from these flowers were sown, but the plants from them all bore red blossoms.—*G. S. S.*

Poppy, Hybrid (*P. Moneti*) (*Rev. Hort.* p. 150; April 1, 1902).—An accidental hybrid between *P. Rhœas* and *P. glaucum* noticed by M. Claude Monet in his garden. Described as nearer to *P. glaucum*, and very ornamental. Three varieties have been obtained: *P. Moneti genuinum*, *P. M. hirsutum*, and *P. M. rhœoides*.—*C. T. D.*

Porphyra, An Account of the Species of, found on the Coast of North America. By Henry T. A. Hus (*Proc. Cal. Acad. Sci.* 3rd series, Bot. vol. ii., No. 6, pp. 173–240; 3 plates, 28 figures).—The work here presented was done in the botanical laboratory of the University of California, under Dr. Setchell, by Mr. Hus, now an instructor in the Hortus Botanicus at Amsterdam. The subdivisions of this thoroughly careful paper on this genus of seaweeds are as follows:—History, morphology, distribution, description of species, key to Pacific Coast species, economic uses, method of mounting specimens, and list of publications and exsiccatæ cited. Fifteen species are described, six of which were first described by Setchell and Hus.

C. H. S.

Potato Crop. By O. M. Morris (*U.S.A. Exp. Stn. Oklahoma, Bull.* 52; December 1901).—This is a small pamphlet on the commercial industry of Potato-growing actively carried on in the valley of the North Canadian River, in Pottawatomie County.

The soil is sandy and admirably adapted to this crop. The report deals with planting, cultivation, harvesting, yields, and variety tests, &c., the paragraph devoted to keeping Potatos being specially interesting.

C. H. C.

Potato Diseases and Pests. By C. D. Woods (*U.S.A. Exp. Stn., Maine, Report*, 1901, pp. 49–64).—In the first of the articles referred to under the above title the results of spraying Potatos with Bordeaux mixture during 1901 are given. The Bordeaux mixture had the following composition: Copper sulphate, 5 lb.; fresh (unslaked) lime, 5 lb.; water, 50 lb.

The following table clearly demonstrates the benefit derived:—

	Yield of Potatos					
	Pounds per ⅓ Acr			Bushels per Acre		
	Merchantable	Small	Rotten	Merchantable	Small	Rotten
North part unsprayed .	553	96	101	184	32	34
Adjoining rows sprayed .	957	95	—	319	32	—
South part unsprayed .	330	94	81	110	31	27
Adjoining rows sprayed .	738	90	—	246	30	—

The relative values of ready-made commercial and freshly prepared Bordeaux mixtures were compared, and it was found that so long as the solution of the former *contained as much copper* as the latter it was equally effective. The second article emphasises the value of spraying for the suppression of insect enemies of the Potato, early and late blight and other leaf diseases of the Potato, describes the necessary apparatus, and gives formulæ for the making of the necessary spraying solutions.

F. J. C.

Potatos: Experiments with Fungicides. By Chas. D. Woods (*U.S.A. Exp. Stn. Maine, Report for* 1901, pp. 49–57).—Spraying experiments with Bordeaux mixture were successfully carried out, and demonstrated the value of Bordeaux mixture when applied on a large scale, not only in diminishing the blight, but increasing the yield of the crop. The money value was represented by the investment of 10*s.* as the cost per acre with a return profit of £8 per acre as compared with unsprayed sections.—*M. C. C.*

Potato Worm (*Gelechia operculella*, Zellr.). By W. T. Clarke (*U.S.A. Agr. Exp. Stn., California, Bull.* 135; 10/1901; 10 figs.).—The grub of the "Potato worm" causes great injury to Potato and Tobacco crops in the field and in store in California and in other parts of America, Australia, New Zealand, &c. The moth, which is a small greyish insect, lays its eggs in the eye of the Potato in the storeroom. The larva is hatched in about a week and bores into the Potato. It is a pinkish white grub with darker thorax and head, about ½ in. long when fully grown. It pupates in about six weeks from hatching either in the mouth of the burrow or in some crack or cranny near where the Potatos are stored, spinning a cocoon and covering it externally with dirt, &c. It remains in the chrysalis stage about two weeks. Eggs are also laid outdoors on the Potato plant. The larvæ then bore down into the plant, feeding just beneath the epidermis. Fungus attacks follow in the wake of the insect, and the stem succumbs to the combined onslaught. The life-cycle is completed in California in about 66 days.

Experiments are recorded which show that the Potatos may be infected in five ways:—

1. By infection of the stem.

2. By direct infection of the tuber in the hill through incomplete covering.

3. Direct infection after digging by the moth laying its eggs on the Potatos.

4. Indirect infection after digging by the larva finding its way into the Potato from the stem.

5. Infection in the sack or bin.

The remedies suggested are :—

1. Destruction of the food plants, which include many of the *Solanaceæ*, e.g. *Solanum nigrum*.

2. Light trapping—the moth is easily taken at light.

3. Destruction of infested stalks.

4. Careful hilling.

5. Avoidance of exposure during digging.

6. Exposure of the Potatos to the fumes of carbon bisulphide in the storeroom.

Two other Potato pests in California are incidentally mentioned, viz. flea beetle (*Epitrix subcrinita*, Lee), and the "yellow ground cricket" (*Stenopelmatus*).—*F. J. C.*

Primula cortusoides. Anon. (*Journ. Hort.* p. 278; March 27). There is a large portrait of *P. cortusoides* var. *amœna grandiflora lilacina.* These large-flowered forms are generally referred to *P. Sieboldi*, which as a species is doubtfully distinct from *P. cortusoides.* The varieties are well recommended for open border cultivation, under which they will spread into large free-flowering breadths, quite hardy and perennial, but requiring a dressing of soil both in autumn and spring, otherwise the points of the shoots get detached and perish on the surface of the soil.

C. W. D.

Primula sinensis. A. Henry (*Gard. Chron.* No. 800, p. 269, figs. 84 and 85; 26/4/1902).—The wild form of this plant has only hitherto been found in one locality, namely, in the gorges of the Yang-tse, near Ichang. The wild form was introduced into cultivation by seeds sent home by Mr. Pratt: its habitat and mode of growth are very different from what is found in the cultivated forms. The wild plant grows on ledges in limestone cliffs where there is practically no soil or moisture. These ledges are often hundreds of feet in length, and when the plants are in flower are strikingly beautiful. The cultivated plant was introduced from Canton, but there is no history of its origin in Chinese writings.

G. S. S.

Pruning and Planting, Methods of Free (*U.S.A. Exp. Stn. Rhode Island*, p. 238; 1901).—Photographs of Apple trees treated as follows:—

1. Trimmed to whips and cut back to about three feet in height.
2. Trimmed to whips with the leader left untouched.
3. Branches cut back, one half leader left.
4. Untrimmed.

No. 3 is considered best, and it is recommended to leave all sound roots and shorten back the tops: this helps to bring about a proper balance between root and leaf, and also improves the subsequent character of growth of the tree.

The experiments show that under favourable conditions a tree will adjust itself to almost any kind of treatment and still make a good tree.
C. H. H.

Prunus Pseudocerasus Watereri and P. serrulata Hisakura. By E. Koehne (*Gartenflora*. p. 2; pl. 1495; 1/1/1902).—A coloured plate and short description of these two ornamental Cherries from Japan. The former has semi-double pale Rose flowers resembling those of *P. Pseudocerasus fl. ros. pleno* (*Cerasus Sieboldi*, Carr. *fl. ros. pleno*) but larger. *P. serrulata Hisakura* has slightly smaller, paler, rose-coloured, semi-double flowers, and the young leaves are green.—*J. P.*

Promenæa stapelioides, Lindl. (Cogniaux in *Dict. Icon. Orch.* Promenæa; pl. 1; 2/1902).—A native of Brazil. Flowers green dotted with purple brown; lip blackish purple.—*C. C. H.*

Promenæa xanthina, Lindl. (Cogniaux in *Dict. Icon. Orch.* Promenæa; pl. 2; 2/1902).—Introduced from Rio de Janerio by Gardner in 1837. Flowers clear citron yellow with small red dots at the base of column and lip. A pretty little species.—*C. C. H.*

Ruellia Lorentziana. By Ed. André (*Rev. Hort.* pp. 136, 137; March 16, 1902).—Coloured plate and description. Very pretty Lilac flowers *à la Salpiglossis* [on a small scale—*C. T. D.*] in lax panicles. Native of Uruguay. Temperate house, or in the open in summer. Culture easy.—*C. T. D.*

Railway Embankments, Floral. By H. Correvon (*Rev. Hort.* pp. 114, 115; March 1, 1902).—An interesting article on the utilisation of railway slopes and stations for floral decoration, with special reference to the Railway Banks Floral Association in this country, of which Miss Willmott, of Warley, is honorary treasurer.—*C. T. D.*

Ranunculus, Alpine Species of. By C. Wolley Dod (*Gard. Mag.* No. 2526, p. 196; 29/3/1902).—A selection is made in this article of the best species for the garden from a genus largely abounding in weedy plants. The term "Alpines" does not necessarily mean dwarf plants, as *R. aconitifolius* and *R. platanifolius*, both growing knee-high, are included. The useful information that Mr. Wolley Dod always gives in his writings makes this a very readable article, as this garnishing gives a new interest to these simple mountain flowers.—*W. G.*

Rates of Charge, Changes in the, for Railway and other Transportation Services. By H. T. Newcomb (*U.S.A. Dept. Agr.* (*Div. Stat.*) *Bull.* 15, 1901).—A report on changes in the rates of charge, touching incidentally on the charges for the transportation of agricultural products to the principal markets and seaports in the Western States and on the Pacific Coast.—*C. H. C.*

"Rejuvenated" Stems in Aged Willows, The Production of. By Dr. G. Tischler (*Flora*, vol. xc. 1902, p. 278; 4 woodcuts).–When the heartwood of a Pollard Willow rots the splintwood survives; but this, too, may die in strips owing to damage to the bark &c. The cambium of a strip of living splint-wood forms a callus, and extends its crescent wings year by year till a circular stem, distinct from the old trunk, is evolved from the original strip, connecting the head and the roots. The figures are very interesting, and might well be reproduced here.—*M. H.*

Ribes, Some New Species of Pacific Coast. By Alice Eastwood (*Proc. Cal. Acad. Sci.* 3rd series, Bot. vol. ii., No. 7, pp. 241–254; 2 plates, 10 figures).—An interesting contribution to the literature of a difficult genus. Nine species hitherto unnamed are described and illustrated. A key to all the Pacific Coast species, fifty-seven in number, closes the paper.—*C. H. S.*

Rose Fungus. *Phragmidium subcorticatum.* By William Carruthers (*Jour. R.A.S.* vol. lxii. p. 248; 1901).—"The diseased twigs of a Rose tree from Cambridgeshire were found to be distorted from the presence of the æcidium form of the rust *Phragmidium subcorticatum.* The different stages of the rust all develop on the same host, and the fungus can be destroyed by spraying the plants with a solution of copper sulphate. The diseased twigs and leaves should be gathered and burned."
R. N.

Rose, H. T., 'Baldwin' (syn. 'Helen Gould'); **Rose, H. T., 'Miss Alice Roosevelt'; Rose, T. 'Ivory'** (*Amer. Gard.* xxiii. pp. 167, 169, 170; figs. 37–40; 15/3/1902).—Excellent photographs of these new American Roses.—*C. C. H.*

Roses, Pruning. By J. H. Pemberton (*Gard. Mag.* No. 2524, 15/3/1902).—This matter at first sight may appear to be commonplace, but when it is dealt with by a master in the art of Rose culture the subject commands close attention. Mr. Pemberton classifies the garden Roses and describes how they should be pruned, and specialises various sorts that require different treatment in this direction from the rest. Abstaining from pruning altogether is recommended in some sorts, such as 'La France,' and this may appear to be unusual practice until one reads the results obtained. The proper pruning of Roses, as in other flowering shrubs, is still an art about which we have yet a good deal to learn, though a matter often considered of small importance by even practical gardeners. The subject is continued in the following number (No. 2525, p. 178).—*W. G.*

Rose 'Sarah Nesbitt' (*Amer. Gard.* xxiii. pp. 6, 7; fig. 1; 4/1/1902). A sport from 'Mrs. J. P. Morgan' having the same origin as 'Mrs. Oliver Ames,' though quite distinct. A pale creamy-pink Tea Rose with pink tip and yellow base.—*C. C. H.*

Rubus, Ornamental Species of. By W. T. (*Gard. Mag.* No. 2523, p. 142; 8/3/1902).—The few species of Bramble cultivated solely for ornament are described, the finest by a long way being *R. deliciosus*, which is illustrated. The writer is well acquainted with the subject, and describes clearly the various kinds and their particular value at various seasons and in different positions in the garden.—*W. G.*

Rubus palmatus. By Sir J. D. Hooker (*Bot. Mag.* tab. 7801). Nat. ord. *Rosaceæ*, tribe *Rubeæ*.—Native of Japan and China. A very elegant species, with white elliptic-shaped petals. It flowered with Messrs. Veitch & Sons in 1899. It is now 20 ft. high at Kew.—*G. H.*

Saintpaulia ionantha. By Ed. André (*Rev. Hort.* pp. 184, 185; April 16, 1902).—Coloured plate illustrating three pretty varieties: *alba*, *rubra*, and *violacea*; *rubra* is nearer mauve than red.—*C. T. D.*

San José Scale, Spraying Experiments for. By W. E. Britton (*U.S.A. Exp. Stn., Conn., Bull.* 136; 2/1902; 2 figs.).—This pamphlet gives an account of spraying, with kerosene and water, crude oil, and Babbitt's lye (1 lb. to 4 galls.), Peach trees in foliage. It was found that crude oil with a specific gravity of 43° Beaumé and a kerosene and water mixture containing 20 per cent. kerosene were both effective in destroying scale on *dormant* Peach trees, and did not harm the trees, while the scale was kept in check on trees in foliage by an application of kerosene and water in mixture containing 15 per cent. kerosene. The most effective time to spray trees in foliage was in July. Crude oil and water and common soap and water (1 lb. to 8 galls.) both caused injury to the foliage.—*F. J. C.*

San José Scale Investigations. By V. H. Lowe and P. J. Parrott (*U.S.A. Exp. Stn., New York, Bull.* 202; 12/1901).—It was found that in winter, spraying with crude petroleum emulsion containing 25 per cent. of petroleum or more, seriously injured Peach trees, while Apple and European Plum trees were uninjured except by 40 per cent. and stronger emulsions, and Pears and Cherries were uninjured either by emulsified or undiluted petroleum. In spring spraying (before the buds burst) the Plum trees were seriously injured by the undiluted and slightly by the 60 per cent. emulsion, Peach trees by the 40 per cent., Pears and Cherries uninjured.

Twenty-five per cent. emulsion did not kill the scales, but 40 per cent. killed them both in winter and spring.

Hydrocyanic acid at ·3 gram of cyanide per cubic foot of air space was required to kill the scales in December, but in June they could be killed with gas at ·18 gram. Apple, Pear, Plum, and Cherry buds are uninjured by the stronger gas, while Peach buds were slightly injured, but quite uninjured with gas at a strength of ·22 gram.

Two plates illustrating the tent used for fumigating are given, and numerous tables showing the result of the use of insecticides are set out. Among other insecticides worthy of trial whale-oil soap and crude petroleum compound; lime, sulphur, and salt wash; and kerosene-lime emulsion are suggested.—*F. J. C.*

Saxifraga oppositifolia and allied Species. By G. R. (*Garden*, No. 1584, p. 205; 29/3 1902).—This group of the Saxifrage family is widely distributed and found almost everywhere on the higher points of European and Asiatic mountains, but especially on the Alps. The various positions in which these plants naturally grow and other interesting information concerning their habitats are given, and the treatment best suited to their success under cultivation.—*E. T. C.*

Scale, The San José, and the Administration of the Crop Pest Laws of Virginia. By W. B. Alwood (*Third Rep. of the State Ent. and Path.* p. 49, pls. ii., iii.; 1901).—The author gives an account of the entire scope of work and investigations undertaken under the Crop Pest and San José Laws of the State of Virginia.—*R. N.*

Scale, the San José, in Japan, A Preliminary Report on. By C. L. Marlatt (*U.S.A. Dep. Agr., Bull.* 31, N.S., pp. 41–48; 1902).—From the author's observations made in Japan it seems tolerably certain that this pest is of comparatively recent origin in Japan, and that it has been probably introduced from the United States of America.—*R. N.*

Scapaniæ of East Indies (*Beih. Bot. Cent.* bd. xi. ht. 8, pp. 542–545).—Herr Karl Müller (Freiburg-im-Breisgau) gives a full account of the distribution of the *Scapaniæ* brought by Drs. Levier and Hartless from India. Two new species are also described, viz. *S. Levieri* and *S. Hartlessii*.—*G. F. S.-E.*

Schizocodon soldanelloides. Anon. (*Journ. Hort.* p. 348; April 17, 1902).—A life-size portrait of a fine specimen is given on page 347. Now that this neat little plant has been in cultivation in England for about fifteen years, and may be imported direct from Japan for twopence a plant, we may expect to learn more of its successful cultivation. Up to this time success with it has been exceptional and rare. *C. W. D.*

Schomburgkia Thomsoniana var. **minor.** By Sir J. D. Hooker (*Bot. Mag.* tab. 7815).—Nat. ord. *Orchideæ*, tribe *Epidendreæ.* Native of the Cayman Islands, West Indies. There are two varieties: one, *atropurpurea*, with large cream-coloured and purple flowers, the lip with a deep purple throat; and *minor*, with canary-yellow flowers 2 inches across and only the tip of the labellum being purple.—*G. H.*

Scolopendrium, var. Drummondæ superba. Anon. (*Gard. Chron.* No. 784, p. 5, fig. 3; 4/1/1902).—This very interesting and ornate variety originated as a seedling from *S.* v. *crispum Drummondæ*, found wild near Falmouth. This variety far exceeds all others in its fimbriate and plumose character; it is also singular in producing prothalli at the tips of the filaments. A specimen was exhibited recently by Mr. C. T. Druery, and obtained an Award of Merit from the Floral Committee of the Royal Horticultural Society.—*G. S. S.*

Senecio magnificus. By Sir J. D. Hooker (*Bot. Mag.* tab. 7803). Nat. ord. *Compositæ*, tribe *Senecionidæ*.—Native of Australia. It is a tall glabrous under-shrub, with rather coriaceous leaves; oblanceolate in form, about 6 inches in length, the heads in loose corymbs, nearly 2 inches across; golden yellow.—*G. H.*

Senecio præcox, Water Storage and Conduction in. By John W. Harschberger, Ph.D. (*Contr. Bot. Lab. Phil.* vol. ii. No. 1, p. 31; pls. 7, 8).—The anatomical peculiarities described show that as regards the roots and the stem *Senecio præcox* is well protected against the dry season, and can lay up a store of water in the pith for use during the period of drought. Hence the plant is well adapted to grow under the condition of climate presented in the valley of Mexico. The Cacti of Mexico and other succulents of that region secure immunity from drought by consolidation and by reduction of transpiration surface, as does likewise this plant the Tree Groundsel.—*M. C. C.*

Shot-hole Fungus on Cherry Fruit Pedicels. By F. C. Stewart and H. J. Eustace (*U.S.A. Exp. Stn. New York, Bull.* 200, pp. 85–87, 1901).—The Shot-hole fungus (*Cylindrosporium padi*), so destructive to the foliage of Cherries and Plums, has been discovered attacking the fruit pedicels of Cherries. This discovery is of scientific interest, but it has little or no practical bearing on the control of the disease.—*M. C. C.*

Shrubs, Moving small. By J. Clark (*Garden*, No. 1581, p. 162).—Some of the most difficult plants to move in a young state are Arbutus, Hollies, Magnolias, Cedars, *Sequoia gigantea*, *Libocedrus decurrens*, &c. All these require to be shifted every year for the first few years, and if this is done each autumn they will suffer little if at all. Other valuable information is given.—*E. T. C.*

Shrubs, The Pruning of Hardy Flowering. By W. Dallimore (*Garden*, No. 1585, p. 223; 5/4/1902).—Shrubberies of a few years ago required quite a different treatment from the up-to-date shrubbery or collection of shrubs of to-day. Then shrubberies were composed of a few things early; the plants used were those which caused least trouble. Now it is different. Broadly speaking, four kinds of pruning should be practised—shortening branches, thinning, disbudding and removal of seed heads, and root pruning. The writer proceeds to discuss the best methods adapted to the various groups.—*E. T. C.*

Shrubs, Pruning Flowering. By Alger Petts (*Gard. Mag.* No. 2523, p. 144; 8/3/1902).—If there is one subject more than another that gardeners least understand and practise, it is the pruning of hardy flowering shrubs, and yet it is of much importance in the proper management of a garden. This state of affairs is set forth by the writer in a way that must appeal to those who have always followed the wrong practice in shrub pruning. There can be no general rule for pruning, as different species require different treatment in this direction, and Mr. Petts explains why such as Forsythias, Deutzias, Kerrias, Chimonanthuses, and various other shrubs should be pruned immediately after flowering, and not in autumn and winter, as is usually the case. It is a subject that should be studied by all who have the management of shrubs, and particularly in the London and other public parks, where ignorance of rational pruning is most apparent.—*W. G.*

Sobralia virginalis lilacina, Cogn. (Cogniaux in *Dict. Icon. Orch.* Sobralia; pl. 3A; 2/1902).—A beautiful variety introduced from Colombia by M. Patin for M. Peeters, of Brussels. Differs from the type in having a delicate lilac tint around the front lobe of the lip.

C. C. H.

Soil, Natural Fertility of. By J. J. Willis (*Gard. Mag.* No. 2516, p. 32; 18/1/1902).—The writer of this article discusses the question of natural soil fertility from a scientific standpoint, and explains clearly how soils in a primitive condition become gradually more fertile by the influences of atmospheric changes, and by the decay of organic compounds which combined with inorganic constituents render natural soils fertile for the support of vegetation.—*W. G.*

Solanum Xanti. By Sir J. D. Hooker (*Bot. Mag.* tab. 7821).—Nat. ord. *Solanaceæ,* tribe *Solaneæ.* Native of California. It is remarkable for the extraordinary variability of the leaves. The flowers are of a pale purple colour in an umbellate cyme.—*G. H.*

Sonerilas, Floriferous. By F. Rehnelt (*Die Gart.* p. 325; 12/4 1902; with illustrations).—On the Continent these pretty stove plants are at the present time in great favour. Formerly grown under hand-lights in hothouses, far finer plants are now grown without these lights. Specially recommended are *Sonerila Hendersoni argentea, S. margaritacea, S. orientalis,* and several hybrids.—*G. R.*

Sphærotheca mors-uvæ (Schw.) or Gooseberry Mildew: Its Occurrence and Distribution in Russia. By P. Hennings (*Gartenflora,* p. 170; 1/3/1902).—This destructive Gooseberry parasite is common in North America, and has been met with in Ireland. (See Salmon, JOURNAL R.H.S., 1900, pp. 139–142.) The author received specimens from near Moscow and considers it indigenous in Russia.—*J. P.*

Spinach. By E. D. S. (*Journ. Hort.* p. 162; Feb. 20, 1902).—Notes are given concerning this crop. In light dry soils *Tetragonia expansa,* called New Zealand Spinach, makes a good substitute; also *Beta maritima,* called Spinach Beet, may be gathered all the year round. A bed of *Chenopodium Bonus Henricus* ('Good King Henry'), hardy and perennial, is always useful for early gatherings.—*C. W. D.*

Spiræa Millefolium. By Sir J. D. Hooker (*Bot. Mag.* tab. 7810).—Nat. ord. *Rosaceæ,* tribe *Spiræeæ.* Native of California. It is remarkable for emitting an odour of creosote. It grows to 3 feet in height at Kew, and flowered in the open air in 1901. The flowers have a white corolla, ½ inch in diameter, being crowded in terminal panicles.—*G. H.*

Spraying for Horticultural Diseases in the United States (*U.S.A. Hort. Soc. Illinois,* 1901, pp. 7, 191, 219, 385, 387, 390, 451, 485, &c.; tabs., plates, &c.).—Quite a large amount of information on this subject has been collected together in this volume as a result of research and experiments of an extensive nature. Directions, formulæ, important details, and illustrations of apparatus are to be found by those interested in the subject. It is impossible in a short space to do justice to the articles, but each one will be dealt with briefly.

Directions and Formulæ.

This paper, prepared under the direction of the chief in horticulture of the State of Illinois, explains five points which must be kept in view for successful spraying:—(1) Pure materials; (2) proper preparation of mixtures; (3) proper method of application; (4) time of application; (5) good judgment. Paris green is regarded as the most important insecticide for destroying chewing insects, and it should be a dry and wholly impalpable powder of a bright light emerald-green colour. Bordeaux mixture being a complex and insoluble compound of lime and copper suspended in water, care must be taken to get the proper combination as regards quantities especially. An excess of uncombined copper sulphate is very injurious to the foliage. The author recommends it being tested before use. Upon this point the author has given careful and elaborate tables referring to some dozen mixtures. As to the application considerable pressure and a fine nozzle should be used, held a short distance away from the leaves and fruit; just sufficient to cover with fine "dew drops" and no more should be applied. As to the time of application this depends upon the tree to be treated, and reference should be made to the list given; but the chief point to bear in mind seems to be to spray in time; a very few days' delay may mean ruin. Insecticides of course act in two ways: (*a*) As a poison to be eaten along with the plant; (*b*) by contact with the insect. Fungicides also act in two ways: (*a*) by contact with mycelium; (*b*) by destroying the germinating tube of the fungus before it penetrates the skin.

Spraying for Bitter Rot.

This paper is the result of experiments which have been made by Professor Blair to determine various questions. A good illustration is given of a convenient spraying outfit being used in an orchard. The spraying should take place early in June. Bordeaux mixture having the undesirable effect of staining the fruit, ammoniacal carbonate of copper is recommended, and its composition and preparation are carefully described. The spray should be fine and misty until the fruit is entirely covered, but in no case make such a heavy application that the liquid runs off, thus leaving many places unprotected.

Experience with the Dust Spray.

The dust spray has the advantage of being less expensive than a liquid one, for it is easier prepared and quickly applied. Another advantage is that the same care need not be used in using the exact proportions and in the mixing, for with the dust spray the same mixture can be used for Apple, Peach, Plum, and all other fruit trees and bushes. The machine is always ready for business and does not require an expert to keep it going. As a result of actual experiments it would seem that the method was successful with winesaps and the blooms and fruit of Apple and Peach trees generally, and the foliage was in no case injured, but less success was obtained against the scab and bitter rot. The author, Mr. A. A. Hintley, is very confident of the ultimate success of this method of spraying.

Second Brood of Codlin Moth.

The author of this paper, Mr. John W. Lloyd, regrets that spraying is not commonly done for the *second* brood, which attacks the fruit in July and August after the Apples have attained considerable size. No matter how thorough the spraying for the first brood, some of the worms are sure to escape. These develop into moths which lay eggs for the second brood ; and since one moth may lay from fifty to 100 eggs it would take only a few moths to make a numerous second brood.

A second paper by the same gentleman goes more fully into the subject and gives tables showing the results of experiments. He arrives at two conclusions : (1) That the spray protected the Apples from attack, *i.e.* it killed the worms before they entered ; (2) it killed many worms after they had entered the Apple, and thus prevented them from going to the interior. The paper is concluded with a remark that further experiments are needed to determine what material will be best to use, and at what strength it may be applied. It is claimed that arsenate of lead will not injure foliage, no matter how strong a mixture is used.

Some Spraying Lessons deduced from the Season of 1901.

This season having been a " record breaker " as to extreme heat and drought, the author of this paper, Mr. A. V. Stubenrauch, of the Illinois University, points out that several lessons have been learnt, especially in the way of spraying. Mr. Stubenrauch believes that the development of the art and science of spraying is undoubtedly the most important advancement that has been made in modern horticultural operations. It is the *one* thing that has made possible the present system of commercial orcharding in the States.

Since it is impossible to isolate infected orchards and trees, the spray pump is the only salvation, and makes it possible to control diseases and insects. The word " control " is emphasised, for it is pointed out that it is impossible to eradicate any of the diseases and pests which now afflict our trees and fruits. The paper goes on to say that to spray properly is expensive, but it is a profitable investment. To spray improperly is time and money wasted, and is therefore extravagant at any price. To spray properly requires painstaking care and the closest attention to every detail of the work.

Important Details of Spraying.

Professor Stubenrauch has made this paper perhaps the most valuable of the series, covering as it does sixteen pages and including nine beautifully produced plates. The paper opens with a reiteration of the importance of spraying and necessity for care in every part of the process, good apparatus, pure materials, and patient and intelligent attention to every detail. It is admitted at once that it is an expensive operation. An interesting account of fungi is given and a particular description of the Apple bitter rot fungus, followed by a description of the mixtures to be applied and the correct mode of application. Full details are given of the composition and effect of the various well-known spraying mixtures: *e.g.* Paris green, Bordeaux mixture, ammoniacal copper carbonate. The plates show: (1) bitter rot spores as seen under the microscope, (*a*) before, and (*b*) after germination; (2) proper and improper spraying; (3) Apples properly and improperly sprayed; (4) leaves properly and improperly sprayed, the other plates showing the appearances of the various mixtures, &c. *V. J. M.*

Spraying the Orchard. By Wm. B. Alwood (*U.S.A. Exp. Stn., Virginia, Bull.* 100).—Spraying is not usually necessary for diseases in young orchards during the first four or five years, but after this, spraying ought to begin. Alkali wash is recommended to be used in alternate winters. Weak solution of copper sulphate is a good fungicide, and cheaper, though not so cleansing.

To renovate an old orchard, cut out the dead wood and thin the trees, to admit air and sunlight; in order to avoid too severe a shock the thinning out may be extended over two years. Before spraying, scrape the trunks and barks with a triangular scraper. Spray for the first two winters with alkali, at a strength of 3 degs. Beaumé, applied from the ground to the ends of the branches.

In summer wash with weak Bordeaux mixture.

First spraying of dormant trees (March 17).—Ninety-three very large trees, 30 ft. high, with an equal spread of branches, took 325 gallons of weak solution of bluestone, three men and team five hours. Cost: 13 lb. bluestone at $4\frac{1}{2}$ cents, 59 cents; one half-day team, 75 cents; half-day for three men \$1.50, \$2.84; a fraction over 3 cents per tree.

Second spraying (April 28).—Buds opening; sprayed with Bordeaux mixture, 400 gallons. Cost: 32 lb. bluestone=\$1.44; 40 lb. lime, 40 cents; eight hours for three men, \$2.40; eight hours for team, \$1.20. Total, \$5.44; a fraction less than 6 cents per tree.

Third spraying (May 12).—Bloom fallen. Bordeaux mixture and green arsenite, 8 oz. to 50 galls. Bordeaux; ten hours three men and team, 400 galls. Cost: Bluestone and lime as above, \$1.84; three men, \$3; team, \$1.50; poison, 4 lb. 50 cents. Total, \$6.84; about $7\frac{1}{3}$ cents per tree. These trees in good years have borne over thirty bushels per tree. Cost of the three sprayings \$15.12 cents, or $16\frac{2}{10}$ cents per tree.

SPRAYING THE YOUNG ORCHARD—603 trees, eleven years old.

First spraying (March 13).—Trees dormant. Weak solution of bluestone, three men and team, eight hours; 325 gallons solution. Cost of labour and material, \$4.19; a fraction under $\frac{7}{10}$ cent per tree.

Second spraying (April 26). Buds just opening.—450 gallons Bordeaux. Time of three men and team, ten hours. Cost: Three men, \$3; team, \$1.50; 26 lb. bluestone, \$1.62; 45 lb. lime, 45 cents. Total, \$6.57; a fraction over a cent per tree.

Third spraying (May 16, 17). Bloom fallen.—Bordeaux and green arsenite, 8 oz. to 50 gallons Bordeaux. Time, seventeen hours; three men and team, 850 gallons. Cost: Men, \$5.10; team, \$2.55; bluestone, \$3.06; lime, 85 cents; poison, \$1.08. Total, \$12.64, or a fraction over two cents per tree.

Total cost of three applications, $23.40, or $3\frac{8}{10}$ cents per tree by student labour; if by trained labour the cost would be one-third less.

Many of these trees bore five to eight bushels of Apples.

The time to spray.—First application, dormant season. To clean the trees of Lichen; to destroy hibernating insects in form of egg, larvæ, or pupæ; and, as a fungicide against Apple-scab (*Fusicladium dendriticum*) and brown rot of stone fruit (*Monilia fructigena*) &c.

1. The alkali wash by cleaning the bark also renders it less liable to attack by the canker-producing fungi, and less opportunity for insects and fungi to find lodgment on the trunks and limbs.

2. The alkali wash destroys the eggs of *Aphis mali* and *Mali foliæ*, which are found on the twigs in winter and attack the young foliage as soon as it appears, and are very difficult to treat after the leaves become curled. It also destroys the woolly aphis (*Schizoneura lanigera*), which hibernates in wounds and under cracks in the bark; and the larvæ of the codlin moth (*Carpocapsa pomonella*), which commonly hibernate under cracks in the outer bark.

3. As a direct fungicidal application to destroy pathogenic forms like the scab fungus and spores of the brown rot fungus, the winter treatment is excellent. The scab fungus hibernates on the twigs of Apple as delicate strands or threads (mycelium), and the alkali wash helps to destroy this growth. The spores of brown rot which adhere to the limbs and trunks of Plum, Peach, and Cherry trees are destroyed by this wash. (The mummied fruit should be removed from trees.) For these fungi the weak solution of copper is a good wash, but alkali is believed to be even better.

Time of applying winter washes.—Any time that suits the grower during the dormant period; in calm mild weather it is customary to spray in February or March before the buds push.

For San José Scale.—One pound soap to a gallon of water. The soap wash cleans the trees beautifully.

Winter washes, when orchard is in good condition, are usually not deemed necessary oftener than once in every two or three years, unless it is to keep down aphids or scale insects.

Second spraying.—The first Bordeaux and poison spray is to prevent the development on Apple, of scab, orange rust (*Gymnosporangium macropus*), the brown spot of leaf (*Phyllosticta pirina*); and on stone fruits, the leaf curl of Peach (*Exoascus deformans*), leaf spot (*Septoria cerasina*), and the brown rot of fruit. Among the insects poisoned on Apple are the tent caterpillar (*Clisiocampa americana*), bud moth (*Temetocera ocellana*), occasionally canker-worm (*Anysopteryx* spp.), and both pome and stone fruit weevils (*Conotrachelus nenuphar*).

Apple scab grows out at once when the buds open on the young leaves and upon the fruiting stems, and the young fruit as soon as set, and may in this manner largely destroy the crop before it reaches the size of full-grown Cherries. The brown spot of the leaf begins at the same time from spores on old leaves.

It is surprising how quickly insects yield at this stage, while if left until their ravages are noticeable the treatment seems to give little relief, as the insects, when half-grown or nearly mature, yield much less readily to poison.

The time to apply the first spring spray.—Begin when the fruit buds have pushed out so as to part the thick scales, partially disclosing themselves, and the whorl of leaves which surround the cluster of fruit buds are appearing. Cease when the trees open their blossoms, because it may kill bees, and spraying is itself inimical to pollination.

If aphids or scale insects, soap washes are best. One pound good whale-oil soap to six gallons of water.

Third application—Second Bordeaux and poison spray.—Same as previous application for same fungi and insects with the addition of the codlin moth (*Carpocapsa pomonella*), which is the most serious insect pest attacking apple orchards.

Time of treatment.—Immediately after the bloom falls, whilst the calyx lobes are turned back exposing the eye, as the parent codlin moth deposits her eggs usually upon the young fruits soon after the bloom falls. The larvæ find their way into the eye of the fruit and commence their depredations. One object of spraying at this period is to lodge poison in the eye and destroy the larvæ before entering the Apple. The fruit develops rapidly at this period, and in a few days, the poison penetrating to the eye, becomes less certain, and consequently spraying will be less efficacious against codlin moth.

If this spray is washed off by a sudden storm before the Bordeaux has "set," the spraying should be repeated.

Black rot (*Sphæropsis malorum*), bitter rot (*Glæosporium fructigenum*), or brown spot on the leaf should be sprayed for at their first appearance.

Showery weather interspersed with hot sunshine favours the spread of fruit rots.

Washes for Dormant Season.

Alkali wash.—6 lb. potash to 50 gallons of water, 3*d.*, on a Beaumé acid spindle (acid spindle for testing gravity costs 2*s.*).

Sulphate of copper solution. 2 lb. in 50 gallons. Stronger solutions are unnecessary and wasteful. Dissolve 40 lb. in a 50-gallon cask and use $2\frac{1}{2}$ gallons of the solution to each 50 gallons of wash (an ordinary wooden pail holds $2\frac{1}{2}$ gallons).

Make stock solution a day or two in advance.

Soap washes for dormant plants may be used very strong without injury. For scale insects 1 lb. soap to one gallon.

Bordeaux washes.—The great fungicidal wash, only the most minute quantity of copper possible is necessary to produce the required effect. $1\frac{1}{4}$ lb. lime decomposes the copper sulphate and neutralises the sulphuric acid of 1 lb. copper sulphate.

Formula.—	Copper sulphate . .	4 lb.
	Unslacked lime . .	5 lb.
	Water	50 gallons.

In one tub slack 50 lb. lime, strain at once into a 50-gallon barrel and fill with water. Keep barrel covered to prevent evaporation and to prevent trash getting into it: this will keep good indefinitely.

When Bordeaux mixture is wanted use five gallons of each to make 50 gallons of wash. Stir stock solutions before mixing. Run water into the spray barrel and when about half full put in the ingredients and stir as the barrel fills. The Bordeaux stays in suspension better when handled in this manner than if mixed full strength and the water then added.

The arsenite should be carefully mixed into a thick paste and then thinned and added to the wash. Paris green or green arsenite at 8 oz. to 50 gallons, for Peach half this strength. London purple varies in strength, but is one of the best to stay in suspension: it should be used with an excess of lime to prevent burning.

The best pumps are manufactured by Morell and Morley, Benton Harbor, Michigan; The Deming Company, Salem, Ohio; Gould's Manufacturing Company, Seneca Falls, N.Y.—*C. H. H.*

Stanhopea Reichenbachiana, Roezl. (Cogniaux in *Dict. Icon. Orch.* Stanhopea; pl. 3; 2/1902).—A large and beautiful species discovered in 1874 by Roezl (probably in the Andes of Colombia). Flowers white shaded yellow and dotted with rose; the flowering season is in winter, and, contrary to many other species of the genus, the flowers last a long time.—*C. C. H.*

Stapelia bella. By A. Berger (*Gard. Chron.* No. 792, p. 137, fig. 40; 1/3/1902).—The origin of this new species is not known; it has hitherto been cultivated under the name of *S. glauca*, from which, however, it appears to be quite distinct. The structure of the flower is curious, as may be seen from the figure, which gives a diagram of the details of the blossom, as well as a general view of the plant in flower. A description of the plant is given.—*G. S. S.*

Strawberry-growing on S.-E. Coast of Queensland. By James Pink (*Qu. Agr. Journ.* ix. pp. 551–554; December 1901).—This is simply a description of Strawberry culture and harvesting in the Wellington Point and Cleveland District. Ten years ago Strawberries could not be made to grow at any price, but industry and perseverance have again illustrated what Queensland soil is capable of producing when cultivated by intelligent men. In the course of the present season more than fifty tons of Strawberries have been sent from the above district to the Sydney and Brisbane markets and to the jam factories, and sold at a remunerative price to the growers. This district having proved pre-eminently suitable for Strawberry culture, there is little doubt that in a few years it will be able to supply all the Strawberries required for jam-making in Australasia.—*M. C. C.*

Strawberry, The. By W. J. Allen (*Agr. Gaz. N.S.W.* p. 1544, December 1901).—An exhaustive article on this most popular fruit, dealing with the soil, situation, preparing the soil, manuring, planting, cultivation, irrigation, perfect and imperfect blooming varieties, and diseases. The following are the varieties on offer in New South Wales at the present day: 'Bidwell,' 'British Queen,' 'Captain,' 'Commander,' 'Comte de Paris,' 'Counts,' 'Countess,' 'Crimson Cluster,' 'Crescent Seedling,' 'Caroline,' 'Duke of Athol,' 'Duc de Malakoff,' 'Dr. Hogg,' 'Duke of Edinburgh,' 'Early White,' 'Eclipse,' 'Edith Christy,' 'Empress Eugénie,' 'Elton,' 'Enchantress,' 'Frogmore,' 'Gandy,' 'Garibaldi,' 'Grove End Scarlet,' 'Glenfield Beauty,' 'Hautboys,' 'James Veitch,' 'Jubilee,' 'Jesmond,' 'Keen's Seedling,' 'La Chalonnaise,' 'La Grosse Sucrée,' 'La Marguerite,' 'Lee's Prolific,' 'Léonée de Lambertyne,' 'La Constant,' 'La Grosse Suève,' 'Melon,' 'Mikado,' 'Myatt's Pine,' 'Myatt's Surprise,' 'Monarch,' 'My Favourite,' 'Marshal,' 'Milner's Perfection,' 'Mammoth,' 'Noble,' 'Oscar,' 'Pauline,' 'Pink's Prolific,' 'Pioneer,' 'President,' 'Princess Alice Maude,' 'Red Chilian,' 'Rifleman,' 'Roi Albert de Saxe,' 'Royal Sovereign,' 'Sensation,' 'Sharpless,' 'Shuckless,' 'Sir Joseph Paxton,' 'Stirling Castle Pine,' 'Superba,' 'Trollope's Victoria,' 'The Creswell,' and 'White Chilian.'—*H. G. C.*

Strawberry and Vegetable Notes for 1901. By L. R. Taft and M. L. Dean (*U.S.A. Exp. Stn., Michigan State Agr. College, Hort. Dep., Bulls.* 195, 196; January 1902).—Bulletin 195 is a critical catalogue of all the new varieties of Strawberry produced in America, followed by tables of the results of observations as to the possession of qualities desirable in a Strawberry by these and a number of older varieties. These results are given by means of dates and marks, placed respectively under the headings of "Bloom" (*i.e.* date of), "First ripe," "Last ripe," "Vigour," "Hardiness," "Per cent. of bloom killed by frost," "Size," "Form," "Colour," "Quality," and "Firmness."

It appears that in Michigan 'Clyde' is the best all-round early Strawberry. 'Gladstone' is the first ripe, and bears longest. 'Parker Earle' is the latest bearer and 'George's Triumph' is the best all-round late variety.

Bulletin 196 in the same cover gives similar accounts of new varieties of Beans, Cauliflower, Cabbage, Lettuce, Peas, Sweet Corn, Potatos, and Tomatos, which were principally grown from seed supplied by American seed growers, whose names are given.

Among Lettuces the writers recommend 'Hamilton Market' and 'Early Curled Simpson,' with 'Grand Rapids' for forcing. 'Giant Glacier,' 'Golden Queen,' and 'Crystal Palace' are said to be choice varieties; and among the larger kinds we are told that there are few better sorts than 'Leviathan,' 'Maximum,' and 'New York.'

Peas that they recommend for market-garden purposes are 'Scorcher,' 'Prolific,' 'Early Market,' and 'Earliest of All,' though for quality 'Gradus' or 'Thomas Laxton' is superior. As main-crop varieties are suggested 'Hosford Market Garden,' 'Master,' and 'American Wonder,' with 'Stratagem' and 'Champion of England' as standard late varieties. 'Monarch' and 'Blue Imperial' are promising new late sorts.

'Michigan' is said to be the leading white early Potato, followed by 'Acme,' 'Andes,' and 'Cole.' 'Daughter of Rose,' 'Ohio,' and 'White Ohio' are good second early kinds; and among desirable late varieties are 'Carman,' No. 1 and No. 3, and 'Sir Walter Raleigh.'

For a succession of good Tomatos are given 'Earliana,' 'Early Michigan,' 'Noble,' 'Rosalind,' and 'Success,' with those of the Ponderosa type as later varieties.—*M. L. H.*

Stuart, The late Dr. Charles. By R. D. (*Journ. Hort.* p. 171; Feb. 20, 1902).—A brief notice of his useful work amongst florist's flowers, especially in new varieties of *Viola.*—*C. W. D.*

Stylidium gypsophiloides. By S. L. Moore (*Journ. Bot.* 469, pp. 27, 28; 1 1902).—Description of a species, E. Pritzel's No. 116, from the Murray District, West Australia.—*G. S. B.*

Sugar Beet, Influence of Environment on. By Harvey W. Wiley (*U.S.A. Dep. Agr. Bur. Chem., Bull.* 64).—Contains records of careful chemical analysis of the proportion of sugar in sample Beets taken from crops grown at experimental stations in various districts of America. The crops were all produced from a single packet of Austrian Kleinwanzlebener Beet seed imported for the purpose of establishing, as far as possible, what climatic and cultural conditions were most favourable to the production of a Beet containing the highest possible proportion of sugar for commercial purposes.

Each table of analysis contains headings for "Number of Beets examined," "Dates of examination," "Weight," "Sugar by polarisation," "Sugar in Beet," and "Purity," and is accompanied, whenever possible, by a table drawn up at the nearest weather bureau giving the meteorological data of the district.

Further on these facts are all collected in an ingenious series of charts by means of variously produced lines crossing or corresponding with each other.

The experiments have so far only been carried on for one year, and are necessarily to a certain extent incomplete and inconclusive. Even those facts which have been arrived at seem only in some cases to reveal the existence of new problems, but it seems possible to conclude already that—

1. Low temperature and high sugar go together.
2. Short days and low sugar go together.
3. Altitude as it affects temperature has an evident effect upon the production of sugar in the Beet, as has also
4. Rainfall, though in this case it is not greater or less amount which is important so much as its even distribution during the season of actual growth, and its reduction during the period of ripening.—*M. L. H.*

Sugar Beets, Influence of Manure upon. By W. H. Jordan and G. W. Churchill (*New York Agr. Bull.* No. 205, December 1901).—The experiments, extending over four years, were undertaken to test the accuracy of the statement that Sugar Beets are of inferior quality when grown on land heavily manured in spring with stable dung.

Comparisons were made of the quality of several varieties of Sugar Beets grown with no manure, 1,000 lb. artificials, and 40,000 lb. to 80,000 lb. stable dung per acre respectively.

All three methods gave Beets of high quality, those on the stable dung plots being slightly better than those manured with 1,000 lb. of commercial fertiliser per acre.—*J. P.*

Sugar Cane (*Jour. Imp. Agr. Dep. W.I.* vol. iii. pp. 29–73).—Very valuable papers are given on experiments with seedling and other Canes, and also on the differing effects of different manures on different varieties of Canes. Those interested in the growth of Sugar Cane will find much practical assistance. Pages 73 to 85 contain a very valuable essay by Mr. Howard on fungoid diseases which attack Cane cuttings. He finds that the non-germination of the cuttings is almost invariably caused by an attack of *Thielaviopsis ethaceticus*, a fungus which generally commences at the cut end of the cuttings, and often destroys them while in transit. He recommends the immediate destruction of all rotten Canes by burning and immersing the cuttings immediately they are made in Bordeaux mixture for six to twelve hours, and then when they are dry tarring the ends with a mixture of half a pint of either methylated spirit or kerosene to a gallon of tar.—*W. W.*

Syringa oblata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7806). Nat. ord. *Oleaceæ*, tribe *Syringeæ*.—Native of North China. It is closely allied to *S. vulgaris*, and is perhaps only a geographical variety. It flowers, however, twelve days later, and the leaves turn a dark russet-red colour in autumn. It was introduced into Europe by Fortune. It flowered at Kew in 1901.—*G. H.*

Tamarisks, The. By W. Goldring (*Garden*, No. 1588, p. 272; 26/4/1902).—As an inland plant the Tamarisk is not commonly planted, owing probably to the wrong impression that seaside plants will not flourish away from the sea. This article disproves such a fallacy and gives cultural directions. The various species and varieties are described.
E. T. C.

Tea, Commerce and Adulteration of (*Bull. R. Soc. Tosc. Ort.* p. 94; March 1902).—Chief reason why trade with China is decreasing is that the cultivators in the English and Dutch colonies supply better goods and at more suitable prices, and send the Tea direct from the ports of origin to the European retailers without it having to pass through the hands of dealers, who are largely concerned, as is the case in the various Chinese ports, in the adulteration of the product. In China the adulteration consists in impregnating the boiled Tea (*i.e.* Tea deprived of its aromatic and extractive principles) with starch glue mixed with catechu earth (an extract from a Chinese Acacia) and in sprinkling the leaf thus impregnated with dust and fragments of Tea.—*W. C. W.*

Textile Plant, A new (*Apocynum venetum*) (*Rev. Hort.* p. 7 January 1, 1902).—Native of Siberia (south), Turkestan, Asia Minor, Northern India, Indo-China, Manchuria, and Japan. Described as furnishing a very strong fibre from its stems, easily extracted, stronger than flax, long, flexible, white, and silky. Used for cloth, cordage, and suggested for banknote paper.—*C. T. D.*

Thuyopsis Novelties. By C. Ansorge (*Die Gart.* p. 356; 26/4/1902). Seeds gathered fourteen years ago from plants of *Thuyopsis dolabrata* have been the means of raising a number of fine specimens;

four of them are not alone quite different from the parent plants, but differ also among themselves so as to be like four different forms, with marked vigour of stem. The raiser (Mr. Ansorge) believes the variation is entirely due to climatic influences. These seedlings have never suffered from the effects of the severe German winter, though the ordinary plants are often killed during very cold winters.—*G. R.*

Tibet or High Asia, The Flora of: being a Consolidated account of the various Tibetan botanical collections in the herbarium of the Royal Gardens, Kew, with an Exposition of what is known of the flora of Tibet. By W. Botting-Hemsley, assisted by H. H. W. Pearson (*Jour. Linn. Soc.* vol. xxxv. pp. 124–265, with a map).—In this interesting paper an exhaustive résumé is given of our present knowledge of the flora of this part of Asia. A history is given of the journeys of the various travellers who visited this district, and gave any information concerning the plants growing there. The boundaries and physical characteristics of Tibet are then described, and the climate is dwelt on at some length, though it is admitted that the data are very incomplete. Short itineraries of the various travellers are then given, with notes on the flora and fauna. These are followed by a classified list of all the plants in the joint collections, with their localities and the works in which they are described. Considering the size of the area (about 20 degs. of longitude by 10 degs. of latitude) from which the plants were obtained, the number contained in the combined collections is very small, only 283 species being enumerated: these belong to 119 genera and 41 natural orders. The *Cruciferæ*, *Compositæ*, and *Gramineæ* are far more largely represented than any other order, for they contain 42 genera, which are very evenly divided between them, and 109 species, of which 53 belong to the *Compositæ*. It is curious that only one fern and no plant belonging to the *Orchidaceæ* should have been found. The flora, owing to the altitude of the district and its dry ungenial climate, is a very peculiar one: there are very few annual plants, and it is mentioned that "a very large proportion of the species are perennial herbaceous plants, having long, often very long, thick tap roots, almost no stem, which may be either unbranched bearing a single or compound inflorescence, or very shortly branched, bearing several inflorescences, a rosette of leaves when unbranched, commonly lying flat on the ground, and an almost sessile inflorescence nestling in the centre of the rosette of leaves." When the stems are branched the leaves are usually very small and numerous. It appears that the tallest plant met with in these regions is *Clematis orientalis*, which grows to the height of one foot. Some very interesting tables are given comparing the Tibetan and Himalayan floras together. The paper concludes with a very complete bibliography and index.

G. S. S.

Tigridias: Their Culture. By G. B. Mallett (*Garden*, No. 1582, p. 174; 15/3/1902).—There are about eight distinct Tigridias, which, although much alike in form and habit, differ in size and colouring. These Tigridias are fully described in this article, and their cultural requirements are given.—*E. T. C.*

Tillandsias. By E. Jahn (*Die Gart.* p. 291; 22/3/1902; with illustrations).—An interesting article on Epiphytic Tillandsias, being compared to the northern Lichens, preparing the ground for other plants, mostly Orchids, by deposits of humus. In Europe they are cultivated in hothouses, excepting the North American *Tillandsia usneoides*, which is quite hardy here.—*G. R.*

Tomatos, Forcing Dwarf, under Glass. By F. Wm. Rane (*U.S.A. Exp. Stn. New Hampshire*; 1901).—A variety called 'Dwarf Champion' averaged twenty-eight fruits per plant, average weight of fruit per plant $5\frac{1}{2}$ lb., average weight of individual fruits 3 oz. For dwarf Tomatos trained with one stem the best distance seems to be 18 inches each way. Night temperature not less than 60°, with 70° or more during the day.—*C. H. H.*

Tomato Blight. By N. A. Cobb (*Agr. Gaz. N.S.W.* p. 410, April 1902).—Two additional blights of the Tomato have recently been called into notice in this State. One of these, the *Septoria* leaf-blight, is of a serious nature, and it had been hoped that it would have been kept out by the Vegetation Diseases Act. It is not possible to decide how it had been introduced. Attention was first called to its existence in New South Wales during the summer of 1901. To the second disease the name Tomato rosette has been applied provisionally. The Tomato leaf-blight (*Septoria*) has been studied, and found to be comparatively simple in its history and amenable to treatment with fungicides. When the fungus causing the disease occurs on the stalks the spores are not so large as when borne on the leaves, so that it may be assumed that the fungus is less at home on the stalks than on the leaves. Various remedies for the treatment of the disease are given. The rosette of the Tomato disease is of widespread occurrence. It seems only too probable that it may be found wherever Tomatos are grown regularly in any considerable quantity. The losses due to the disease are usually confined to the few isolated cases to be found in most gardens at one time or another, and it is worthy of notice that this disease is much worse in some seasons than in others. The disease is exceedingly easy to describe and recognise. It is characterised above all by the appearance, particularly in the middle of the season, of rosettes of small deformed leaves at the end of the various branches of the half-grown vine. A vine that up to the middle of the season has appeared at any rate to be fairly healthy begins to lose its normal properly shaped leaves, and to produce, more particularly at the ends of the branches, dense tufts of small and deformed leaves, among which may be seen here and there a tiny and also deformed fruit. After the foregoing description of the leading characteristics of the disease it is needless to describe the minor ones, for the reason that up to the present there is no other malady of the Tomato with which the rosette can be confused. There seems to be little or no danger from infection, there being no decisive evidence that the disease spreads from plant to plant. As the cause of the disease still remains in obscurity, no precautions can be recommended that are based on a satisfactory knowledge of the disease. This much can be said, that such plants never produce satisfactory fruit, and they should therefore be pulled up and destroyed as soon as recognised.—*H. G. C.*

Tradescantia Laramiensis, n. sp. By L. N. Goodding (*Bot. Gaz.* xxxiii. No. 1, p. 68).—This is related to *T. scopulorum*, the flowers being lighter in colour. It is pubescent.—*G. H.*

Trees, Scientific Methods of Transplanting (*Gard. Mag.* No. 2523, p. 149; 8/3/1902).—An extract from the *Scientific American*, in which common-sense methods of tree moving are explained. Though differing somewhat in detail, the methods advised agree with those that have been followed in this country for generations. The article is, however, worth reading by all interested in the subject.—*W. G.*

Trees, New, of N. America. By C. S. Sargent (*Bot. Gaz.* xxxiii., No. 2, p. 108 seqq.).—The following are described: *Prunus tarda, Cratægus Bushii, C. edita, C. fecunda, C. Georgiana, C. sordida, C. sera, C. corusca, C. Ellwangeriana, C. gemmosa, C. blanda, C. Ravenelii, C. lacera*, and *C. floridana*.—*G. H.*

Trees, New, of N. America. By W. W. Ashe (*Bot. Gaz.* xxxiii. No. 3, p. 230).—The following are described: *Fraxinus catawbiensis, Tilia eburnea, Cratægus cibilis, C. altrix, C. obtecta*.—*G. H.*

Trees, Determination of Age of. By Raymond Roger (*Rev. Hort.* pp. 21–24; 3 woodcuts; January 1, 1902; and pp. 72–74; 2 figs.; February 1, 1902).—Two interesting articles dealing with the ring formation, the reason of its marked character, seasonal effects upon it, and accidental disturbances.—*C. T. D.*

Trevoria Chloris. By Sir J. D. Hooker (*Bot. Mag.* tab. 7805). Nat. ord. *Orchideæ*, tribe *Vandeæ*.—Native of the Andes of Colombia. The spike is pendulous, few-flowered; the sepals are broadly ovate, green; the petals very narrow, pale yellow; the whole flower being 2 inches across.—*G. H.*

Trichopilia crispa marginata, Warner (Cogniaux in *Dict. Icon. Orch.* Trichopilia; pl. 2; 2/1902).—A large-flowered variety with a large irregular white border round the sepals and petals and a fine regular white margin round the lip. First appeared in 1862.—*C. C. H.*

Trimming and Pruning Trees and Shrubs. By J. V. N. Standish (*U.S.A. Hort. Soc. Illinois*, 1901; pp. 277–280).—In this short paper the author shows the necessity of knowledge, skill, and judgment in pruning. The pruner should know something of vegetable physiology and the habits and growth of trees. Many trees may be killed by injudicious pruning. The author proceeds to give some valuable hints, *e.g.* limbs must be cut off *close* to the body; prune trees in June and *at no other month*: cover the wound, if large, with coal tar or paint. The paper certainly well repays perusal.—*V. J. M.*

Tristania Brownii. By S. L. Moore (*Journ. Bot.* 469, pp. 25, 26; 1/1902).—Description of a species collected by Banks and Solander at Possession Island, North Australia, and by Robert Brown at Prince of Wales Island.—*G. S. B.*

Tropæolum tricolorum. By C. Rimann (*Die Gart.* p. 364; 3/5/1902; with illustration).—This beautiful old greenhouse climber is here warmly recommended.—*G. R.*

Tuberoses. By B. D. (*Journ. Hort.* p. 84; Jan. 23, 1902).—These flower only once, and where hothouses are not available they should be planted early in April, and never deluged with water, or they will not flower.—*C. W. D.*

Tulip Bulbs attacked by the Fungus Botrytis parasitica. William Carruthers (*Jour. R.A.S.* vol. lxii. p. 247; 1901).—This fungus forms grey velvety patches, consisting of upright brown branching filaments with heads of whitish spores. "The diseased bulbs should be burned. . . . A correspondent in Hertfordshire wrote that he had cured bulbs attacked by a similar fungus by immersing them for some weeks in a powdered mixture of French chalk and copper sulphate called 'sulphosite.' The cure seems to have been as effectual as it was simple."
R. N.

Tupistra grandis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7829).—Nat. ord. *Liliaceæ*, tribe *Aspidistreæ*. Native of the Malayan Peninsula. The inflorescence is a dull spike; the flowers purple, with a white style bearing a peltate-formed stigma, with a furrowed surface and crenulate margin. It flowered at Kew in 1899.—*G. H.*

Vaccinium, Horticultural Status of the Genus. By W. M. Munson (*U.S.A. Exp. Stn. Maine, Report for* 1901, pp. 113–160).—The genus includes about 125 species of wide geographical distribution. North America proper about twenty-five species; Mexico and Central America as many more. The Himalayan region is particularly rich in species, but, with few exceptions, the genus is unrepresented in the southern hemisphere and in the lower regions of the tropics.

In America the fruit must have been used extensively by the Indians in colonial times, though there are but few records of such use. Until very recently no attempt has been made at improvement by cultivation.

The most widely distributed species is *V. Myrtillus*, and the berries are of considerable importance for food in Germany, Siberia, and with the Indians of the Rocky Mountains. *V. uliginosum* is the next most widely distributed species, and has large juicy black fruits, which are eatable but not agreeable in flavour as ordinarily found. Of *V. Vitis-Idæa* the berries are made into preserve, and form an important article of commerce in the seaports bordering the Gulf of Bothnia, whence they are sent to the South of Europe along with Cranberries. The berries of *V. ovalifolium* are used largely by the natives of the North-West. Of all the American species used for food the most important are, perhaps, *V. corymbosum, pennsylvanicum, canadense,* and *vacillans.* The first of these is the "High Bush Blueberry" or "Huckleberry" of the middle West. The shrub grows rapidly, is easily transplanted, and is the natural starting point in attempts to add the "Blueberry" to the list of cultivated fruits. During the last few years it has received considerable attention as a garden fruit, especially in New England.

Among the plants which lend tone to the landscape in October and November by reason of their bright foliage many of the species of *Vaccinium* may be included, the brilliant red crimson and orange colours often persisting much longer than the bright-hued leaves of a majority of other plants. Of the ornamental species none are more strikingly beautiful late in the autumn than *V. corymbosum*: the bright scarlet and crimson effects, rivalling the Sumach in brilliancy, are unsurpassed. As an ornamental plant the species deserves a place in every garden. Other species are also named, with notes as to their appearance, habits, and value as ornamental plants.

The following are recommended for ornamental planting :—*V. corymbosum*, beautiful in flower ; fruit attractive ; bright scarlet and crimson effects in autumn, rivalling the Sumach. *V. pennsylvanicum* and *V. canadense*, bright, but early dropping its foliage. *V. stamineum*, early deciduous, but attractive in bloom, and all summer, by its graceful habit ; thriving in any good garden soil, and suited for densely shaded situations. *V. hirsutum*, like *corymbosum* in brilliancy. *V. Vitis-Idæa* and *uliginosum*, effective as edging for shrubbery border, while Douglas characterises *V. ovatum* as one of California's most beautiful hedge plants.

Information is then given as to propagation and cultivation, in some cases by cuttings and in others by seedlings. The progress of cultivation since 1868 indicated that the work has been taken up systematically, and is still in progress.

The extent to which the Blueberry industry has already attained is notified by the fact that one person in 1887 states that he ships an average of 1,000 bushels a year from his farm in New Hampshire. He estimates that as many as 20,000 bushels are sent annually along one branch of the Boston and Maine Railroad.

In S.-E. Maine there are about 150,000 acres known as the "Blueberry Barrens." About 40,000 acres of these barrens belong to Mr. William Freeman, of Cherryfield, who may be regarded as the pioneer in the Blueberry industry of America. Then follow the details of Mr. Freeman's methods of harvesting and marketing the fruit, and also of packing and canning, as adopted in Maine. There were in 1900 seven factories in Maine which engaged in canning Blueberries. The total canned product of the Blueberry barrens in 1899 was about 50,000 cases, valued at about $2.20 per case.

In Michigan large quantities of fruit are shipped every year.

The paper concludes with scientific botanical descriptions of all the most important species, in many cases with figures illustrating the habit of the species, and a copious catalogue of the monographs and current literature on the subject.—*M. C. C.*

Vegetables for Exhibition. By E. Beckett (*Garden*, Nos. 1580–

1586).—A practical and useful article which deals at length with the culture of vegetables. All those most generally cultivated are treated, and sound information is given with reference to each. The best methods of preparing vegetables for exhibition are also given.—*E. T. C.*

Verbenas from Seed. By W. S. (*Journ. Hort.* p. 192; Feb. 27, 1902).—This mode of cultivation is recommended as far less troublesome than that by cuttings. The variety of colour obtained is greater, and the colours mostly blend well.—*C. W. D.*

Viburnum Opulus roseum. By Carl Räde (*Die Gart.* p. 159; 4/1/1902; with illustration).—Well recommended for heavy dry soil, but flowering much freer in rich and light soil.—*G. R.*

Villa and Front Gardens. By C. Hinze (*Die Gart.* p. 349; 26/4, 1902; with several artistical illustrations).—The author, who evidently is well versed in the art of landscape gardening, gives some useful hints how even the smallest front garden can be properly laid out and planted in an artistic and natural way, and in addition enumerates a number of plants adapted for planting in sunny and shady positions in towns and suburbs of towns.—*G. R.*

Vine Erinose. By F. T. Bioletti and E. H. Twight (*U.S.A. Exp. Stn., California, Bull.* 136; 11/1901; 4 figs.).—Erinose in Vines is due to the attacks of a mite (*Phytoptus vitis*) on the leaves, which it punctures and so injures, causing damage especially to young Vines. The disease is characterised by swellings on the upper surface of the leaves and corresponding depressions on the lower surface. These depressions become coated with a thick felt-like growth, at first white, then rusty, and finally dark brown. This felt-like growth consists of abnormal outgrowths of the epidermal cells of the leaf, and was at one time thought to be a fungus, and described under the name of *Erineum*. The four-legged larvæ (which later acquire six and finally eight legs) pass the winter under the rough bark of the Vine or among the bud scales. Sulphuring is recommended as a remedy.—*F. J. C.*

Viticulture: The Propagation and Cultivation of the Vine in South Africa. By J. P. de Waal (*Agr. Jour. Cape G.H.* vol. xix. No. 13, pp. 837–850; vol. xx. No. 1, pp. 42–53).—The author deals with his subject under the following heads:—Varieties of American vines recommended for cultivation: their propagation, pruning, handling and treatment of cuttings; sale and transport; establishment of vineyards with grafted American stocks; and the nursery grafting of American stocks; the selection and preservation of scions for grafting; the pruning and training of the vine; pruning and cultivation of vineyards; manuring; irrigation; drainage, &c.—*R. N.*

Vitis (?) Voinieriana. By Ch. Baltet (*Rev. Hort. Belge,* xxviii. No. 1, p. 3).—This is remarkable for its superb quinquefoliate leaves, each leaflet being 8 by 4½ in. It is a native of Tonkin, where it covers "The Pagoda of Birds."—*G. H.*

Viscum cruciatum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7828.—Nat. ord. *Loranthaceæ*, tribe *Visceæ*. Native of Spain, N.-E. Africa, and Syria. It is parasitic on Olive-trees, *Cratægus*, *Populus alba*, and *Pinus Pinaster*. The fruit is of a dull red colour.—*G. H.*

Wall Gardening at Gunnersbury. By J. Hudson (*Garden*, No. 1580, p. 140; 1/3/1902).—A most interesting account of how a wall which was quite bare in March was covered with flowering and foliage plants by September of the same year. A list of the principal plants made use of is also given, together with illustrations of the wall in the above-mentioned months.—*E. T. C.*

Warm Water for Watering Plants. By Jules Burvenich (*Rev. Hort. Belge*, xxviii. No. 1, p. 17).—He recommends using water of a temperature 50°–55° C. (120°–130° F.) as being very useful when the plants raised in pots are enfeebled by some injurious matter in the soil, produced by the presence of organic acids, such as ulmic and humic. Under the influence of these acids rootlets turn brown, lose their activity, the leaves become yellow, &c. After repotting the pots should be plunged into the warm water for several weeks. This is followed by excellent results. A complete re-establishment of the plant will be secured.—*G. H.*

Water-lilies from Seed. By Geo. Moulder (*Journ. Hort.* p. 356; April 24, 1902).—It is perhaps not generally known that the hardy Water-lilies of various colours are easy to grow from seed out of doors, and flower the first year. The tender kinds are mostly as easy, but require warmth to germinate; these, too, flower in a year. Full directions are here given for planting the seed and rearing the plants. Fresh seed is essential to success.—*C. W. D.*

Water-melons. By F. W. Rane (*U.S.A. Exp. Stn., New Hampshire, Bull.* 86; Nov. 1901; 14 figs.).—This pamphlet recommends more extensive culture of the Water-melon outdoors in New Hampshire (lat. 44° N.). It attributes want of success in growing the crop to improper culture, and states that the best kind of soil is a rich warm sandy loam, well supplied with humus. A southern slope is best. The result of a variety test with 51 varieties is given, together with a classification of the varieties, based on the colour and shape of the fruit. It is stated that "a Melon weighing between twelve and twenty-five pounds and containing black seeds is generally preferred." The Cucumber beetle seems to be the worst pest Melon growers have to fear.—*F. J. C.*

Wheat Culture, Experiments in. By Luther Foster and W. H. Fairfield (*U.S.A Exp. Stn. Wyoming, Bull.* 48, May 1901).—This bulletin gives the results of various experiments in Wheat culture, which, begun in 1891, are still continuing.

These experiments included:—

Variety tests.

Inter-tillage *versus* field culture, showing so far that the beneficial results of the former do not compensate for the increased expense.

Quantity of seed per acre.

Subsoiling *versus* ploughing, showing subsoiling to be distinctly beneficial, and lasting in its effects.

Wheat after Alfalfa, produced eight to ten dollars more an acre than when following Potatos and Grain.

Profits of Wheat growing, giving as an average profit for the State of Wyoming for three years ten dollars per acre.

Treatment for smut, giving three methods, viz.—

(1) Corrosive sublimate : dangerous.

(2) Copper sulphate : cheap, simple, and effective.

(3) Formalin, 1 lb. to 50 or 60 gallons of water : effective.

C. H. C.

Wistarias. By W. Goldring (*Gard. Mag.* No. 2516, p. 36; 18/1/1902).—The writer gives a full descriptive account of the species and the history of their introduction, the varieties of each, noting the finest for general culture and the various ways of using them in the garden. The soils most suitable for Wistarias and methods of propagation are mentioned, and excellent illustrations are given of the Chinese Wistaria as a house or wall climber.—*W. G.*

JOURNAL

OF THE

Royal Horticultural Society.

Vol. XXVII. 1902.

Part II.

PESTS OF THE FLOWER GARDEN.

By M. C. Cooke, M.A., LL.D., V.M.H., A.L.S., F.R.H.S.

[Part II. with three coloured plates.]

Evening Primrose Leaf-spot.

Septoria Œnotheræ (West.), Pl. III. fig. 55.

The living leaves of the Evening Primrose are subject to the attacks of this parasitic fungus, not only in most parts of Europe, but also in North America.

The spots are rather small, rounded, at first pale greenish, then more or less brown or bleached, margined by a vinous red band. They occur chiefly on the upper surface, to the number of from six to ten, whilst a quantity of dot-like receptacles are to be seen collected towards the centre of the spots.

The sporules are long and thread-like, mostly curved, and contain a row of little nuclei ($35–40 \times 1\frac{1}{2}\, \mu$), and the spots are traversed by the mycelium.

It is generally thought that in these leaf-spot diseases spraying with Bordeaux mixture may be of service. At any rate the spread of the disease may be checked by persistently destroying diseased leaves.

Sacc. Syll. iii. 2782; *Grevillea*, xiv. 101.

Although the above is the only parasite upon *Œnothera* which has yet appeared in this country, there are other species known, especially in North America, such as *Æcidium Peckii*, and *Æcidium Œnotheræ*, *Puccinia Œnotheræ*, and *Pucciniastrum Œnotheræ*, *Uromyces Œnotheræ* and *Uromyces plumbarius*, in addition to a rot-mould, or *Peronospora*. As these have not crossed the Atlantic, a favourite cottage flower flourishes with us comparatively unharmed.

Fuchsia Diseases.

Although the Fuchsia is largely grown in this country, its enemies are very few, and, so far as we are aware, none of a fungus origin have as yet been found, although a leaf-spot is known in France.

Houseleek Rust.

Endophyllum Sempervivi (A. & S.)

This peculiar parasite is somewhat intermediate in its character

Fig. 97.—*Endophyllum Sempervivi*, attacking *Sempervivum monticolum*. A, Entire plant; B, C, Leaves. (*Gardeners' Chronicle.*)

between a uredo and a cluster-cup. The envelope which encloses the spores is immersed in the substance of the succulent leaves, and bursts irregularly to discharge the spores.

The teleutospores, as they are termed, are for the greater part rounded or obovate ($25–35 \times 20–32\ \mu$), with the surface warted and of a brownish-yellow colour. They germinate after the manner of those of *Puccinia*.

The species is known over the greater part of Northern Europe.

Sacc. Syll. vii. 2675; *Gard. Chron.* May 22, 1880, p. 660, with fig.; *Cooke M.F.* 200; *Cooke Hdbk.* No. 1636; *Plowr. Br. Ured.* 229.

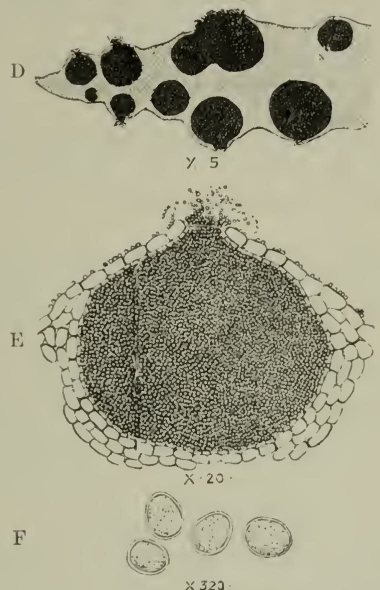

FIG. 98.—*Endophyllum Sempervivi*, D, Section through affected leaf, magn.; E, Section through pustule, magn.; F, Spores, magn.

HONEYSUCKLE LEAF-SPOT.

Phyllosticta Loniceræ (West), Pl. III. fig. 56.

The Honeysuckle may claim to be a garden flower, and is certainly a favourite in cottage gardens. The leaf-spots are rounded and pallid, with a brown margin, and the perithecia are quite small, appearing like very minute dots upon the spots.

The sporules are rather large for the genus to which they belong, and are narrowly elliptical, with two nuclei ($10–14 \times 2\frac{1}{2}–3\frac{1}{2}\ \mu$), and colourless.

The spot is known also in France, Belgium, Germany, Austria, Italy, Portugal, and the United States of North America.

Sacc. Syll. iii. 90; *Cooke Hdbk.* No. 1353.

A similar leaf-spot with large brownish spots, and very minute sporules, *P. nitidula*, is found in Algeria, whilst another species with greyish spots, *P. Caprifolii*, occurs in Italy, France, and Siberia.

Species with two-celled sporules are known, one in France and one in Italy, as well as another in Belgium.

Two species with thread-like sporules are also known, the one in Switzerland and the other in Portugal.

Honeysuckle Cluster-cups.

Æcidium Periclymeni (Schum.).

Although the cluster-cups are usually found upon uncultivated plants, it is not an uncommon British parasite, and is one of those species to which no *Uredo* or *Puccinia* has been affiliated.

The spots on the leaves are roundish, or oblong, and yellowish, whilst the cups are clustered together on the spots. The cups are somewhat cylindrical, with a fringed white margin. The æcidiospores are roundish, sometimes angular by compression (16–28 μ diam.), delicately warted, and orange in colour.

The species is recorded also in France, Belgium, Germany, Switzerland, Italy, and Siberia.

Sacc. Syll. vii. 2809 ; *Cooke M.F.* 196 ; *Plowr. Br. Ured.* 264.

Another species (*Æ. lonicerinum*) is reported to be found upon the living leaves of a species of Honeysuckle in Asiatic Siberia.

Honeysuckle Black Blotch.

Lasiobotrys Loniceræ (Kunze), Pl. III. fig 57.

This is a peculiar parasite which has been known in this country for many years on living Honeysuckle leaves, although not likely to give much trouble in gardens. The leaves are spotted with several roundish black shining blotches (2–5 m. diam.)

An external stromatic cup, which ruptures irregularly, encloses a number of black receptacles or perithecia (50 μ diam.) densely clustered together. Each of these perithecia contains a number of club-shaped asci, or membranous sacs, which include the sporidia, eight of which are enclosed in each ascus. These sporidia are shortly fusiform and colourless ($8–10 \times 4–5$ μ), which are set free by the irregular splitting of the perithecia.

The pustules are sometimes quite round, black, shining, and convex, so that they appear to be superficial, like little spots of pitch on the leaves.

It is recorded for France, Belgium, Germany, Italy, Algeria, and Siberia.

It is so rare on Honeysuckle in gardens that the effect of fungicides has not been determined, but they are scarcely to be relied on for so deeply seated an endophyte.

Sacc. Syll. i. 121 ; *Cooke Hdbk.* 1909.

Although the powdery mildew (*Microsphæria Ehrenbergii*) has been found on Honeysuckle leaves on the Continent, we have no record of it in Britain.

PESTS OF COMPOSITE PLANTS.

It seems rather remarkable that so large an order of plants as the *Compositæ*, containing many garden flowers, should be so conspicuously free from the atttacks of fungoid parasites. Who shall explain wherefore

Puccinia Helianthi (Schum.), which is so universal in North America on Sunflower and Jerusalem Artichoke, has never made its appearance in this country, although it has been reported in Europe. Why are Dahlias so impervious to attack, and a host of smaller annuals, Asters, *Coreopsis*, Marguerites, and the plebeian Marigold, go almost free? Even the cultivated *Cineraria*, which is popular enough in all conscience, has never received a check in this country, although it has been threatened abroad.

Chrysanthemum Leaf-spot.

It will be well to be guarded against the occurrence of leaf-spot on Chrysanthemums, as some three or four exotic species are already known.

The purple spot (*Phyllosticta Chrysanthemi*), with small simple sporules ($4–5 \times 2\frac{1}{2}–3\ \mu$), has, up to the present, only been found in Canada.

The ringed brown spot (*Septoria Chrysanthemi*), with long thread-like sporules ($55–65\ \mu$ long), has apparently been confined to Italy. This is the most essential to be watched of all, since it is European.

The black spot (*Cylindrosporium Chrysanthemi*) is very destructive in Canada, and has large, sooty, indefinite spots, with fusoid conidia ($50–100 \times 3–4\frac{1}{2}\ \mu$). When the leaves are attacked they soon turn yellow and shrivel, and the flower buds do not expand.

Mass. Pl. Dis. 292.

Chrysanthemum Oidium.

Oidium Chrysanthemi (Rabh.), Pl. III. fig. 58.

This effused white mould is found on the leaves of Chrysanthemum, but fortunately it has not hitherto been sufficiently common to cause alarm.

The thin white mealy patches are without definite form, and consist of a creeping mycelium from which the fertile threads arise. These are at first just like simple threads, with cross divisions, separating them into joints; but at length the upper joint enlarges and becomes elliptical, and when mature falls away as a conidium or sporule, capable of germination, to be followed by the next joint and the next, and so on in succession until a large number of conidia are produced and thrown off, as in other species of *Oidium*. The conidia are rather large ($40–50 \times 20–25\ \mu$) as compared with other species.

It may be assumed that such remedies as are successful with *Oidium Tuckeri* on the vine would be applicable here, and of these the application of sulphur is most to be commended.

The above-named mould appeared in this country for the first time in 1884, and is known also in France and Germany.

Sacc. Syll. iv. 199; *Gard. Chron.* Nov. 29, 1884, fig. 118; *Ib.* 1901, p. 351.

Chrysanthemum Rust.

Uredo Chrysanthemi (Arth.), Pl. III. fig. 59.

When this rust was first observed on the leaves of Chrysanthemum in 1897 it was believed that it would be discovered to be the Uredo form of *Puccinia Hieracii*, and hence was called *Uredo Hieracii*; but it has since been shown that it must be regarded as a distinct species, for which no teleutospores have yet been found.

The pustules of the *Uredo* occur on the under side of the leaves, which soon split irregularly and discharge the powdery snuff-coloured spores, and these readily disperse themselves over the surface of the leaf. The uredospores are somewhat elliptical, with a rough surface ($17–32 \times 16–36\ \mu$), and irregular in size.

This pest at one time threatened to spread over France and this country, and produce havoc amongst Chrysanthemums, but has since been brought under control.

Spraying with potassium sulphide solution is recommended, especially upon apparently clean leaves, while rusted leaves should be carefully removed. Paraffin has also been recommended in dilution.

It should be remembered that uncultivated composite plants are, of all others, most susceptible to the attacks of rust and brand, and it is in that direction that danger lies.

Gard. Chron. Oct. 8, 1898, with figs.; *Mass. Pl. Dis.* 241; *Journ. R.H.S.* xxvi. 1902, p. 915.

Great trouble in the United States in growing Asters on account of fungoid disease. (*Journ. R.H.S.* xxvi. 1901, p. 531.)

Corn Flower Rust.

Puccinia Centaureæ (DC.), Pl. III. fig. 60.

During the past year or two Corn flowers in cultivation have been seriously attacked by this rust, which has long been known on uncultivated species of *Centaurea.*

We have nothing to do with the *Æcidium* here until it is proved to be distinctly related to the rust on *Cyanea.* The *Uredo* appears on the stem and leaves in elliptical pustules, which are longer on the stems, soon fissured, and exposing the snuff-coloured uredospores which are almost globose (22 μ diam.), and we could detect no roughness on the surface. The colour was pale brown under the microscope, and certainly not, as some have stated, chestnut brown.

It is the custom in these latter days to lump together a number of the species of rust found on composite plants under the name of *Puccinia Hieracii,* and this among the number. For the present we prefer to call it *Puccinia Centaureæ.*

We can only suggest the spraying of healthy plants, or those but slightly affected, with the potassium sulphide solution and burning badly diseased plants out of the way.

Sacc. Syll. vii. 2210; *Plowr. Br. Ured.* 186; *Cooke M.F.* 63, 207; *Journ. R.H.S.* xxvi. 1901, p. cxxv.

Senecio Rust.

Coleosporium Senecionis (Pers.), Pl. III. fig. 61.

A common bright orange rust is to be found every season on the under side of the leaves of the Common Groundsel and other indigenous species of *Senecio*. Occasionally the same species makes its appearance in gardens on the leaves of cultivated species of the same genus, such as *Senecio pulcher* and *S. sarracenicus*.

Theorists tell us that the æcidiospores of this pest are produced on the leaves and twigs of certain conifers, which, not being garden flowers, may here be excluded. Even the believers are a little sceptical, for Plowright says: "I have had so many failures in infecting *Senecio vulgaris* with the æcidiospores from Fir trees that I think there must be more than one species."

The pustules of the *Uredo* are reddish yellow, soon becoming paler and powdery. Uredospores shortly catenulate, or growing in chains, then separating, elliptical, ovoid (20–40 × 14–26 μ), warted, orange. Afterwards teleutospores are said to be produced in other darker-coloured pustules. Teleutospores cylindrical (110 μ long), for the most part divided transversely into four cells of an orange-red colour.

We can suggest no remedy, except prevention, by keeping all wild species of Ragwort at a distance and destroying infected plants, as the garden forms are not apparently so susceptible to the disease.

Universally diffused through Europe.

Sacc. Syll. vii. 2633; *Mass. Pl. Dis.* 261; *Cooke M.F.* 97, 218, fig. 145, 146; *Tubeuf. Dis.* 374, fig.; *Plowr. Br. Ured.* 240.

Recently *Æcidium Cinerariæ* has been detected in Austria on leaves of *Cineraria*.

Ptarmica Dot.

Schizothyrium Ptarmicæ (Desm.)

Plants of *Achillea Ptarmica* are to be met with in old-fashioned gardens, and the green leaves are liable to the attack of a special fungus.

The leaves and stems are at first dotted over with the small black points of *Leptothyrium Ptarmicæ*. These minute black receptacles contain a number of oblong sporules, with an apparent central division (10 × 6–7 μ). This is regarded as an early and imperfect condition of a more highly developed parasite, which resembles it in size and appearance, and often grows in company with it.

This latter, or *Schizothyrium*, came over from France with imported plants many years ago. To the naked eye they look like fly spots, causing no discoloration of the foliage. The receptacles are flattened and open on the upper surface, enclosing minute ovoid sporidia (10 μ long), enclosed in asci, closely packed side by side in the interior. It has evidently a perennial mycelium, since the dots or receptacles will continue to appear on the same plant year after year for many years. The plants are stunted, but not much disfigured by the parasite.

The disease is known in France, Belgium, Germany, Finland, and Siberia.

Sacc. Syll. iii. 3379, ii. 5559.

Lobelia Dot.

Phoma devastatrix (B. and Br.), Pl. III. fig. 62.

For the first time, in 1856, the clumps of *Lobelia* in gardens were attacked by a minute parasite, which was so destructive that it secured for itself the specific name of "the destroyer." It is seldom that the fungi of the group to which this pest belongs make any attack upon living plants, being largely restricted to dead stems and dead leaves and twigs.

The dots or receptacles, which, with their mycelium, represent the entire fungus in this instance, are scarcely visible to the naked eye. They consist of a minute globose body, like a pin-point, or a small black dot, containing a number of colourless sporules, which are long and narrow (8–10 μ), rounded at the end and furnished with two or three nuclei. Fortunately in this case it took the form of an epidemic, which gradually passed away, and for many years not an example has been seen.

For a deep-seated disease like this there is no effectual remedy and no protection, except to root up bodily all the plants which are, or are likely to become, infected and burn them.

This disease appeared afterwards also in the United States.

Sacc. Syll. iii. 791 ; *Cooke Hdbk.* No. 1221.

About a dozen other parasites on *Lobelia* are recorded, most of them in North America.

PRIMROSE PARASITES.

The Primrose family seems to be rather susceptible of fungoid diseases, although perhaps their virulence is not upon an equality with their number. The most dangerous, the rot-mould, has never established itself as a pest, and the commonest are the leaf-spots. Most species of *Primula* appear, however, to be liable to attacks from the rusts and smuts.

Primula Leaf-spot.

Phyllosticta primulæcola (Desm.), Pl. IV. fig. 64.

This endophyte is not a very common disease of the leaves of *Primula vera* and *Primula elatior* in France and Belgium, whence it probably extended to Britain. Discolorations sometimes seen on leaves of cultivated Primulas, which do not perfect themselves, may belong to this species.

The spots are white, circular, and rather large on both surfaces, with a tawny margin. Sometimes the spots are naked, but at other times are dotted with the minute blackish receptacles, which are then very numerous, and, especially towards the centre, just visible to the naked eye.

The sporules developed within the receptacles are exceedingly minute, and are extruded in considerable numbers when mature (4–5 × 2–3 μ).

Sacc. Syll. iii. 308 ; *Cooke Hdbk.* No. 1349 ; *Grevillea*, xiv. 74, No. 433.

Scotch Leaf-spot.

Ascochyta Primulæ (Trail), Pl. IV. fig. 65.

This second leaf-spot has occurred in Scotland on *Primula vulgaris*, and is exactly similar in external appearance to the foregoing. The

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sporules, however, are larger ($5–6 \times 2\frac{1}{2}\ \mu$) and divided by a transverse septum into two cells.

Sacc. Syll. x. 5969 ; *Grevillea* xv. 1887, p. 108.

Wild Primrose Leaf-spot.

Septoria Primulæ (Buck), Pl. IV. fig. 66.

We have included also this leaf-spot, which was found on the leaves of uncultivated Primroses near Bristol, and, apparently, has not been recognised elsewhere.

The spots are conspicuous chiefly on the upper surfaces of the leaves, and are somewhat rounded and pallid, with a brown border. The perithecia are dot-like, and are scattered over the spots, which are scarcely to be distinguished from the other two forms of leaf-spot.

The sporules are very different, for in this instance they are long and threadlike ($45–50\ \mu$ long) and apparently nucleate.

It has never been shown that there is any connection between these three genera of leaf-spot fungi, and it is scarcely probable, since any genetic connection would probably be with fungi of a higher order, and, presumably, of the *Sphæriaceæ*.

Grevillea, xiv. 1885, p. 40 ; *Sacc. Syll.* x. 6389.

Primrose Smut.

Urocystis primulicola (Magn.), Pl. IV. fig. 75.

In some of its features this smut bears slight resemblance to the Violet smut, but it differs in that it attacks the fruit, so that all the seed capsules are filled with smut instead of seeds, and unless eradicated will continue to appear year after year. Its first appearance in this country was recorded in the autumn of 1884 upon *Primula farinosa*, although it is said to have been seen as far back as 1867.

The glomerules of spores are roundish or irregular, and are composed of from seven to ten teleutospores, which are normally globose, but become angular by compression, of a dark-brown colour, and smooth ($9–15\ \mu$). The outer circle of sterile and pale-coloured spores is nearly of the same size and shape.

Germination takes place after a similar manner to that of the Violet smut. A short thick process or promycelium is thrust out, and this bears another generation of smaller and secondary spores at its extremity, and these again can produce their like. These secondary spores are engaged in the dissemination of the species.

This is a deep-seated endophyte, not to be dislodged when once it takes possession of a plant. It has been found in Silesia, Saxony, and Italy.

Sacc. Syll. vii. 1899 ; *Gard. Chron.* Aug. 30, 1884, fig. 52 ; *Plowr. Br. Ured.* 289.

Primrose Cluster-cups.

Æcidium Primulæ, DC.

These cluster-cups, on the leaves of *Primula* of various species, might have been included with the rust, only that the habit is so different as to appear like a different disease, and the ordinary observer might well be puzzled. There is no doubt of its being a prelude or an early stage of the rust; but it may appear without the rust, and the rust may be seen quite independently of the cluster cups.

The cups are usually clustered together on the under surface upon discoloured spots, which are also distinctly indicated on the upper surface. The cups are rather urn-shaped, partly immersed, with a white fringed margin. The æcidiospores, at first globose, are soon angular, with a roughened surface and yellow (17–23 × 12–18 μ). Of course, as usual, produced in chains within the cups.

The area of distribution is the same as that of the rust.

Hitherto cluster-cups have not generally been regarded as troublesome garden pests, so that picking off and burning diseased leaves has been considered sufficient to prevent spreading.

Sacc. Syll. vii. 2170; *Cooke M.F.* p. 199; *Cooke Hdbk.* No. 1631; *Plowr. Br. Ured.* p. 159.

Primrose Rust.

Puccinia Primulæ (DC.), Pl. IV. fig. 70.

This is one of the species of rust which passes its three stages of cluster-cups, *Uredo*, and *Puccinia* upon the leaves of the same plant. Doubtless it is more often met with on wild than on cultivated plants, but its existence is not therefore to be ignored.

The pustules of the uredospores are aggregated together in somewhat orbicular spots, soon splitting the cuticle and setting free the powdery uredospores, which are rounded or ovoid (19–22 μ) and minutely rough on the surface, of a pale-brown colour. The pustules are found on the under surface, as well as those of the teleutospores, which latter are scattered or sometimes gregarious, and darker in colour. The teleutospores are somewhat elliptical, with a central division into two cells, the upper of which is rounded at the apex and the lower a little narrowed into the very short stem (22–30 × 15–18 μ), externally smooth, brown, with the outer coat thickened at the apex.

Its distribution is recorded for France, Belgium, Switzerland, Germany, and Finland, as well as Britain.

All the rusts are difficult of treatment, and seldom can be checked to any considerable extent by the use of fungicides. Efforts should be directed rather to check dispersion and extension.

Sacc. Syll. vii. 2170; *Cooke M.F.* 204; *Hdbk.* No. 1471; *Plowr. Br. Ured.* 159.

Primrose Simple Brand.

Uromyces Primulæ (DC.), Pl. IV. fig. 69.

Found on the leaves of *Primula integrifolia* and Auricula, and the theorists have, singularly enough, united this species, as well as *Puccinia Primulæ*, with the Primrose cluster-cups (*Æcidium Primulæ*) as the Æcidiospore form. Hence the one *Æcidium* must be held to be responsible for two species of teleutospores.

In the present endophyte the teleutospores are elliptical or ovoid (20–35 × 10–20 μ) and warted, with a hyaline papilla at the apex and a short deciduous pedicel at the base. The teleutospores differ from those of *Puccinia* in being one-celled. The colour is also brown.

The uredospores are supposed to be unknown, although the pustules of the teleutospores are said to be sometimes intermixed with the cluster-cups. Never having seen them in this connection, we cannot vouch for the authenticity of the assertion.

This endophyte has been recorded, not only in Britain, but also in France, Germany, Austria, Italy, and Asiatic Siberia.

Sacc. Syll. vii. 2007 ; *Cooke M.F.* 227.

Primrose White Mould.

Ovularia interstitialis (Cooke), Pl. VI. fig. 67.

Under the name of *Peronospora interstitialis* this mould was first made known by Berkeley in 1875 from specimens obtained from Scotland, but at the time he seems to have had a suspicion that it was not a true *Peronospora*, since confirmed. It was afterwards quoted as *Ramularia interstitialis* ; but that even is scarcely tenable, and we substitute the above.

It occurs in yellowish patches on the under side of the leaves, in the spaces between the veins, rarely occupying any extended surface. The threads are short and flexuous, apparently unbranched, with a few projecting spicules in the upper portion to support the conidia, which are elliptical and either apical or lateral (which Berkeley calls "oblique"), but there is no evidence of septum ($15–17\frac{1}{2} \times 6–7\,\mu$).

We believe it to be the same species as *Ovularia primulana* (Karst) found in Finland, also on the leaves of *Primula vera* (*Sacc. Syll.* iv. 737).

This is the kind of parasite which is likely to be amenable to the influence of fungicides, and has none of the pertinacity, or the resting spores, of the rot-moulds.

Sacc. Syll. vii. 867 ; *Berk. Ann. Nat. Hist.* 1875, No. 1455 ; *Gard. Chron.* May 1, 1886, fig. 124 ; *Grevillea*, iii. 183.

Primrose White Mould.

Ramularia Primulæ (Thum.), Pl. IV. fig. 68.

The spots in this disease are circular or somewhat angular, and of a pale ochraceous colour, without a definite margin, upon which the mould is seated in tufts on either surface. The threads are rather long ($50–60 \times 5\,\mu$), without septa or divisions, but very rarely at all branched. The conidia are cylindrically fusiform ($20–30 \times 3–6\,\mu$) and sometimes uniseptate, or with one transverse division, and uncoloured. Our own measurements are somewhat different ($25 \times 5\,\mu$).

Would be submissive to spraying with dilute Bordeaux mixture.

This mould has been recorded in Italy, Austria, and Siberia, as well as in Britain.

Sacc. Syll. iv. 1040 ; *Sacc. F. Ital.* t. 985.

A black mould (*Cercospora Primulæ*) seated on whitish-grey spots of the leaves of *Primula elatior* has occurred in France. The tufted threads are short and olive, whilst the conidia are long and narrow (60–100 × 4 μ), attenuated upwards almost to a point, and divided transversely by eight or nine septa.

Primrose Rot-mould.

Peronospora candida (Fckl.), Pl. IV. fig. 70*.

Although of rare occurrence in this country, the above rot-mould has made its appearance on wild plants, without visiting and inflicting damage on cultivated species, except on rare occasions.

White mouldy spots appear on the under side of living leaves, which are conspicuous by their snowy whiteness, although not very dense. Slender erect threads arise from the creeping innate mycelium which are many times branched in the upper portion in a forked manner. The final branches are short and spreading, acute at the tips, and bearing singly the elliptical conidia, which are comparatively small (22–26 × 16–30 μ) and hyaline.

Within the substance of the petioles and stem the mycelium produces the usual resting spores, which have a yellowish and afterwards a bright brown and rather thick integument (30 × 33 μ). These bodies provide for the rejuvenescence of the parasite in the spring, by remaining at rest through the winter. The production and development of these resting spores have already been described in the introduction (*ante*, p. 2).

The distribution of this parasite is narrow, only Germany and Belgium having been recorded in addition to Great Britain.

It has never been sufficiently prevalent or destructive to have been experimented on with fungicides.

Sacc. Syll. vii. 860; *Gard. Chron.* May 1, 1886, with fig.; *Cooke M.F.* 237; *Cooke Hdbk.* No. 1786.

Cyclamen Leaf-spot.

Two kinds of leaf-spot have been described on the leaves of *Cyclamen*, but neither of them has as yet been decidedly recognised in this country.

The French leaf-spot, *Phyllosticta Cyclaminis*, is manifested by somewhat circular brown spots over which the minute perithecia are scattered, and the sporules are small, narrowly elliptical (6–8 × 2 μ), rounded at the ends, and colourless (*Bull. Soc. Myc. de France*, 1893, t. xiv., f. 4).

The other species, which we may call the "Concentric Cyclamen Spot," forms rather large and irregular smoky spots, with a rufous margin, the surface being concentrically lined (*Septoria Cyclaminis*). It was first described in the "Flora of Algeria." The sporules are long and threadlike (25–30 × 1½ μ), divided by three transverse septa. This species has occurred in Italy as well as Algeria.

As far as we are aware, these are the only fungus parasites which have been described as troubling the Cyclamen.

Auricula Brown Mould.

Heterosporium Auriculæ (Cooke), Pl. IV. fig. 71.

About the year 1888 this parasite was first brought to our notice, flourishing upon living leaves of *Auricula*, and then threatening to become troublesome ; however it scarcely seems to have appeared since, or during the past three or four years.

The leaves are disfigured by smoky patches on the surface, with a minutely velvety appearance, caused by the threads of this mould, which are erect, slender, and unbranched, but somewhat flexuous, and at length septate and olive. The conidia are terminal, sometimes briefly concatenate, narrowly elliptical, at first continuous, then one or two septate (25–35 × 10 μ) the surface rough with minute scabrous points or warts, but with a rather thicker and darker epispore than in the allied species.

It has not yet been recorded elsewhere.

Two or three other species of this genus are known in Britain, and all of them have proved to be destructive pests, such as *Heterosporium echinulatum* on Carnations, and *Heterosporium gracile* on Iris.

The only remedy suggested in these cases has been spraying with ammoniacal copper carbonate solution, and clearing away all dead leaves.

Grevillea, xvi. 109.

Soldanella Rust.

Puccinia Soldanellæ (DC.)

In this instance, as the endophytes are rare, we may include all the stages which occur upon the leaves of *Soldanella alpina* under one notice.

The cluster-cups (*Æcidium*) are scattered over the lower surface of the leaves, and do not present any remarkable difference in appearance from the same kind of endophyte on other plants. The æcidiospores are subglobose or somewhat angular, with a finely granulated surface, and are of a yellow colour (20–26 × 17–20 μ).

The pustules of the *Uredo* are developed on the upper surface, and are minute, gregarious, and brown, when ruptured encircled by the remains of the cuticle. The uredospores are rounded, ovoid, or elliptical (20-32 × 20–30 μ), with a rough surface.

The teleutospores are produced in the same or similar pustules, and are ovate, somewhat irregular and somewhat apiculate at the apex, brown at first, with a short pedicel, the surface reticulated finely.

The entire fungus is reported from France, Germany, Switzerland, and Italy, but we are not aware that any form except the *Æcidium* has been found in Britain.

Sacc. Syll. vii. 2181 ; *Cooke M.F.* 195 ; *Cooke Hdbk.* No. 1608 ; *Plowr. Br. Ured.* 159.

A Soldanella leaf-spot (*Septoria Soldanellæ*) with dark spots and thread-like sporules (20–30 × 1 μ) has been recorded as occurring in Italy.

Gentian Rust.

Puccinia Gentianæ (Straus.), Pl. IV. fig. 63.

Although Gentians are known to have been affected by ten separate diseases, only one of these has at present been detected in this country. In 1885 the above-named parasite first appeared in a bed of *Gentiana acaulis* in a public garden, where it was previously unknown. It commenced on some imported plants, and threatened to involve all in destruction. Various experiments were undertaken to check the disease, but proving fruitless the whole of the affected plants were uprooted and destroyed.

The lower leaves are first attacked and become of a sickly colour. The pustules soon appear upon the leaves, and these split irregularly at the vertex and expose the spores.

The earliest to make an appearance are the uredospores, which are almost globose ($22 \times 16\ \mu$) and rough externally. The teleutospores soon follow, which are intermixed with the uredospores in the same pustules, and are larger, of a darker colour, divided transversely into two cells. In form they are somewhat elliptical, each cell being almost triangular, like inverted cones attached at their bases, the lower cell with a colourless stem, which finally disappears ($28–38 \times 20–26$), the surface quite smooth.

This pest is reported to be very common in Russia, and not unknown in other parts of Europe.

As remarked above, all efforts to save infected plants by spraying with fungicides proved to be ineffectual.

Sacc. Syll. vii. 2153; *Gard. Chron.* Sept. 19, 1885, fig. 82; *Grevillea* xiv. p. 39; *Plowr. Br. Ured.* 147.

Periwinkle Rust.

Puccinia Vincæ (Berk.), Pl. IV. fig. 72.

This is a very tenacious species, since when it once attacks a plant it seldom leaves it, making its appearance on the under surface of the leaves.

A complicated biology is attributed to it, which recognises æcidiospores without cluster-cups, but produced in flattened pustules, of a dark brown colour containing globose spores, which are colourless and echinulate ($10–12\ \mu$ diam.)

There are also two kinds of uredospores, the primary ones produced early and elongated, the secondary later on and nearly globose.

The teleutospores are developed normally in small pustules, although an Italian author attempted to establish the fact that there are two kinds of teleutospores, and therefore must be two species of *Puccinia*, one of which was to be called *Puccinia Vincæ* and the other *Puccinia Berkeleyi*.

The teleutospores are elliptical, divided in the centre, and slightly constricted, the upper cell thickened at the apex, the lower cell somewhat attenuated downwards into a long peduncle, which soon falls away. The final spores are rather large ($38–56 \times 17–28\ \mu$).

Recorded for France, Germany, Portugal, and Italy.

Sacc. Syll. vii. 2241, 2495; *Gard. Chron.* July 25, 1885, p. 108, figs. 22, 23; August 20, 1887; *Cooke M.F.* 103, 205, fig. 132; *Plowr. Br. Ured.* 161; *Cooke Hdbk.* No. 1478.

Leaf-spots and a rot-mould are known on the continent of Europe on the Periwinkle.

Convolvulus Anthracnose.

Marsonia Ipomœæ (C. & M.), Pl. IV. fig. 73.

The cultivated species of *Convolvulus* and *Ipomœa* do not appear to be susceptible to fungus parasites in this country, although some half-dozen species are recognised abroad.

The above-named was first discovered on the stems of *Ipomœa* in 1887, and occasionally on the leaves. The pustules were densely collected on the stems of living plants, elevating and splitting the cuticle in an irregular manner, then becoming dark-coloured, like the pustules of a *Uredo*.

The conidia, or sporules, ooze out in tendrils, especially when moist, and are narrowly oblong or cylindrical, blunt at the ends, and divided in the middle by a transverse septum ($10\text{–}15 \times 3\ \mu$), entirely colourless. At first the conidia are produced upon short spore-bearers, which proceed from a cushion-like base, but they soon break away, and form a gelatinous mass.

The majority of the species of *Glœosporium* and *Marsonia* are very destructive and persistent pests, against which fungicides have proved of little avail. Destruction of infected plants seems to be the only safe remedy.

Sacc. Syll. x. 6900; *Grevillea*, xvi. 48.

Rivea Chain Mould.

Oidium erumpens (C. & M.), Pl. IV. fig. 74.

It was in the autumn of 1887 that the leaves of *Rivea hypocrateriformis*, under cultivation, were found to develop, on the under surface, little tufts of a whitish mould, which soon gave a sickly complexion to the foliage. The tufts, which broke through the cuticle, were rounded and convex, of a greyish colour, becoming darker with age.

The threads composing the tufts were rather robust, and divided in the upper portion, which soon became torulose, or beadlike, and then the cells separated as globose conidia, or nearly globose ($7 \times 5\ \mu$), and became sprinkled over the leaf.

This mould is more tufted and less diffuse than in most species of *Oidium*, but the structure is the same.

No opportunity occurred for experiment, but it is possible that an application of sulphur would be the most effective.

There is no record of this species anywhere other than in Great Britain.

Sacc. Syll. x. 7091; *Grevillea*, xvi. 49.

Numerous parasites are recorded in North America as attacking the different species of *Phlox*, but hitherto none have given any trouble in this country.

Henbane Rot-mould.

Peronospora Hyoscyami (De Bary), Pl. VI. fig. 78.

This pest has assumed additional importance since it has made vigorous attacks upon Tobacco plants under cultivation, both in North America and Australia.

In this country its activities have been chiefly confined to the Henbane, but it evidently is on the alert for all Solanaceous plants.

The mycelium is abundant within the tissues of the plant before the mould makes its appearance on the surface. The fertile threads are rather robust, branching from five to eight times, in the upper portion in a forked manner, with the branches spreading apart, and attenuated upwards, the final branchlets separating at a very obtuse angle, being short and rather conical, each apex bearing a single spore, or conidium, of an elliptical shape (13–24 $\times$ 13–18 μ) with a tinge of violet.

Resting spores are probably produced on the mycelium, but at present there is no evidence.

It is uncertain whether the conidia only germinate, or whether they produce zoospores.

Hitherto the species is recorded for Britain, Germany, Australia, and North America.

The only treatment suggested is spraying with dilute Bordeaux mixture.

Massee Pl. Dis. 81, 357; *Gard. Chron.* February 7, 1885, fig. 33; *Sacc. Syll.* vii. 877; *Grevillea,* ii. 139; *Mass. B.F.* 126.

Another species (*Peronospora dubia*) is recorded on *Hyoscyamus* in Austria.

Petunia White Mould.

Ramularia Petuniæ (Cooke), Pl. IV. fig. 76.

At present this mould must be considered as scarce, it having been found only once or twice in this country on the leaves of *Petunia.*

The spots are large, occupying nearly half the surface of the leaf, somewhat circular in form, with a pale ochraceous tint. The conidia are produced in considerable numbers at the apex of rather short undivided colourless threads, which are more or less clustered on the spots. The conidia are cylindrical, rounded at the ends, at first continuous, but at length divided by a septum across the centre (20–22 $\times$ 4 μ).

Wherever it has occurred this parasite has proved to be very destructive, the spots sometimes extending over the entire leaf. No explanation can be offered for its sudden appearance in the south of Britain, but it is known that the moulds of this genus are very erratic, and, as a rule, destructive.

In the event of picking off and burning the diseased leaves not being effective in checking the disease, it is recommended that diluted fungicides should be applied, and for this purpose weak Bordeaux mixture may be tried.

Sacc. Syll. x. 7294; *Grevillea,* vol. xx. 1891, p. 8.

Other ordinary leaf-spots have been recorded on leaves of *Petunia* abroad, such as *Phyllosticta Petuniæ* and *Ascochyta Petuniæ.*

Lavender Leaf-spot.

Septoria Lavandulæ (Desm.), Pl. IV. fig. 77.

Parasites of Labiate plants under cultivation as garden flowers are very limited. It is now many years since we found Lavender plants with a great number of the leaves attacked by this endophyte, which is not uncommon in France, but which we have not met with again.

The bleached spots are small on both surfaces of the leaves, mostly rounded, but sometimes irregular, limited externally by a raised purple line. They do not generally exceed one eighth of an inch in diameter, but several spots are often seen on the same leaf. On the upper surface of the spots a few black dots are to be discerned, which are the receptacles or perithecia of the fungus.

The sporules, or conidia, are long and thread-like, straight or curved, and very narrow (25–35 × 2 μ) ultimately; when fully matured they are expelled through a pore at the apex of the receptacle.

This species has been found also in France, Italy, and Madeira.

Sacc. Syll. iii. 2914; *Cooke Hdbk.* No. 1340; *Grevillea*, xiv. 103, No. 523.

Lavender is also liable to a sickening disease, or "wilting," but the cause has not been ascertained, and no fungus been found.

PESTS OF THE SCROPHULARIACEÆ.

It is a singular fact that no important parasite has yet been recorded in Britain for the numerous Scrophulariaceous plants in general cultivation, although many are known abroad.

The destructive rot-moulds (*Peronospora*) are represented by at least four species, which attack *Antirrhinum*, *Digitalis*, and *Veronica*, but only *Peronospora grisea* has been met with on uncultivated *Veronicæ*, and *Peronospora sordida* on *Verbascum*, in this country.

The three diseases which produce leaf-spot on *Mimulus*, and the four on *Pentstemon*, have, with one exception, never invaded our shores, whilst *Calceolaria* is still unharmed, and therefore, on the whole, we must be regarded as peculiarly fortunate. The exception is in the case of *Phyllosticta Pentastemonis* (*Grevillea*, xiv. 90) which has produced leaf-spot on one or two occasions in this country. There is also a leaf-spot (*Septoria Pentastemonis*) with small round white spots on leaves of *Pentstemon*, known in North America.

A new fungus disease on *Antirrhinum majus* of the kind known in America as Anthracnose, produced by *Colletotrichum Antirrhini* (Stew.), is recorded recently as causing elliptical or circular sunken spots on the leaves of that plant in the United States (*Journ. R.H.S.* vol. xxvi. 1901, p. 194).

DISEASES OF ENDOGENOUS FLOWERING PLANTS.

For the sake of reference we have kept these diseases together, as they affect plants mostly of outdoor culture, reserving others, which require warm houses or stove treatment, for separate notice hereafter, with other hothouse plants. Hence Orchids and other exotics will find no mention here.

Lily Leaf-spots.

Fortunately Lily leaf-spot has not been detected in this country, but it is not uncommon abroad.

One species (*Phyllosticta Lilii*) has pallid spots with a broad rufous margin and small pale brownish sporules ($4–5 \times 3\ \mu$) on *Lilium superbum* in Canada.

Another (*Phyllosticta liliicola*) has no definite spots, but the receptacles are scattered, and the sporules are larger ($10 \times 3\ \mu$). It is found on *Lilium candidum* in Italy.

In another species on Martagon Lily (*Cylindrosporium inconspicuum*) there are irregular and indefinite brown spots, and the sporules are long and threadlike ($60–100 \times 3\frac{1}{2}\ \mu$), with from three to five transverse divisions. At present confined to Switzerland.

Lily Cluster-cups, Pl. V. fig. 81.

The cluster-cups of the Lily of the Valley (*Æcidium Convallariæ*) are credited with attacking the leaves of *Lilium canadense* in Belgium and the United States.

Another species (*Æcidium Safianoffianum*) occurs on leaves of Martagon Lily in Siberia.

These are named incidentally, as some one of them may at any time pay a visit to our shores.

Lily Brand.

Puccinia Liliacearum (Duby), Pl. V. fig. 84.

A disease which affects indiscriminately a large number of Liliaceous plants, but fortunately not common in this country, and never recognised until within the last few years, it having been found chiefly upon *Ornithogalum*. It forms unsightly pustules on the leaves, enclosing the very dark, almost black, teleutospores.

There is said to be an *Æcidium* which is the prelude to this brand; but it has not been seen in Britain.

The pustules are grouped together, and are for a long time covered by the cuticle, which is at length ruptured longitudinally. The teleutospores are oblong, divided in the middle, and a little attenuated towards each end, of a comparatively large size ($40–70 \times 22–35\ \mu$), dark brown, and externally smooth, on rather long deciduous pedicels.

It is known in France, Germany, Austria, Italy, as well as in Great Britain.

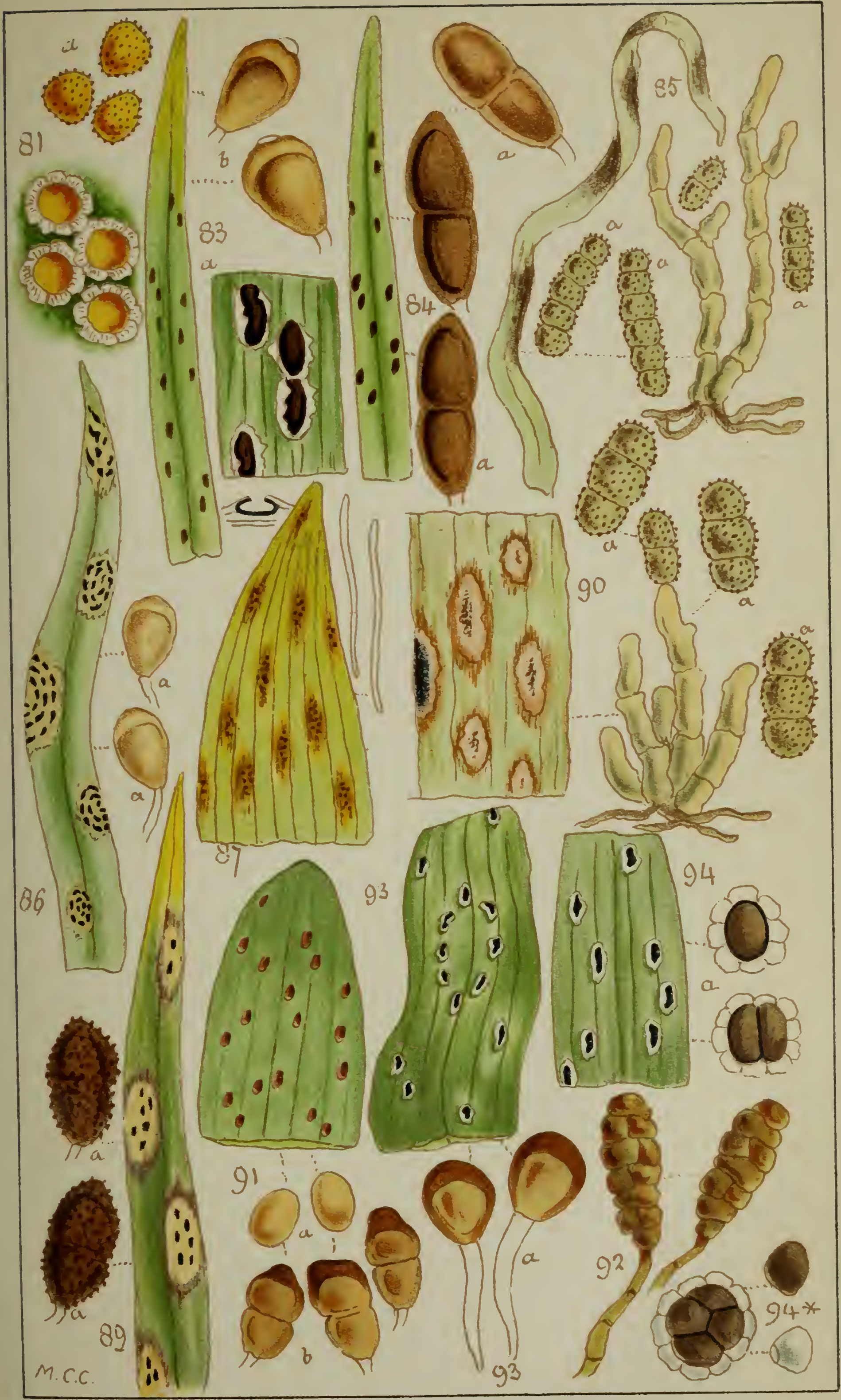
Should this pest make its appearance all the affected leaves should be stripped off and burnt, so as to destroy the teleutospores and prevent the spread of the disease to other plants.

Sacc. Syll. vii. 2314; *Gard. Chron.* July 28, 1888, fig. 2; *Plowr. Br. Ured.* 196.

Lily Simple Brands.

Uromyces sp.

These, which we call simple brands, have a similar life-history to the two-celled brands of the genus *Puccinia*, but the teleutospores have only



PESTS—FLOWER GARDEN.

one cell. Of those which occur on the foliage of Lilies there is one species which is found in Germany on *Lilium canadense*, and called both *Uromyces Lilii* and *Uromyces Liliacearum*, which has since been included as a variety of *Uromyces Erythronii*, a conclusion the accuracy of which we venture to doubt.

Another species on leaves of *Lilium* has been called *Uromyces Rabenhorstii*, and is also found in Germany. This has also been attributed by Saccardo as a form of *Uromyces Erythronii*. In both these species the teleutospores, which have been communicated to us, differ from each other and from the typical form of those in *Uromyces Erythronii*.

The last species is probably distinct: it occurs on *Lilium canadense* leaves in the United States (*Uromyces Lilii*, Clint.), but hitherto we have not seen it, and should scarcely venture an opinion. The teleutospores are rugulose ($36–37 \times 20–25\ \mu$).

Lily Disease.

Botrytis elliptica (Berk.), Pl. VI. fig. 80.

The history of this disease seems to have been most mysterious throughout, since it was several years after its first appearance before any light could be thrown upon its cause. It was in 1881 that specimens were sent to the Rev. M. J. Berkeley in such a condition that he was able to detect a small white mould as the probable cause of the mischief, which he called *Ovularia elliptica* (*Gard. Chron.* Sept. 10, 1881, with figure). Afterwards, by some means, it acquired the name of *Botrytis elliptica*.

Attention being called to it again, it was made the subject of reference in 1888, when it was figured again (in *Gard. Chron.* Aug. 18, 1888, fig. 21), and then for a time was permitted to rest, but not for long, since Marshall Ward, in 1889, under the name of *Botrytis*, evidently introduced the same mould into his account of the Lily disease, and figured it as a species of *Botrytis*.

This may, or may not, be the same mould as the *Botrytis parasitica* (Cav.) on Tulip stems, alluded to by Massee, but of which no description is given.

Then Saccardo intimates that the *Polyactis cana*, which he calls *Botrytis canescens*, attacks the immature fruits of Lilies.

Last of all we find the name of the mould buried altogether, and the disease attributed to *Sclerotinia*, a kind of *Peziza*, or Ascomycetous fungus, which, at the same time, it is confessed, has never been seen, and the existence of which is only suspected. A rather curious episode in "imaginative mycology," which is seeking to supplant the old-fashioned "science of fact."

Under all these circumstances we prefer to retain the name of *Botrytis elliptica*, and not travel into the region of romance.

This disease attacks most species of Lilies. Rust-coloured patches come upon the leaves and buds, as if they had been burnt, if the buds are not completely destroyed; the flowers become imperfect and distorted, and the whole plant has a blighted appearance.

The threads of the mould arise from the creeping mycelium, and are somewhat branched in the upper portion, the ends of the branches having Pear-shaped swellings, each bearing about a dozen conidia, each conidium attached to the swollen end by a minute peg-like stalk. The conidia are egg-shaped and colourless ($20 \times 14\ \mu$).

Beyond Great Britain the area of distribution is not ascertained.

No remedies have been suggested, or tried, beyond destroying infected plants and bulbs, so as to prevent the formation of sclerotia, which are the resting stage of the mycelium, and its consequent diffusion in the succeeding year.

Sacc. Syll. iv. 752; *Grevillea*, vol. x. 1881, p. 51; *Gard. Chron.* Sept. 10, 1881, fig. 66; Aug. 18, 1888, fig. 21; *Marshall Ward, Ann. Bot.* Nov.

FIG. 99.—BOTRYTIS SPECIES. 1. Flower-bud of Lily attacked by the fungus. Nat. size. 2. Fruiting branch of the fungus: × 50. 3. Head of fruiting branch: × 500.

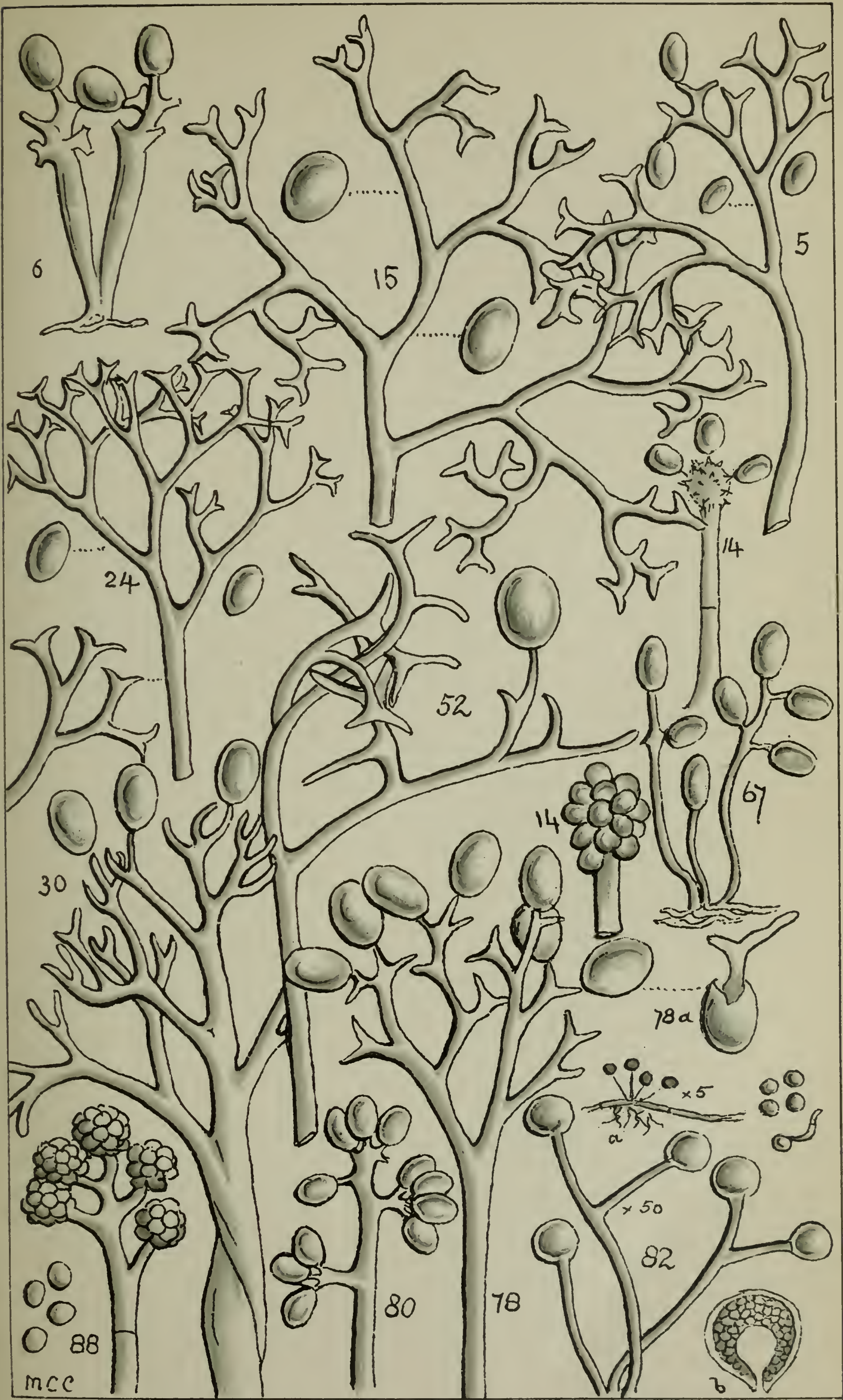
1888, p. 319; *Diseases of Plants*, p. 117; *Massee Pl. Dis.* p. 161; *Journ. R.H.S.* vol. xxvi. 1901, p. 372, fig. 190; *ibid.* vol. xxvi. 1901, p. cxxix.

JAPAN LILY DISEASE.

Rhizopus necans (Mass.), Pl. VI. fig. 82.

This is a disease affecting the bulbs of *Lilium speciosum* and *Lilium auratum* raised in Japan for exportation to Europe, and hitherto only affects imported bulbs.

At first a slight discoloration at the base of the bulb is discovered when the bulb is cut open. This extends until the entire bulb becomes discoloured, and afterwards soft and rotten. Diseased bulbs which have become rotten show a white weft of mycelium, from which numerous clusters of the fungus, resembling miniature pins with black heads, stand erect. These are the conidial or summer fruit. The globose conidia



PESTS—GARDEN FLOWERS.

(5–6 μ diam.) being enclosed in the black heads, resting spores are produced within the tissues of the decayed bulb.

This fungus belongs to the Mucors, which produce resting spores, after an act of conjugation, and the species are generally saprophytes, living at the expense of decayed matter. Those who are responsible for the conclusion have probably sound evidence for regarding this as the cause and not the effect of the disease. We have not heard of any experiments to show that sowing the *Rhizopus* on healthy bulbs will produce the disease.

Naturally there is no remedy for rotted bulbs, and the only safeguard is in prevention, and the destruction of diseased bulbs.

Kew Bulletin, 1897, p. 87, plate; *Mass. Pl. Dis.* p. 57, cuts, 351; *Journ. R.H.S.* vol. xxvi. 1901, p. 376.

Tulip Smut.

Ustilago Tulipæ (Heufl.)

This smut has appeared on the leaves of Tulips in France, Germany, and Austria, but not as yet in Great Britain.

The pustules are elliptical and convex, scattered over the leaves, and soon splitting longitudinally, exposing the sooty spores, which appear to be quite black in the mass. They are globose or irregularly rounded (16–20 μ diam.), smooth, with a thick coat. Externally with much the same appearance as the smut on *Ornithogalum*.

Sacc. vii. 1640.

Tulip Mould.

Botrytis parasitica (Cav.)

We are informed that cultivated Tulips are often killed by the attacks of a mould which forms olive-brown velvety patches on the stem, leaves, and flowers, which answers to the name given above. The threads are grey, erect, with the basal joint inflated. Conidia ovate, large (16–20 × 10–13 μ), disposed on minute branches in an umbellate manner. Later on smooth lentil-shaped sclerotia appear on the outer parts of the bulb, sometimes so numerous as to form a black crust.

Cav. App. Pat. Veg. p. 10, t. 6, figs. 1–4; *Mass. Pl. Dis.* 158; *Sacc. Syll.* x. 7167; *Journ. R.H.S.* xxvi. 1901, pp. 43, 198.

Tulip Brand.

Puccinia Tulipæ (Schr.)

There are said to be two species of brand which affect Tulip leaves, of which the above is one, which is known in Germany and Austria. This is one of those species for which neither cluster-cup nor uredo is known.

The pustules are minute, rounded, or elliptical, and densely aggregated together, or confluent, dark brown. The teleutospores are broadly ellipsoid, rounded at both ends, with a thick spore-coat, or epispore, which is densely warted (30–44 × 21–32 μ). The spores appear at first to be involved in a hyaline mucous envelope. The short pedicel soon vanishes.

Sacc. Syll. vii. 2347.

Spiny Tulip Brand.

Puccinia Prostii (Moug.)

This is the second, and older species, which is known on Tulip leaves in France and Italy. This also has neither affiliated cluster-cups nor uredo.

The pustules are oblong, convex, brown on both surfaces of the leaves, either scattered or rather crowded, at length ruptured. The teleutospores are ellipsoid and, of course, uniseptate (60–66 × 34–36 μ), considerably larger than in the preceding, everywhere covered with long colourless acute spines. The general colour of the epispore cinnamon brown, with a hyaline pedicel or footstalk.

Sacc. Syll. vii. 2580.

Ornithogalum Brand.

Uromyces Ornithogali (Wallr.), Pl. V. fig. 83.

The species of *Ornithogalum*, *Gagea*, and *Erythronium* seem to be specially favoured in this country by the absence of parasites, which are sufficiently common abroad, to the extent of some eighteen or twenty species.

The leaves of *Ornithogalum* and *Gagea* are alike subject to the above brand, which is only known in the teleutospore form. The pustules are elliptic and bullate, mostly scattered, soon splitting and discharging the powdery nearly black spores.

The teleutospores are ovate, or pear-shaped (26–50 × 17–26 μ), narrowed into the pedicel at the base and rounded above, with a minute hyaline wart-like apiculus. The surface is smooth, rarely otherwise, and of a pale or chestnut brown colour.

It occurs in France, Germany, Hungary, and Portugal.

Sacc. Syll. vii. 2015; *Plowr. Br. Ured.* 142; *Grevillea*, vii. 138.

A corresponding species (*Uromyces Erythronii*) is found on *Erythronium* and other Liliaceous plants nearly throughout Europe and in the United States. (See fig. 100 on opposite page.)

Puccinia Liliacearum occurs in Britain on *Ornithogalum umbellatum*, and another species, *Puccinia Kalchbrenneriana*, at the Cape of Good Hope, and *Puccinia Lojkaiana* in Italy, the Tyrol, and Hungary, all upon *Ornithogalum*.

Ornithogalum Black Mould.

Heterosporium Ornithogali (Klot.), Pl. V. fig. 85.

In the majority of instances the black moulds are truly regarded as saprophytic, living upon and at the expense of dead vegetable matter; but there are decided exceptions to this rule in entire genera, such as *Cercospora* and the present *Heterosporium*, which seem to be entirely parasitic. The latter genus was named by Klotsch more than half a century ago, but was not clearly defined until 1877 with this as the typical species.

The leaves become spotted with sooty-looking minutely velvety spots, caused by the dark threads and mycelium of this mould, and soon decay.

The threads grow in tufts, and are long and flexuous, with thin walls, pale brown, septate, and occasionally branched, bearing at their apex the conidia of variable size and form, some being elliptical and continuous, others two-celled and longer, whilst others are cylindrical, with rounded ends and two or three divisions ($30–80 \times 10\ \mu$), externally rough with minute points and slightly coloured.

When mature these conidia will germinate freely from every joint.

Spraying with potassium sulphide is stated to check the disease. To prevent spreading, diseased leaves should be burnt.

Sacc. Syll. iv. 2306; *Cooke Journ. Q.M.C.* 1877, t. 25, f. 13; *Gard. Chron.* June 1877, fig. 163; *Grevillea*, v. 123.

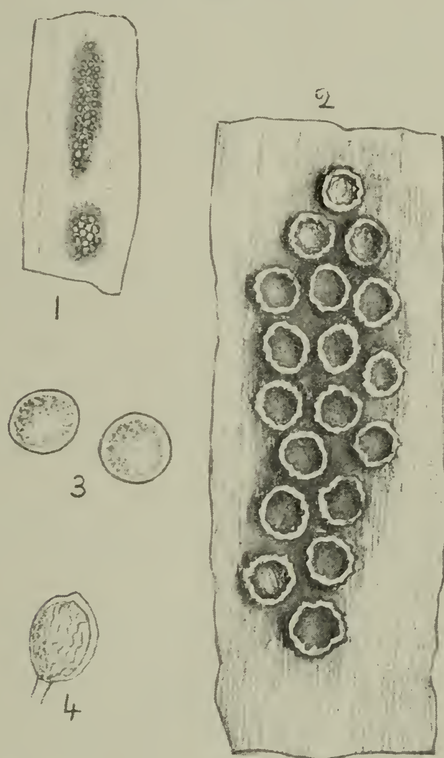


Fig. 100.—Uromyces Erythronii. 1. Portion of a leaf showing clusters of the fungus. Nat. size. 2. A single group of the fungus fruit known popularly as "cluster-cups": × 100. 3. Uredo, or summer-spores: × 400. Teleuto- or winter-spore: × 400.

Squill Brand.

Uromyces Scillarum (Grev.), Pl. V. fig. 86.

This parasite is very common on the leaves of the Wild Hyacinth, and probably has thence found its way into gardens, where it attacks the leaves of *Muscari botryoides* and other species.

The attacked leaves are blotched with paler spots, upon which the pustules soon appear, at first covered by the cuticle. The paleness is caused by the internal mycelium which pervades the tissues.

The pustules are small and numerous, generally arranged upon the spots in concentric rings, or parts of rings, with a tendency to coalesce. The spores are soon exposed by rupture of the cuticle, when they are powdery and of a chestnut-brown colour.

The uredospores are at present unknown.

The teleutospores are subglobose, or rather Pear-shaped ($19–30 \times 14–24\ \mu$), and sometimes irregular by compression, quite smooth, and of a pale brown. The epispore, or spore coating, is of equal thickness throughout, and *not* thickened at the apex, as in many other species. There is a short hyaline stem, which soon disappears.

Its area of distribution, outside this country, includes France, Germany, Austria, Hungary, Greece, Italy, Egypt, and South Africa.

It is possible that spraying with one of the fungicides may be of a little service, but the perfection and dispersion of the spores should be prevented by picking and destroying infected leaves.

Sacc. Syll. vii. 2014; *Cooke M.F.* 213; *Cooke Hdbk.* No. 1548; *Plowr. Br. Ured.* 141; *Grevillea*, vii. 138.

Black Smut.

Sclerotinia bulborum (Wakk.), Pl. IX. fig. 135.

A pest under the name of "black smut" has appeared around Haarlem, where it has been very destructive to Hyacinth culture. It is not a "smut" according to our acceptation of the term, but a Sclerotium.

It makes its appearance after flowering, causing the leaves to turn yellow and fall off. No external mycelium is to be observed, except at the base of the leaves. The bulb is completely permeated with mycelium, and black irregular nodules appear on the surface, mixed with some that are softer and paler coloured. These are the "sclerotia," or nodules of compact mycelium. These nodules are like resting spores, and must pass through a period of quiescence, so that they will not germinate until the following spring.

If the bulbs are potted, and watered copiously, at the period when their activity should commence the sclerotia will germinate and produce the little *Peziza* cups, resembling those produced from the sclerotium of the Potato. To this Peziza-form Wakker has given the name of *Sclerotinia bulborum.* The sporidia are binucleate ($16 \times 8\ \mu$).

There is one peculiarity about these sclerotia, that when cultivated in a nutrient solution they will form a mycelium and produce secondary sclerotia.

It is needless to say that when once a bulb is attacked remedy is hopeless. Onion bulbs are also liable to attack.

Gard. Chron. May 12, 1894, p. 592; *Mass. Pl. Dis.* 380.

Hyacinth Yellow Disease.

Pseudomonas Hyacinthi.

A disease affecting Hyacinth bulbs has been described under the name of "yellow disease," which appears on them in the autumn, filling the vascular bundles with a yellow slime. This mucus is said to contain immense quantities of a bacterium, to which at first the name of *Bacterium Hyacinthi* was applied.

Whilst these little bodies are embedded in the slime they remain motionless, but when removed from it they soon exhibit a lively motion, and begin to divide. In the spring they appear in the vascular bundles of the leaves.

Gard. Chron. May 12, 1894, p. 592; *Jour. R.H.S.* xxvi. 1901, p. 222.

Another disease attacks principally the flowering parts and is attended by the production of a foul-smelling mucus. Upon making a close examination Dr. Heine discovered that the mucus and the tissues were full of bacteria, quite different from those of the "yellow disease," and was called *Bacillus Hyacinthi septicus.* It is reported that when healthy plants are inoculated with this the evidence of infection is manifested within twenty-four hours. When cultivated on Potato it formed a yellow slimy layer, and in a few days gave off a strong offensive smell.

Gard. Chron. May 12, 1894, p. 592.

Tubeuf contends that a common large *Peziza*, which grows on manure heaps (*Peziza vesiculosa*), attacks Hyacinths and other plants in gardens and kills them.

Mass. Pl. Dis. 162.

Convallaria Brown Spot.

Septoria brunneola (Fries), Pl. V. fig. 87.

This leaf-spot is found, not uncommonly, on living or fading leaves of Lily of the Valley, but not often in fruit, so that the spots remain sterile and harmless. It is believed, however, to be only a prelude or early stage of a more highly developed fungus (*Sphærella brunneola*).

Brown irregular spots on the leaves, which at length acquire a blackish colour, precede the receptacles of the *Septoria*, which latter subsequently appear as little dots clustered upon the spots. The sporules are long and threadlike, without division ($75–100 \times 2\ \mu$).

This parasite is known also in Sweden, Italy, and Moravia.

Sacc. Syll. 3113; *Journ. R.H.S.* xxvi. 1901, p. cxl.

Convallaria Red Spot.

Phyllosticta cruenta (Fries).

Another leaf-spot has been found in Britain on leaves of Solomon's Seal, forming oblong blood-red spots with a pallid centre, upon which the receptacles are scattered. The sporules are somewhat sausage-shaped, rounded at the ends, and curved ($14–16 \times 5\frac{1}{2}–6\frac{1}{2}\ \mu$).

This spot has also been found in France, Belgium, Germany, Italy, Portugal, Siberia, and North America.

Sacc. Syll. iii. 324; *Grevillea*, xiv. p. 74, No. 437.

Lily of the Valley Cluster-cups.

Æcidium Convallariæ (Schum.), Pl. V. fig. 81.

The Lily of the Valley is very rarely attacked by this parasite in Britain, although it is occasionally seen; but on the Continent it has the reputation of being a destructive pest.

No *Uredo* form or teleutospores have yet been affiliated to this species of cluster-cup.

The cups are clustered together on paler spots of the leaves, chiefly on the upper surface, and the white fringed cups are filled with bright orange æcidiospores, presenting under the microscope the most elegant appearance. The æcidiospores are globose, minutely warted (20–25 μ diam.)

It is to be hoped and anticipated that remedial measures will not be called for.

The area of distribution includes Belgium, Germany, Hungary, Finland, and North America.

Gard. Chron. July 5, 1884, with figs.; *Grevillea,* xiv. 2; *Sacc. Syll.* vii. 2945; *Plowr. Br. Ured.* 264.

Snowdrop White Mould.

Botrytis galanthina (B. & Br.), Pl. VI. fig. 88.

This mould appears to have first been made known in 1873, when it was detected on the bulbs of Snowdrops, attacking the outer coats and destroying them. At first it threatened to become very destructive in the North, but has never given much trouble in the South.

The threads of the mould are shortly branched in the upper portion turning brownish. The branches are somewhat thickened upwards, bearing the obovate spores in clusters about the apices, each spore or conidium being seated upon an elongated spicule. The conidia are hyaline and subglobose or obovate (15–18 × 10–11 μ).

The mould attacks also growing plants, as soon as leaves and flowers appear above ground, stopping the flowering and the proper development of the leaves. Then a delicate white mould is seen to cover the leaves and spathes. Later on numerous minute black sclerotia are formed in the tissues of the decaying leaves and the outer bulb scales.

Some impetuous author has called this fungus *Sclerotinia galanthina* before a single cup of the *Peziza* has ever been seen, or existed, except in his own fertile imagination. We do not intend to follow him into fairyland, but adhere to the *Botrytis* until it falls away. Massee calls the mould *Botrytis cinerea,* and the Peziza *Sclerotinia Fuckeliana.** (See fig. 101.)

Ann. Nat. Hist. 4th series, xi. p. 346; *Grevillea,* ii. 139; *Gard. Chron.* Mar. 2, 1889, p. 275; *Mass. Pl. Dis.* 159; *Sacc. Syll.* iv. 705.

Crocus White Mould.

Botrytis Croci (Cke. & Mass.)

This mould was found upon the dead leaves of *Crocus* in the autumn of 1887; but it is just possible, acknowledging its relationship, that it

* *Journ. R.H.S.* xxvi. 1901, p. 41, fig. 4, and p. xxxvii; also 1902, xxvi. p. 731, fig. 306.

FIG. 101.—BOTRYTIS GALANTHINA, A PARASITE ON SNOWDROPS.

1. A young Snowdrop badly diseased, nat. size. 2. Fruiting branch of the *Botrytis*, or summer form of the fungus, × 350. 3. A Snowdrop bulb with sclerotia, nat. size. 4. Isolated sclerotia, nat. size. 5. A sclerotium bearing a crop of *Botrytis*, the spring following its formation, × 10. 6. *Botrytis* conidia germinating, × 400. 7. An organ of attachment of the *Botrytis*, × 400. 8. Chains of conidia, of unknown use, formed on mycelium of the *Botrytis*, × 400.

may not hesitate to attack living plants in the same way as the Snowdrop species.

It forms dark smoky tufts, which sometimes unite in a larger effused mass. The threads are comparatively thick and rather closely jointed, attenuated upwards towards the apex, where they are slightly and sparingly branched, downwards of a pale olive colour, but uncoloured in the upper portion. Conidia elliptical, hyaline (15–18 × 8–10 μ), collected together at the tips of the threads, or of the branches, in small glomerules or clusters of from three or four to seven or eight conidia. In this respect the present species appears to be rather peculiar, since the head or glomerule of conidia in most cases contains a large number of individuals.

It has to be discovered whether this species is capable of providing itself with sclerotia and of developing therefrom the customary *Sclerotinia*.

Grevillea, xvi. 10 ; *Sacc. Syll.* x. 7165.

Copper Web.

Rhizoctonia crocorum (DC.)

Amongst the diseases to which the *Crocus*, especially the Saffron Crocus, is subject is one which has long been known under the name of "copper web." This is due to the presence of a parasitic fungus which lives and thrives at the expense of the Crocus corm. The fungus was classed amongst the Truffles by Duhamel in 1728 and afterwards figured by Bulliard under the name of *Tuber parasiticum*, which was afterwards changed by Persoon into *Sclerotium croceum*; but it was De Candolle who finally raised it to the dignity of a genus and called it *Rhizoctonia*.

This singular parasite consists of Sclerotia-like tubercles united by byssoid filaments going from one to the other and forming a sort of subterranean web or net. It is by means of these filaments, which are attached to the rootlets of the plant or which creep over the surface of the bulbs after having pierced their integuments, that the parasite appropriates their nutritive juices after the manner of the "Dodder," and induces, if not direct death, at least a weakly development.

It was doubtful for a long time whether any real fructification was produced; and even now it is uncertain, although Broome found, on what he considered the same web on Mint, not only the hard warts, but little tawny tufts of a looser texture covered with globose or ovate spores. It seemed evident that the tufts and warts were forms of each other, but whether the spores were the true fruit, or only a secondary form of fruit, has not been determined.

Journ. R.H.S., vol. v. 1850, p. 23.

Narcissus Brand.

Puccinia Schroeteri (Pass.), Pl. V. fig. 89.

The leaves of *Narcissus* have recently been found in this country to be affected with a disease which apparently originated in Italy and afterwards extended into Germany.

The spots are large and oblong, with a tawny violet border ; the pustules are produced on these spots, and either solitary or a few together, either covered with, or girt by, the remains of the ruptured epidermis.

No *Æcidium* or *Uredo* has been found associated with this disease.

The teleutospores are somewhat elliptical, from golden yellow to chestnut brown (38–60 × 24–27 μ), obscurely reticulated, either rounded at both ends or with the base somewhat attenuated into the very short, thick deciduous peduncle, with a central partition dividing the teleutospore into two nearly equal cells.

Nuovo Giorn. Bot. Ital. vii. 255 ; *Sacc. Syll.* vii. 2579.

The attack of *Fusarium bulbigenum* on *Narcissus* bulbs (*Grevillea*, xvi. 49) has not been repeated.

A form of leaf-spot (*Septoria Narcissi*), with the receptacles scattered over the tips of fading leaves, has not yet been observed out of Italy.

Iris Rust.

Uredo Iridis (Thum.)

This rust is believed to be common in gardens on the leaves of various species of *Iris* and to be quite distinct from another *Uredo* which furnishes the uredospores of *Puccinia Iridis* (DC.) This *Uredo* is supposed to have neither *Æcidium* nor *Puccinia* associated with it.

The pustules are linear-ovate, and sometimes confluent, on both surfaces of the leaves, covered at first by the cuticle and then exposed by rupture, of a chestnut-brown colour. The uredospores are almost globose, rarely somewhat Pear-shaped, externally rough, brown (30–35 × 20–25 μ).

Dr. M. Foster says "it does not readily attack the broad-leaved Mediterranean forms, but I am inclined to think that almost every species would take it."

Sacc. Syll. xi. 1299 ; *Plowr. Br. Ured.* 257.

There is supposed to be another species in North America (*Uredo iridicola*) on the leaves of *Iris versicolor*, with rough globose uredospores (25 μ diam.), of which we know nothing, and it may be the *Uredo Iridis* of Schweinitz.

Iris Brand.

Puccinia Iridis (DC.), Pl. V. fig. 91.

It is difficult to follow the mutation of names, but this we believe to be the same fungus which Berkeley called *Puccinia truncata*. It is found on the leaves of many species of *Iris*, besides *I. fœtidissima* and *I. germanica*.

The uredospores are found in crowded pustules, at first covered, then exposed, of a rusty-brown colour, crowded together, and either subglobose, elliptical, or ovoid (20–35 × 16–26 μ), externally rough, and ochraceous.

The teleutospores occur in linear, elongated, striæform pustules, which are blackish to the eye ; the spores are two-celled, club-shaped, with the apex rounded, or rather obtuse, or acuminate, with the spore-coat thickened at the apex, constricted in the middle at the septum (30–55 × 14–22 μ), smooth, pale brown, with a hyaline pedicel (12 × 5 μ).

This species is known in France, the Ardennes, Germany, Switzerland, Italy, and Siberia.

No associated cluster-cups are known.

Sacc. Syll. vii. 2284 ; *Cooke M.F.* p. 203 ; *Hdbk.* No. 1466 ; *Plowr. Br. Ured.* 190.

Cluster-cups (*Æcidium Iridis*) are known in North America on leaves of *Iris versicolor*.

Iris Leaf-blotch.

Heterosporium gracile (Wallr.), Pl. V. fig. 90.

One of the most persistent and troublesome of *Iris* diseases is this mould, which appears at some seasons with astonishing vigour upon the leaves of *Iris germanica* and other species.

The upper portion of the leaves turns brown and decays or rots, and some plants are soon killed ; large dark spots, becoming black, rounded, or elliptical, from half to one inch in length, with a brown border, appear on the brown parts, or on the still green leaves, velvety with the parasitic mould. In other cases the spots are smaller and more numerous, with a narrow brown margin, and simply bleached or dead tissue, on which are sprinkled a few tufts of the mould.

The mould consists of rather short and thick jointed threads in small tufts, and of a sooty brown colour, bearing singly, or nearly always, the conidia of variable size, some of which are elliptical and without division, whilst others are elongated, and once or twice divided transversely into cells (35–70 × 14–20 μ), and also of a smoky colour, the surface rough with minute points.

This disease seems to be known in France, Germany, Italy, the Cape of Good Hope, New Zealand, and North America.

If not too firmly established, syringing with one of the copper solutions may be of some service ; but the conidia germinate freely at every joint, and if not destroyed will quickly spread the disease.

Gard. Chron. June 9, 1894, p. 718 ; *Sacc. Syll.* iv. 2308 ; *Journ. R.H.S.* xxvi. 1901, p. 450.

Iris Bulb Scab.

Mystrosporium adustum (Mass.), Pl. V. fig. 92.

Bulbs of *Iris reticulata* have lately been affected and frequently destroyed by the incursions of a black mould, previously unknown, and which forms black crust-like patches on the outer sheath, gradually speading to every part.

There is a profuse dark mycelium, from which arise the short branches bearing the large and much-divided conidia. These latter are elliptic-oblong or ovate, with obtuse ends, and from five to seven transverse septa or divisions, which are again subdivided by longitudinal septa in a muriform manner. The divisions are often oblique, and sometimes without longitudinal divisions (45–60 × 20–22 μ), smooth, dark brown, and semi-translucent, produced at the tips of the threads, or at the ends of short branches.

Soaking the bulbs for two hours in a solution of one part formalin to three hundred parts of water will destroy the fungus, so long as it is external and has not penetrated deeply into the bulb.

Mass. Pl. Dis. 325, 441.

Leaf spots of six different kinds are recorded on *Iris* leaves in different countries, but none of them have yet been reported as British.

Gladiolus Smut.

Urocystis Gladioli (Smith), Pl. V. fig. 94*.

This smut, which in some respects resembles that of *Colchicum*, attacks the corms of *Gladiolus*, forming the spore masses within the corms. These are in rounded balls, or glomerules (40–50 μ diam.)

The teleutospores, or central fertile spores, are rounded on the outer side, but angular by compression elsewhere: they are dark brown (4–6 μ) and smooth. Externally in the glomerules are a series of colourless sterile spores or conidia, as in most other species of *Urocystis*, and in this case they are very numerous and evenly distributed.

The glomerules, or spore masses, have somewhat the appearance of large spores, divided in different directions, but in reality they consist of an agglomeration of smaller spores, closely compressed together into a ball, the inner ones being coloured and capable of germination, the outer series uncoloured and sterile. When fully matured the component cells separate under pressure, but the true function of the sterile cells has not been determined.

It might be advisable to immerse any suspected corms for a time before planting in Condy's fluid; but it is hopeless to expect any remedy when the corms are seriously attacked.

Known also in France and Germany.

Gard. Chron. Sept. 30, 1876, p. 420, fig.; *Grevillea*, v. 57; *Sacc. Syll.* vii. 1900; *Mass. B.F.* 187; *Plowr. Br. Ured.* 287; *Cooke M.F.* 232.

Gladiolus leaf-spot (*Septoria Gladioli*) and *Gladiolus* rust (*Puccinia Gladioli*) are at present unknown in Britain.

Colchicum Smut.

Urocystis Colchici (Schl.), Pl. V. fig. 94.

This is a disease of *Colchicum* which has long been known and too prominent in its manifestations to escape notice. The growing leaves are the subject of attack, and these are distorted and disfigured by the long and ugly pustules formed by the pest. These are large, thick, swollen, or bullate, at first covered by the epidermis, but at length ruptured and fringed with the remains of the torn cuticle, exposing the black, sooty-looking mass of complex spores.

The glomerules, or clusters, are nearly globose (20–33 × 16–20 μ), with the central spores few and chestnut brown, compressed at the points of contact (10–15 μ). The sterile spores of the circumference are pale, sometimes in two strata, and also compressed where they come into contact (7–11 μ diam.) When mature the spores are sprinkled about over the foliage in an unsightly manner. The disease is liable to attack species of *Scilla* and *Muscari* if found in proximity.

Spraying the plants early with Condy's fluid has proved to be preventive.

Known in Italy, Belgium, and Germany.

Sacc. Syll. vii. 1895; *Mass. Pl. Dis.* 227, 404; *Cooke M. F.* 232; *Mass. B.F.* 186 figs. 86, 87; *Cooke Hdbk.* No. 1539; *Plowr. Br. Ured.* 286; *Gard. Chron.* Sept. 30, 1876, fig.

Colchicum leaf-spots are also known in Italy and France.

Colchicum Rust.

Uromyces Colchici (Mass.) Pl. V. fig. 93.

At present this is solely a British product, and has for three successive seasons completely destroyed a bed of *Colchicum speciosum*, and has latterly attacked plants of *C. bavaricum* and *C. autumnale* growing in the neighbourhood.

The parasite attacks the leaves, commencing at the base of the leaf-sheath, and gradually extending towards the tip of the leaf. The oldest leaves are the first to be attacked.

The pustules are large for the genus, and often elongated on the sheaths, whilst upon the leaves they are liable to be collected in circular groups. They remain for a long time covered by the cuticle, which is finally ruptured to set the teleutospores free.

Teleutospores broadly elliptical or subglobose, with the apex slightly prominent, epispore, or spore coat smooth, dark brown, and as much as $2\,\mu$ thick ($28–38 \times 21–28\,\mu$) seated upon a hyaline persistent pedicel.

Cluster-cups or *Uredo* unknown.

No remedy has been proved to be successful.

Grevillea, xxi. 6; *Mass. Pl. Dis.* 226, 406.

The species of *Veratrum* are very subject to parasitic diseases in North America.

Dracontium Cluster-cups.

Æcidium Dracontii (Schwz.)

These cluster-cups are found in gardens on the leaves of *Arum triphyllum*, and were first made known in the United States.

The spots on the leaves are pallid and broadly extended, sometimes occupying nearly the whole leaf. The cups are rather large and distinct, being scattered without order over the spots, and not clustered as in *Æcidium Ari*. The æcidiospores are subglobose and of orange-brown colour, somewhat angular by compression and minutely rough ($15–16\,\mu$ diam.)

It is scarcely probable that remedies will have to be sought after for this species, as its appearance will now be problematical after so many years of absence.

Cooke Hdbk. No. 1611; *Sacc. Syll.* vii. 2962; *Plowr. Br. Ured.* 266.

The ordinary *Arum* cluster-cups found on the leaves of wild *Arum maculatum*, and another species (*Æcidium aroideum*) which occurs in Natal, are apparently quite distinct.

FERN DISEASES.

The diseases of hardy Ferns under cultivation in this country are very few and unimportant, although several are recorded abroad.

Damping off.

Pythium intermedium (De Bary).

The "damping off" of the prothallia of Ferns is possibly sometimes due only to an excess of moisture; but an actual disease has been recognised in the United States, and there is no reason why it may not make its appearance amongst us, as the fungus itself is of European origin.

The affected prothallia become quite soft and limp, and darker in colour than the healthy ones.

An allied species of fungus is responsible for the "damping off" of seedlings of crucifers, whilst some authors regard them as the same species.

In structure *Pythium* resembles a *Mucor*, and produces resting spores as the result of conjugation, similar to the rot-moulds.

Bull. U.S.A. Exp. Stn. Cornell Univ. 94, p. 247, pl.; *Bot. Zeit.* 1881; *Sacc. Syll.* xi. 1400; *Mass. Pl. Dis.* 350.

Fern Rust.

Uredo filicum (Desm.), Pl. IV. fig. 79.

There are two or three kinds of Fern rust known, but only one species appears to be known in Britain, and that is not uncommon in gardens and greenhouses, especially on *Cystopteris fragilis*, appearing on the under side of the fronds, which consequently assume a sickly appearance.

The pustules are rounded or irregular, and scattered over the under surface of the fronds in bright yellow spots. The uredospores are powdery, and are of two forms, the one ovate or elliptical and spinulose above, but smooth below (22–35 $\times$ 13–20 μ), the other somewhat angular with a thick smooth outer coating (26–38 $\times$ 18–29 μ), and both of a bright orange colour.

Ferns on which the rust makes its appearance should be isolated, and the diseased fronds cut off and burnt, whilst the plants so left should be sprayed with Condy's fluid.

It is distributed through Belgium, Germany, Finland, Austria, Bohemia, Italy, South Africa, and North America, and appears to be the same as *Uredo Polypodii* (Pers.)

Sacc. Syll. vii. 3096, xi. 1304; *Cooke, M.F.* 112; *Proc. Amer. Acad.* 1894, p. 396; *Cooke Hdbk.* No. 1569; *Plowr. Br. Ured.* 256.

Uredo Aspidiotus in the United States appears to be different, as also *Uredo Pteridis* in California, and *Uredo Scolopendri* in Germany and the Netherlands.

FUNGICIDES

are mixtures which are applied to diseased plants either to prevent or mitigate the ravages of fungoid parasites—if in a fluid form by sprinkling, spraying, or sponging the foliage; and if in powder by dusting it over the plants or the soil, as the case may require.

Fluid.

Ammoniacal Carbonate of Copper.—Mix three ounces of sulphate of copper, and three ounces of carbonate of soda, with one quart of concentrated ammonia, and as soon as all action ceases dilute with twenty-two gallons of water. Some persons advocate the dilution with twenty-eight gallons of water as being less injurious when applied to fruit.

May be used in greenhouses, and is especially useful in epiphytic diseases, such as Rose mildew, Hop mildew, and other *Erysiphæi* and surface moulds, like *Oidium.*

Arsenical Solution.—One ounce of arsenic dissolved in a little alcohol and mixed with 100 gallons of water.

This is recommended in America for spraying Carnation rust, but it must not be used on fruit trees or plants, on account of its poisonous nature.

Berichonne Mixture.—Dissolve six and a half pounds of sulphate of copper in four gallons of hot water. In another vessel dissolve seven and a half pounds of carbonate of soda. When cold mix the two solutions and add one pint and three quarters of liquid ammonia. Dilute with water to make forty-four gallons.

Similar in use to ammoniacal carbonate of copper.

Bordeaux Mixture.—Sulphate of copper sixteen pounds dissolved in twenty-two gallons of water. Thirty pounds of lime dissolved in six gallons of water. When the lime-and-water is cold mix the two solutions together slowly and thoroughly.

The above is the original formula, of which the following is a modification :—

Sulphate of copper six pounds, dissolved in four gallons of hot water. Four pounds of lime dissolved in four gallons of cold water. When the solutions are cold mix thoroughly, and when desired for use dilute to twenty-two gallons with cold water.

Air-slaked lime should never be used, since it injures the foliage.

This is considered to be the cheapest and best all-round fungicide; indeed general testimony is that "it is the most effective fungicide known."

Condy's Fluid.—See Potash Permanganate.

Eau Céleste, or *Blue Water.*—Dissolve one pound of sulphate of copper in three or four gallons of warm water. When completely dissolved, and the water has cooled, add one pint of liquid ammonia, then dilute to twenty-two gallons. The concentrated liquid should be kept in a keg, or some wooden vessel, and diluted when required for use.

The following is a modified formula :—

Sulphate of copper two pounds, carbonate of soda two and a half pounds, ammonia one and a half pint, to twenty-two gallons of water.

Dissolve the sulphate of copper in two gallons of hot water ; in another vessel dissolve the carbonate of soda in a similar manner ; mix the two solutions, and when all chemical reaction has ceased add the ammonia and dilute to twenty-two gallons.

Gastine Mixture.—Dissolve in one pint and three quarters of liquid ammonia two or two and a half ounces of carbonate of copper. To be diluted when required for use to twenty-two gallons by the addition of water.

Gishurst Compound.—A well-known preparation which is useful in some cases and has been recommended.

Iron Mixture.—Prepare a solution by dissolving two pounds of sulphate, of iron in five gallons of water and apply by sprinkling.

Another form : Water fifty gallons, sulphuric acid one pint, iron sulphate twenty-five pounds. Pour the sulphuric acid upon the iron sulphate, and then add by degrees the fifty gallons of water.

A metal vessel must not be used in the preparation, as it would be acted upon by the sulphuric acid.

This mixture may be used with great advantage where a disease has previously existed, to destroy the resting spores. In spraying fruit trees &c. it should be done in the winter, otherwise the foliage would be completely destroyed.

Jeyes's Fluid.—Watering with Jeyes's fluid in the proportion of one ounce to a gallon of rain water is beneficial in sterilising the soil, which should be thoroughly wetted and allowed to remain a week before anything else is planted.

Liquid Grison is prepared by boiling six pounds of sulphur and three pounds of lime in six gallons of water, until the whole is reduced to two gallons. Allow it to settle, pour off the clear liquid, and bottle it until used. For use mix one part of the liquid with one hundred parts of water.

Paraffin.—A wine-glassful to two gallons of water has been used with effect to check the spread of the *Chrysanthemum* rust, and would doubtless be applicable to other rusts.

Potash Permanganate.—This is the well-known fluid called "Condy's fluid." It is more economical to buy the potassium permanganate, in the form of crystals, which dissolve readily in water. The solution should be pale-rose colour.

It has proved effectual in arresting the spread of rust, and was employed successfully to Hollyhock seedlings when the brand was in full activity. Rusted Carnations may be sponged with it.

Potassium Sulphide.—Dissolve one ounce of potassium sulphide, popularly known as "liver of sulphur," in a quart of hot water, then make it up to two and a half gallons with cold water. Useful to check the spread of an epidemic, and proved successful against *Chrysanthemum* rust.

Sulphate of Copper Solution.—Dissolve one pound of sulphate of copper in twenty-five gallons of water, and spray with the solution.

Powders

may be applied by dredging from a flour dredger, or pepper pot, or enclosed in a canvas bag.

David's Powder.—Dissolve four pounds of sulphate of copper in as little water as possible. Slake fifteen pounds of lime in the smallest amount of water necessary, then mix the two preparations thoroughly and let the compound dry, after which it is crushed and sifted and applied in the form of powder.

Sulphatine.—Mix two and a half pounds of anhydrous sulphate of copper with fifteen pounds of finely powdered sulphur and ten pounds of air-slaked lime. Apply in powder.

Sulphur.—This is used as a dry powder in the condition known as "flowers of sulphur." It is most effective against the fungi which are epiphytic, in which the mycelium is entirely superficial, forming a dense white felt on the surface of the leaves, as in the Hop mildew, Rose mildew, and Pea mildew. Sometimes finely powdered quicklime may be mixed with the sulphur.

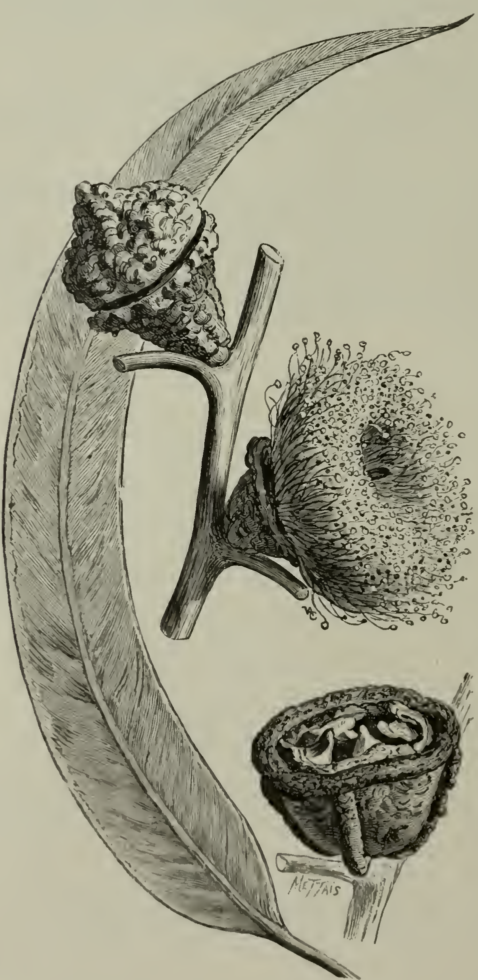
EXPLANATION OF PLATES I. TO VI.

(*The magnified portions are* × 320 *diameters, unless where otherwise stated.*)

Fig. 1.—*Phyllosticta helleborella*, Sacc.—*a*, section of perithecium enlarged; *b*, sporules ×
2.—*Septoria Hellebori*, Thum.—*a*, section of perithecium enlarged; *b*, sporules ×
3.—*Coniothyrium Hellebori*, C. & M.—*a*, sporules ×
4.—*Ramularia Hellebori*, Fckl.—*a*, threads and conidia ×
5.—*Peronospora Ficariæ*, Tul. Hyphæ and conidia ×
6.—*Plasmopara pygmæa*, Ung. Hyphæ and conidia ×
7.—*Urocystis Anemones*, Pers.—*a*, glomerules of spores ×
8.—*Æcidium punctatum*, Pers. Two cluster-cups enlarged.—*a*, æcidiospores ×
9.—*Glæosporium Aquilegiæ*, Thum.—*a*, conidia ×
10.—*Ascochyta Aquilegiæ*, Roum.—*a*, section of perithecium enlarged; *b*, sporules ×
11.—*Phyllosticta Pæoniæ*, S. & S.—*a*, section of perithecium enlarged; *b*, sporules ×
12.—*Cronartium Pæoniæ*, Cast.—*a*, column enlarged; *b*, sporules × ; *c*, sporules germinating ×
13.—*Cladosporium Pæoniæ*, Pass. Hyphæ and conidia ×
14.—*Botrytis Pæoniæ*, Oud. Clusters of conidia *in situ* ×
15.—*Peronospora arborescens*, Berk. Portion of thread with conidia ×
16.—*Cercospora Resedæ*, Fckl.—*a*, hyphæ and conidia ×
17.—*Phyllosticta Violæ*, Desm.—*a*, section of perithecium enlarged; *b*, sporules ×
18.—*Septoria Violæ*, West.—*a*, section of perithecium enlarged; *b*, sporules ×
19.—*Urocystis Violæ*, Fisch.—*a*, glomerule of spores ×
20.—*Puccinia Violæ*, Schum.—*a*, uredospores; *b*, teleutospores ×
21.—*Æcidium Violæ*, Schum.—*a*, cluster-cups; *b*, æcidiospores ×
22.—*Puccinia ægra*, Grove.—*a*, æcidiospores; *b*, uredospores; *c*, teleutospores ×

FIG. 23.—*Ramularia lactea*, Desm.—*a*, threads and conidia ×
24.—*Peronospora Violæ*, DBy. Hypha with conidia ×
25.—*Alternaria Violæ*, Gall.—*a*. conidia ; *b*, germinating ×
26.—*Cercospora Violæ*, S.—*a*, hyphæ and conidia ×
27.—*Phyllosticta Dianthi*, West.—*a*, section of perithecium enlarged ; *b*, sporules ×
28.—*Ascochyta Dianthi*, A. & S. With sporules ×
29.—*Septoria Lychnidis*, Desm. With sporules ×
30.—*Peronospora parasitica*, DBy. Hypha with conidia ×
31.—*Septoria sinarum*, Speg.—*a*, section of perithecium enlarged ; *b*, sporules ×
32.—*Marsonia Delastrei*, De Lacr.— *b*, conidia ×
33.—*Ustilago violacea*, Pers.—*a*, anther ; *b*, spores ×
34.—*Sorosporium Saponariæ*, Rud.—*a*, glomerule of spores ×
35.—*Puccinia Dianthi*, Nssl.—*a*, uredospores ; *b*, teleutospores ×
36.—*Puccinia Silenes*, Schr.—*a*, uredospores ; *b*, teleutospores ×
37.—*Uromyces Dianthi*, Nssl.—*a*, uredospores ; *b*, teleutospores ×
38.—*Macrosporium nobile*, Vize.—*a*, conidium ×
39.—*Heterosporium echinulatum*, Berk.—*a*, threads with conidia ×
40.—*Bacterium Dianthi*, Ar. & B.—*a*, sporules × 2,000
41.—*Phyllosticta destructiva*, Desm.—*a*, section of perithecium enlarged ; *b*, sporules ×
42.—*Puccinia malvacearum*, Corda.—*a*, teleutospores ×
43.—*Colletotrichum Althææ*, South.—*a*, conidia ×
44.—*Melampsora hypericorum*, DC.—*a*, uredospores ; *b*, teleutospores ×
45.—*Fusarium Pelargonii*, Cooke.—*a*, conidia ×
46.—*Glæosporium Pelargonii*, C. & M.—*a*, conidia ×
47.—*Uredo Tropæoli*, Desm.—*a*, uredospores ×
48.—*Uromyces Anthyllidis*, Grev.—*a*, uredospores ; *b*, teleutospores ×
49.—*Septoria rosarum*, West. With sporules ×
50.—*Actinonema Rosæ*, Lib. With sporules ×
51.—*Phragmidium subcorticium*, Sch.—*a*, uredospores ; *b*, eleutospore ×
52.—*Peronospora sparsa*, Berk. Portion of thread with conidia ×
53.—*Botryosphæria diplodia*, Moug. With asci and sporidia ×
54.—*Sphærotheca pannosa*, Lev.—*a*, conidia ; *b*, conceptacle ; *c*, ascus and sporidia ×
55.—*Septoria Œnotheræ*, West. With sporules ×
56.—*Phyllosticta Loniceræ*, West.—*a*, section of perithecium enlarged ; *b*, sporules ×
57.—*Lasiobotrys Loniceræ*, Kunze. With asci and sporidia ×
58.—*Oidium Chrysanthemi*, Rabh.—*a*, conidia ×
59.—*Uredo Chrysanthemi*, Arth.—*a*, uredospores ×
60.—*Puccinia Centaureæ*, DC.—*a*, pustule on stem enlarged ; *b*, uredospores ×
61.—*Coleosporium Senecionis*, Pers.—*a*, uredospores ×
62.—*Phoma devastatrix*, B. & Br.—*a*, receptacle enlarged ; *b*, sporules ×
63.—*Puccinia Gentianæ*, Sw.—*a*, uredospores ; *b*, teleutospores ×
64.—*Phyllosticta primulæcola*, Desm.—*a*, section of perithecium enlarged and sporules ×
65.—*Ascochyta Primulæ*, Trail. With section of perithecium enlarged ; and *a*, sporules ×
66.—*Septoria Primulæ*, Berk. With section of perithecium enlarged ; *a*, sporules ×
67.—*Ovularia interstitialis*, Berk. Threads with conidia ×
68.—*Ramularia Primulæ*, Thum.—*a*, threads with conidia ×
69.—*Uromyces Primulæ*, DC. With teleutospores ×
70.—*Puccinia Primulæ*, DC.—*a*, uredospores ; *b*, teleutospores ×
70*.—*Peronospora candida*, Fckl. Resting spore ×
71.—*Heterosporium Auriculæ*, Cooke.—*a*, threads with conidia ×
72.—*Puccinia Vincæ*, Berk.—*a*, uredospores ; *b*, teleutospore ; *c*, æcidiospore germinating ×
73.—*Marsonia Ipomææ*, C. & M.—*a*, conidia ×
74.—*Oidium erumpens*, Cooke.—*a*, tuft enlarged ; *b*, conidia ×
75.—*Urocystis primulicola*, Magn.—*a*, glomerules ×
76.—*Ramularia Petuniæ*, Cooke.—*a*, threads with conidia ×
77.—*Septoria Lavandulæ*, Desm.—*a*, section of perithecium enlarged ; *b*, sporules ×
78.—*Peronospora Hyoscyami*, DBy. Portion of thread with conidia × ; *a*, conidium germinating ×
79.—*Uredo filicum*, Desm.—*a*, uredospores ×
80.—*Botrytis elliptica*, Berk. Portion of thread with conidia ×

Fig. 81.—*Æcidium Convallariæ*, Schum.—*a*, æcidiospores ×
82.—*Rhizopus necans*, Mass. Tuft × 5
83.—*Uromyces Ornithogali* Wallr.—*a*, pustules enlarged; *b*, teleutospores ×
84.—*Puccinia liliacearum*, Duby.—*a*, teleutospores ×
85.—*Heterosporium Ornithogali*, Klot.—*a*, threads with conidia ×
86.—*Uromyces Scillarum*, Grev.—*a*, teleutospores ×
87.—*Septoria brunneola*, Fries.—*a*, sporules ×
88.—*Botrytis galanthina*, B. & Br. Apex of thread with conidia ×
89.—*Puccinia Schroeteri*, Pass.—*a*, teleutospores ×
90.—*Heterosporium gracile*, Wallr.—*a*, threads with conidia ×
91.—*Puccinia Iridis*, DC.—*a*, uredospores; *b*, teleutospores ×
92.—*Mystrosporium adustum*, Mass. Conidia ×
93.—*Uromyces Colchici*, Mass.—*a*, teleutospores ×
94.—*Urocystis Colchici*, Rabh.—*a*, glomerules ×
94*.—*Urocystis Gladioli*, Smith. Glomerule with spore ×



ON ORNAMENTAL TREES AND SHRUBS IN THE GARDENS AT CASTLEWELLAN, CO. DOWN, IRELAND.*

By the Right Hon. THE EARL OF ANNESLEY.

[July 8, 1902.]

I HAVE derived myself such an infinite amount of pleasure from the collection, the culture, and the possession of beautiful and new and rare plants that I was very glad to receive an invitation from our excellent Secretary to contribute a paper on ornamental trees and shrubs, to be read before the Royal Horticultural Society. Considering that we have now about six thousand members, I hope that it may be a means of increasing the knowledge and the love of numbers of plants which, though at present rare in most gardens, are both ornamental and easy of cultivation. The plants I shall mention are all grown in my own garden, and are hardy with me, the definition of the word "hardy" being that they remain in the open air through the winter without protection of any sort.

I have been endeavouring for many years to introduce, and to acclimatise, a number of exotic plants which are generally said to be tender, or half-hardy; and I believe that there are many of these which from sheer ignorance we put under glass, and give hothouse treatment to, when in reality they would do quite well in the open air if they were tried under favourable circumstances. I may instance as an example the common *Aucuba japonica*. When it was first introduced it was kept in heat, and not for a long time was it put out in the open; as we all know now, it is quite as hardy as the Laurel.

I propose to speak chiefly of things which are half-hardy or greenhouse plants, but which I have found after many years' trial do perfectly well with me out of doors. If I can, by mentioning their names with a few words of description, induce any of my hearers to give some of them a trial in their gardens, I think it may perhaps be of use. When we think of the numbers of fine things which may now be brought to us so quickly, so easily, and so cheaply from all parts of the world by our big ocean liners, why should we be satisfied with the ancient Laurels and Portugals and Aucubas, which are often the principal ornaments of our shrubberies and pleasure grounds? There are so many plants, both beautiful and desirable, that are worth mentioning that I fear, having regard to the shortness of the time at our disposal, that the lecture may almost degenerate into a sort of catalogue. When I told my gardener

* The illustrations are from plants photographed in the gardens at Castlewellan.

that our Secretary had asked me to make these observations before the Royal Horticultural Society, he promptly presented me with a list of 300 different plants in the garden, any one of which he said it would be a shame to omit! However, out of the 1,600 varieties which are in the plant list of my garden I must try and select the most desirable ones.

One word about the garden where these things are grown. It is on one of the foot hills of the Mourne Mountains in the county of Down, about three miles from the Irish Channel, thus benefiting by the mild influence of the Gulf Stream: it faces east and south, and is surrounded by old forest trees, so that it is well sheltered. We suffer little from frost; ten degrees is the average; once, in the hard winter of 1895, we had fifteen degrees. The rainfall is about thirty-two inches; the subsoil is gravel, and as it lies on rather a steep hill there is perfect drainage—a great advantage for tender, as indeed it is for all plants.

If I were asked the country from which we obtain the greatest number of our choicest hardy plants I should name Japan; and I believe there are still many beautiful things there which are not known at all in our gardens. For instance, has any one ever seen here—

DISANTHUS CERCIDIFOLIA, with leaves blood-red; or

RHUS TRICHOCARPA, with scarlet and orange leaves; or

PICRASMA QUASSIOIDES, with leaves changing from orange to scarlet; or

ILEX SUGEROKI, with fruit of a bright scarlet?

They are in no catalogues that I have seen, either in this country or on the Continent, and I have tried in America without success; not even in the beautifully illustrated catalogue of the Yokohama Nursery Company are they to be found; and yet from the description in Professor Sargent's book they are very much to be desired. One of the principal points to be attended to in beautifying a garden is the contrast of colour, of brilliant colour if you can manage to get it; and the plant from Japan which of all others I find most useful in this respct is the *Acer japonicum polymorphum atropurpureum* (it is a pity it has such a long name, but we can follow the example of the ladies and call it the Red Maple). Those who have seen the Canadian forests in the fall of the year, when the Sugar Maples are first touched by the frost, will tell you how glorious colour can be; but I have never seen even there anything more magnificent than this Japanese Maple when it turns scarlet about a week or so before the leaf falls off. If you get a large plant of it between you and the sun at that time, it is so brilliant and intense a scarlet that a soldier's coat would look dull and colourless beside it. In the early spring the foliage is bright blood-red, and as the sun increases in power it changes to a dark purplish green where the rays strike. It is perfectly hardy, and the severest frost has no effect on it. Notwithstanding all these good qualities, how is it that you hardly ever see it even in the best gardens? At Kew, even, there are very few plants of it. There is a story of Dr. Johnson being asked by a lady how he came to spell a word wrongly in his dictionary, and he replied, "Ignorance, madam; pure ignorance!" I must suppose that it is only from ignorance of the beauty of the Japanese Maple that it is not to be found in every garden, as it surely ought to be.

It has only one fault: it will not strike from cuttings. To increase it you must propagate it by layering, or budding, or grafting. I have done so by the hundred, and now my difficulty is to find places to put them; for the colour effect of a large well-grown plant is so striking that it must stand absolutely by itself on the grass. For culture it requires to have the longest shoots shortened at the end of January to induce a dense habit of growth, and the soil we find best is plain loam, with a little spent Mushroom manure and leaf soil added.

JUNIPERUS SANDERI.—A dwarf bushy variety, with bright green foliage, introduced by Mr. Sander from Japan. It is a slow grower, and is not yet in commerce. It will be probably some years before it is sent out.

MUSA BASJOO.—A hardy Japanese Banana: it has been planted out with me about four years, and makes leaves four feet long and twenty inches in breadth. It has not fruited yet, but it is something to have a Musa which will live at all in the open air.

BROUSSONETIA PAPYRIFERA, a shrub or small tree allied to the Mulberry, with pointed leaves, somewhat egg-shaped, and deep scarlet fruit.

The Japanese use the young shoots for the manufacture of paper, which is of a whitey-brown colour and exceedingly strong. It is of rather luxuriant growth, and makes a handsome specimen. It is quite hardy here, and has attained a height of six feet.

AKEBIA QUINATA.—A Japanese climbing plant. Its branches hang down in graceful festoons from the trees to which it is attached attracting attention by the fragrance of their dark purple-brown flowers.

BERCHEMIA RACEMOSA.—Another climber from Japan, a very fast grower, with red bark.

POURTHIÆA VILLOSA.—A small graceful tree with oval sharp-pointed leaves and bearing clusters of white flowers. The foliage turns to a beautiful scarlet colour in the autumn. It is about eight feet high.

HOVENIA DULCIS.—A Japanese shrub of fast growth, having large leaves and handsome white flowers.

ERIOBOTRYA JAPONICA.—A fine evergreen shrub with leaves nearly a foot long by six inches wide, the Japanese Medlar. With me, although it is twelve feet high, it has not fruited yet.

KADSURA JAPONICA is a fast-growing twining plant with dark green glossy leaves and white flowers.

RHUS TOXICODENDRON, or Poison Ivy.—A very beautiful climbing plant, somewhat like *Ampelopsis Veitchii*, but smaller and more delicate in the foliage, which turns a reddish yellow in the autumn. Professor Sargent says "it is one of the common plants in all the central parts of Hondo and Yezo, where it grows to its largest size and climbs into the tops of the tallest trees." It is so exceedingly dangerous and poisonous that I doubt whether it ought to be allowed in any garden, at least where ladies and children can have access to it. After touching the leaves in a short time the victim becomes aware of irritation in the eyelids, which rapidly increases till it is almost intolerable. They become so swollen that they are almost closed. The rest of the face becomes gradually involved, the eruption and swelling always moving from the forehead downwards. Blisters form upon the surface and weep copiously like those of eczema, the glands of the neck become enlarged, and there is much difficulty in eating or even speaking. Last autumn we had the usual harvest service in the church, and the ladies and children helped to decorate it. Unfortunately they chose the Poison Ivy to adorn the pulpit, from the beauty of its colouring ; one after another they all became ill, some more and some less. The German governess was confined to her bed for more than a week and suffered terribly. One lady consulted a specialist for skin disease, and she was told she had blood poisoning, and sent to Harrogate for three weeks. The specialist wrote to me to say that blood poisoning often was caused by bad drains, and strongly advised that they should be tested. I did not quite know what to think about it, when one day three under-gardeners were laid up with it, though very slightly. That settled the matter : it was *Rhus Toxicodendron*, and not blood poisoning at all ! I heard a story of a lady living in the country who suffered from eczema and blood poisoning every autumn—so bad was it that her husband thought the house unhealthy and decided to leave it and take another, which he did. However, his wife was so fond of a fine plant of *Rhus Toxicodendron* which they had in the garden that she moved it to the new house, and it was not till some time after that she discovered that it was the cause of her illness. It is well to note that this *Rhus* has been sent out by some nurserymen as a variety of *Ampelopsis japonica* under the name of *A. Hoggi* ; therefore any one having a plant under that name should be very careful not to touch it. It is curious that some people are not affected by it, but it is so terribly painful that I do not advise any one to experiment much with it. I have had the only plant that people could easily get access to in my garden burnt. Mrs. Tweedie in her travels in Mexico mentions that she was confined to her bed for fifteen days from Poison Ivy. She says : " The parasite in hot climates grows rank, generally in damp shady barrancas, where it spreads prolifically. It is most poisonous when in bloom. Then the pollen flies, and you may be poisoned without touching the plant. The Indians live in constant dread of approaching the creeper. The poison raises large lumps, red and swollen like bites ; pus forms, and a kind of blood poisoning attended by pain and danger sets in."

IDESIA POLYCARPA.—A handsome Japanese tree with large heart-shaped leaves on bright red stalks. It requires careful pruning to keep it in shape, as it is rather a straggling grower. (Fig. 102.)

RAPHIOLEPIS OVATA.—A dwarf evergreen shrub with sweet-scented white flowers, something like Hawthorn, and bluish berries. It is from Japan, and grows four feet high.

RHUS VERNICIFERA.—A tree growing in Japan to thirty feet in height. It has leaves like the Walnut, only elongated, and is interesting, as it is from it the Japanese derive their celebrated lacquer.

HALESIA HISPIDA, or *PTEROSTYRAX HISPIDUM*, has large leaves, eight inches long and four wide. The flowers are white and

FIG. 102.—IDESIA POLYCARPA.

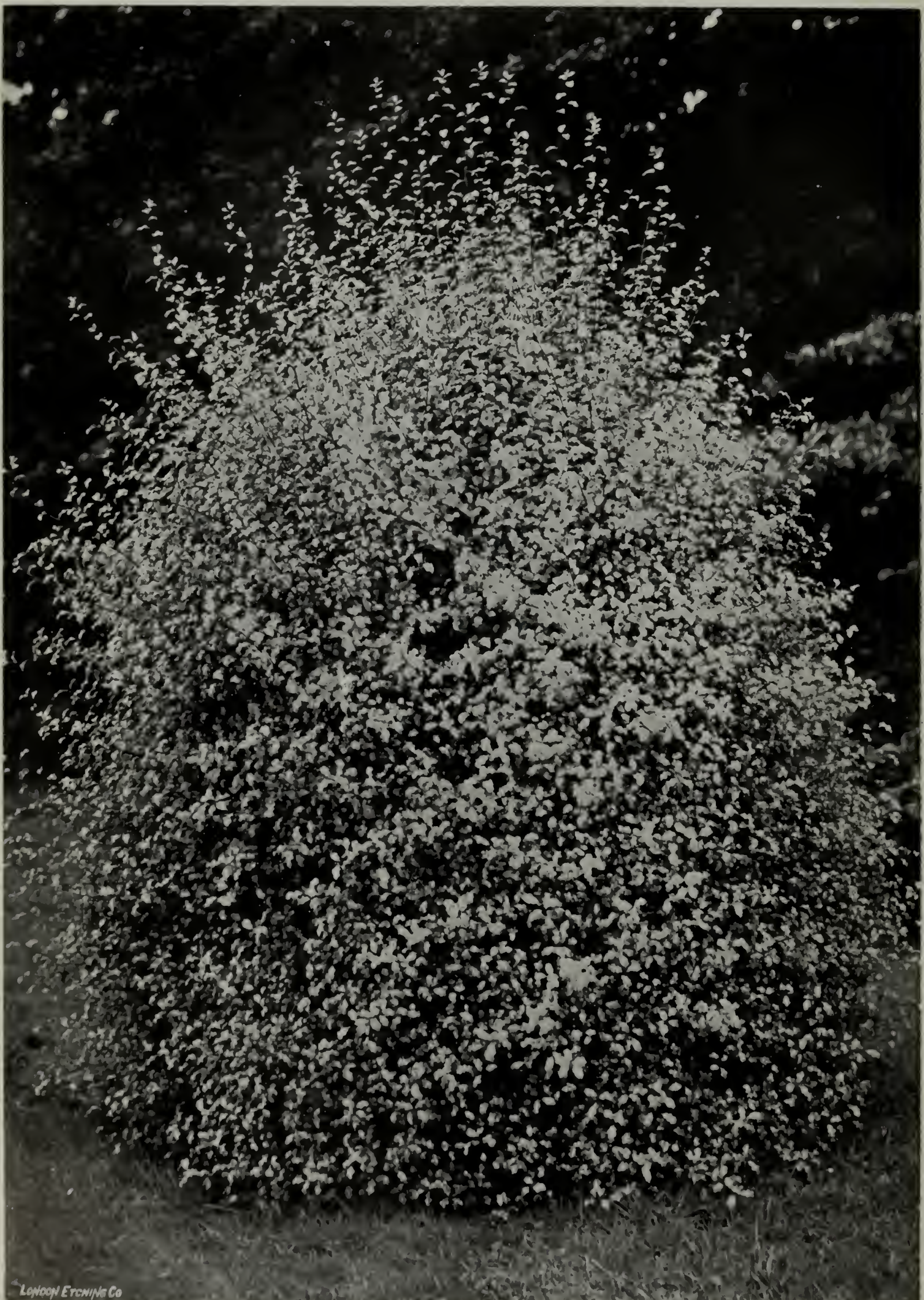


Fig. 103.—Pittosporum Colensoi.

Fig. 104.—Pittosporum Mayi.

Fig. 105. Plagianthus Lyallii.

borne in drooping clusters in July. It is a strong grower and requires liberal treatment as regards soil, as it forms plenty of fibrous roots. Two years ago I had to move a plant eighteen feet high. It carried a ball of over a ton in weight, and is now quite healthy in its new quarters.

SCIADOPITYS VERTICILLATA.—The Umbrella Pine of Japan, one of the most distinct and beautiful of all the conifers. It is most distinct, and too well known in our gardens to need description. When in perfect health the leaves are deep green, but very often there is a tinge of yellow. It is said to be a slow grower; however we find it makes a foot of growth in the season; it has produced cones for several years past. The soil should be peat and leaf soil in equal parts, with perhaps a very little loam.

MAGNOLIA HYPOLEUCA is one of the largest and most beautiful of the deciduous Magnolias. In the early autumn, when the cones of fruit which are sometimes eight inches long and brilliant scarlet in colour stand out on the branches, it is the most striking feature of the forests of Hokkaido. The leaves are fourteen inches long and eight broad, and on young and vigorous trees sometimes twice that size. On the upper surface they are light green and almost silvery beneath. It is used in Japan for all sorts of objects which are to be lacquered, especially sword-sheaths. With me it has not flowered as yet. In some parts of Japan it grows to the height of 100 feet. It was introduced into this country by Mr. Veitch not many years ago.

VITIS THUNBERGII I have grown for twenty-five years. It is one of the finest climbers I know, and for covering large wall spaces is unsurpassed. The leaves become a deep crimson in autumn, interspersed with shades of purple and yellow. I believe that it is a distinct plant from *Vitis Coignetiæ* and the better variety of the two.

ARDISIA JAPONICA.—A dwarf evergreen shrub bearing clusters of white flowers early in June and red berries in autumn.

BERBERIS THUNBERGII.—A dwarf spreading Japanese variety, of bushy habit, most valuable for the brilliant scarlet colour of its leaves and berries in autumn. I notice that it is very much brighter in colour in some years than in others.

LESPEDEZA BICOLOR, also called *Desmodium penduliflorum*, a deciduous dwarf shrub of neat, graceful habit. The flowers, Pea-shaped and rosy purple in colour, are lavishly produced on the long pendulous panicles for several weeks in the autumn.

CLEYERA JAPONICA TRICOLOR.—A handsome variegated evergreen shrub; leaves dark green with white margin tinged with rose. Said to be a greenhouse plant. I have grown it in the open for many years with success. It is very brittle, and liable to be broken by heavy snow.

RETINOSPORA TETRAGONA AUREA.—This is, in my opinion, one of the most beautiful plants in the garden, but to attempt to describe its habit and foliage is difficult. The colour is a rich, one might almost say, ruddy gold mixed with bright green and yellow. I have a plant about five feet high, and never pass it without stopping to admire it. It is a very slow grower.

RETINOSPORA FILIFERA AUREA.—A golden shrub with long pendulous threadlike branchlets. It appears to be a somewhat dwarf form of *R. filifera*.

CERCIDIPHYLLUM JAPONICUM, introduced into this country about ten or twelve years ago, grows in its native land to 100 feet high: it is very hardy and grows rapidly. In its young state it is fastigiate in habit and is valuable for the colour of its leaves, which when they unfold in early spring are bright rosy red.

CÆSALPINIA JAPONICA.—A low spreading shrub with most delicate and graceful foliage, introduced about twenty years ago, the branches covered with very sharp hooked thorns. With me it is ten feet in diameter, and only two feet high, the wood somewhat brittle and easily broken.

DAPHNIPHYLLUM GLAUCESCENS. — A strong-growing vigorous evergreen with large glaucous leaves and dense habit; the flowers are small and inconspicuous, and are succeeded by small purple berries. It makes a very fine specimen standing by itself on the grass. A quick grower, eight feet high, with a circumference of forty feet.

DAPHNIPHYLLUM JEZOENSE is a dwarf variety, of bushy habit, about a foot and a half high.

DAPHNIPHYLLUM MACROPODIUM VARIEGATUM.—A distinct shrub, the variegation creamy-white.

QUERCUS BAMBUSÆFOLIA.—An evergreen Oak which has graceful pointed leaves of an olive colour, which, as its name implies, are much more like a Bamboo than an Oak.

STUARTIA PSEUDO-CAMELLIA.—A deciduous shrub with white flowers, not unlike those of *Carpenteria californica*; a very free grower.

ENKIANTHUS JAPONICUS.—A small hardy deciduous shrub whose leaves turn in the autumn to a most splendid scarlet colour, more brilliant than almost anything else in the garden.

CLERODENDRON TRICHOTOMUM.—A handsome hardy Japanese deciduous shrub bearing red and white flowers in September.

PITTOSPORUM TOBIRA.—The native name of a Japanese evergreen shrub with dark green smooth leaves and very fragrant white flowers.

BAMBUSA METAKE is well known now in our gardens, being one of the most commonly cultivated sorts, owing to its fine bold growth and its extreme hardiness.

ABIES VEITCHII.—The best of all the Silver Firs, introduced from Japan in 1860. The foliage is bright silver underneath, and when moved by the wind is very beautiful. It is quite hardy.

ABIES FIRMA.—A fast-growing Fir with fine deep green glossy leaves. Introduced about thirty years ago.

ABIES MARIESII.—From Japan in 1879. My plants are too small to have shown their character yet.

PINUS THUNBERGII.—A fast-growing Pine of stately proportions. It is the tree chiefly used by Japanese gardeners for topiary work.

ILEX LATIFOLIA.—From Japan in 1840. It has large light green serrated ovate leaves. A handsome shrub, more like a Laurel than a Holly. I have had it out about twenty years.

STYRAX JAPONICUM.—A small tree bearing in autumn sweet-scented white flowers with yellow stamens; the flowers, being borne underneath the branches, are completely hidden from the view.

OSMANTHUS ILICIFOLIA, O. AUREA and *ARGENTEA, O. MYRTIFOLIA, O. PURPUREA.*—All, with pretty serrated leaves and small sweet-scented flowers, are quite worth growing. I have one five feet high and thirty feet round; a dense mass shaped exactly like a plum-pudding.

HAMAMELIS ARBOREA.—A deciduous Japanese shrub of spreading habit; grows about five feet high. It flowers in January. The flowers are of a curious shape, with yellow petals and claret-coloured stamens.

OLEA FRAGRANS.—A pretty bushy shrub of compact growth with yellowish-white flowers borne in July.

ACANTHOPANAX RICINIFOLIUM.—A very distinct small tree from Japan, introduced 1884, with heart-shaped leaves and prickly stems; grows fourteen feet high.

I have grown the above forty-eight plants from Japan for many years in my garden without any protection whatever, and I think it would be difficult to surpass them by those from any other single country, either for their interest or their beauty.

Next to Japan I think we get more good things from Australia than from anywhere else; all of the following forty-nine plants from that country grow with me with singular luxuriance, and it is a great advantage that they are nearly all evergreen, as owing to our abominable custom of going to London in the summer we are never in our gardens in the most enjoyable season of the year, when the plants are at their best, but see most of them in the winter.

First, both for number and beauty, come the Pittosporums. I grow twenty varieties, all perfectly hardy except

P. EUGENIOIDES.—A fine plant of this, ten feet high, was killed to the ground in the long frost of 1895.

The names are *P. Buchanani, P. Colensoi, P. coriaceum, P. crassifolium, P. erioloma, P. eugenioides, P. e. variegatum, P. floribundum, P. lucidum, P. tenuifolium, P. macrophyllum variegatum, P. Mayi, P. nigrescens, P. phillyrœoides, P. Ralphii, P. rhombifolium, P. rigidum, P. Tobira variegatum, P. undulatum.* Of these *P. Colensoi* is by far the most beautiful, both from its colour and its graceful habit. It sometimes loses a few inches of its topmost growths from severe frost, but it should be pruned over just before the spring, which improves it and keeps it dense. It is curious how little these Pittosporums are known or grown. We were honoured by a visit a couple of years ago from eighty members of the Royal Arboricultural Society of Scotland, and I do not think a dozen of them had ever seen one before—at least they asked their names. (Figs. 103, 104.)

P. MAYI is one of the most vigorous growers, and is very hardy; in fact, we put it in the most exposed places, where other things will not grow. It is not known from what country it comes, but I should think almost certainly from Australia or New Zealand. It is eighteen feet high with us, and fifty-seven feet in circumference. (Fig. 104.)

LEPTOSPERMUM BULLATUM.—A graceful New Zealand plant with white flowers, growing to ten feet in height.

L. STELLIGERUM and *L. LÆVIGATUM* grow to six feet high.

JAMBOSA AUSTRALIS.—A very fine evergreen shrub from New South Wales. It is like a Myrtle, but the leaves are larger and stouter; the colour is a darker green. The flowers are plentiful and pure white, succeeded by purple fruit. It is a fast-growing, vigorous shrub, and is never browned by frost or east winds like the Myrtle. It is known in Australia as the Brush Cherry.

LEUCOPOGON RICHEI.—A dwarf shrub from Australia bearing white flowers in spring: it does best in peat leaf soil and sand, and requires a sheltered position. Height three feet.

ACACIA BAILEYANA.—The Silver Wattle tree. A most graceful tree of quick growth. It is considered one of the most beautiful trees in New South Wales.

TECOMA AUSTRALIS.—A very elegant climber of neat habit. It bears a profusion of white and purple flowers.

TRISTANIA CONFERTA.—The Brush Box of New South Wales, a dwarf shrub having curiously frilled white flowers. It grows best in peat and sand, and requires a warm position.

OXYLOBIUM CALLISTACHYS.—A plant of upright habit bearing yellow flowers in terminal spikes. It grows five feet high.

SOLLYA HETEROPHYLLA.—The Australian Bluebell creeper. It has ovate lanceolate leaves with tubular blue flowers. Thrives in peat and sand.

MELALEUCA HYPERICIFOLIA.—An evergreen shrub from New South Wales. It has brilliant scarlet flowers in July, and is of a free-growing bushy habit.

EUCALYPTUS.—I cannot do much with the Eucalyptus. Twenty-four years ago I planted nineteen varieties of them: of these I find that *E. coccifera*, *E. cornigera*, and *E. urnigera* are quite hardy. The latter I have fifty feet high, but most of them grow so fast that they are very liable to be blown over by storms. They require shelter to do any good, and this it is sometimes difficult to give.

EMBOTHRIUM COCCINEUM.—When in flower few hardy plants can surpass this handsome evergreen in beauty. It is from South America, and bears masses of red flowers about midsummer.

CALLISTEMON SPECIOSUS.—The Bottle Brush tree of West

Australia. Flowers in July and August. The flowers, which are plentiful, are said to be scarlet, but I think they are more of an Indian red. There is a fine tree in the garden at Tresco Abbey about twenty feet high, and when it is in full flower it is well worth a journey to the Scilly Isles to see.

CORREA VIRENS.—A small evergreen from South Australia with greenish tube-shaped flowers, sometimes called the native Fuchsia, from its likeness to the blossoms of that flower. It flowers very freely here out of doors.

CLIANTHUS DAMPIERI from Australia. A low-growing climbing plant with clusters of red flowers. It does best on a wall in peat, sand, and loam.

LEPTOSPERMUM LÆVIGATUM.—A light graceful shrub from tropical Australia, called there the Sandstay, from its arresting drifting sand in the deserts. It flowers at midsummer and grows six or eight feet high.

DRIMYS AROMATICA.—A small dark green compactly growing Tasmanian bush with white flowers. The leaves on being crushed have a strong and very pleasant aromatic perfume. The fruit is used as a substitute for pepper.

GREVILLEA ROSMARINIFOLIA.—An evergreen shrub with greyish-green foliage from Tasmania. It has very bright crimson flowers in April.

ASTER ARGOPHYLLUS.—The Musk plant of New South Wales, with grey green leaves and white flowers. The leaves when bruised have a very strong musky perfume.

ATHROTAXIS LAXIFOLIA.—A very handsome and distinct Tasmanian evergreen tree, with small scale-like leaves of a deep green colour. It is very rarely seen in gardens.

ATHROTAXIS SELAGINOIDES.—From the same place. A larger tree of very dark-green colour, of stronger growth and more erect habit. With me it has attained the height of eighteen feet.

ACACIA MELANOXYLON.—An evergreen from South-eastern Australia with yellow flowers in May. Known as the Blackwood tree. In its native country it attains a height of eighty feet.

OZOTHAMNUS ROSMARINIFOLIUS.—An upright-growing greyish-green shrub from Australia. When it flowers (about midsummer) it resembles a mass of snow. It requires a sheltered position.

CALLICOMA SERRATIFOLIA.—A pretty evergreen shrub from New South Wales. It bears yellow flowers in June.

From New Zealand I may mention about two dozen plants which do well out of doors with me:—

FAGUS CLIFFORTIOIDES is a remarkably graceful evergreen tree from the South Island, where it grows to a height of fifty feet. It has very small heart-shaped leaves of a brownish colour, but the singular thing about it is that some of these turn to a brilliant scarlet, and being scattered singly all over the tree produce a most curious and pretty effect. I imported this from New Zealand in a Wardian case some years ago, and I believe it is a rare tree in this country. It is about six feet high, and is very ornamental indeed.

CORYNOCARPUS LÆVIGATA, the Karaka of New Zealand.—It attains sixty feet in height; a very handsome tree with large glossy light green leaves and white flowers. The wood is used by the natives for their canoes.

ENTELEA ARBORESCENS.—An ornamental shrub with large heart-shaped leaves and erect spikes of white flowers. It requires a good rich loam.

NOTOSPARTIUM CARMICHAELIÆ.—The New Zealand Pink Broom. When in flower, in August, few hardy plants surpass this in beauty. Last autumn it was a perfect sheet of bloom of a most brilliant mauve colour. It requires to be sheltered from strong winds, and if planted in peat, leaf soil, and loam soon becomes a good-sized bush about six feet high.

OLEARIA HAASTII.—This is now common. It bears its white flowers in such profusion in autumn that it makes a very fine mass of colour. It is eight feet high and fifty-two feet round. A most vigorous grower.

OLEARIA MACRODONTA has large and deeply indented leaves. It flowers so profusely at midsummer that the branches are bent down with the weight of the flowers. It is a very quick grower.

OLEARIA STELLULATA.—From Tasmania. Flowers in spring; has greyish leaves and Daisy-like flowers.

OLEARIA FORSTERI.—A fine evergreen, with white flowers; the leaves are a yellowish green. It grows to a height of ten feet, and is often injured by frost.

OLEARIA NUMMULARIFOLIA.—A dwarf variety with small yellowish-green leaves and white flowers.

MYOSOTIDIUM NOBILE.—The New Zealand Forget-me-Not does well here in the open. The large glossy deep green leaves and bright blue flowers which are borne in autumn are very handsome.

PLAGIANTHUS LYALLII. A beautiful semi-evergreen shrub from New Zealand growing eight feet high. The flowers are white, with yellow stamens, and are borne in autumn. (Fig. 105.)

EDWARDSIA GRANDIFLORA.—The New Zealand Laburnum is ten feet high, and the same in circumference. The flowers, which are in clusters, are bright yellow and very showy, in shape like a lobster's claw.

COROKIA COTONEASTER.—A dwarf bushy shrub, three feet high, with very small leaves and wiry stems; the flowers are bright yellow. It is deciduous, and in winter becomes a dense mass of a dark purple colour. It is very distinct, and quite unlike anything else in the garden. It should be by itself on the grass.

ACIPHYLLA SQUARROSA, commonly known as the Bayonet plant, is another curious New Zealander. It is a mass of light green spikes, the points as sharp as needles. It sends up flower stems four to five feet high.

ARISTOTELIA RACEMOSA.—A very fast-growing tree with leaves six inches long and four across, of a yellowish-green colour above, the under side light purple.

VITEX LITTORALIS.—An evergreen shrub with trifoliate leaves. The young shoots are liable to get blackened by frost.

CORDYLINE INDIVISA VERA.—A splendid foliage plant, which has almost gone out of cultivation in this country. The leaves are over three feet long and four inches across, dark green above, with the midrib and secondary nerves bright orange, under leaf glaucous. I procured some seed from New Zealand, and my gardener was fortunate enough to raise sixteen plants; a thing which Mr. Burbidge informs me has not been done in Europe for the last forty years. Hitherto we have kept it under glass in winter, but I have now planted out several large plants permanently. I am unable as yet to say that it is hardy here; it is hardy at Scilly.

LIBOCEDRUS DONIANA.—A small dense growing conifer with light green Selaginella-like foliage.

The Senecios are dwarf shrubs from two to five feet in height, of fine light-coloured foliage. They make a good contrast when planted near groups of darker evergreens; they require a light well-drained soil.

SENECIO FORSTERI.—An evergreen with white flowers and very bold deeply serrated leaves, of a green colour above and silvery white on the under side. It requires shelter. (Fig. 106.)

SENECIO GREYII.—A dwarf shrub with yellow flowers and silvery foliage, quite hardy here, and what gardeners call a good doer. Excellent on rocks.

SENECIO ROTUNDIFOLIUS.—A strong-growing shrub with large handsome leaves of a dusty grey colour edged with white. It has a broad spreading habit of growth and requires shelter.

SENECIO ELÆAGNIFOLIUS.—An upright strong-growing shrub, ten feet high, with leaves light green above and white underneath.

SENECIO COMPACTUS.—A dwarf form, growing nearly two feet high, with grey leaves edged with white. The flowers are in clusters and bright yellow.

PLAGIANTHUS BETULINUS.—The Ribbon tree of New Zealand, a very curious and graceful plant, having long slender pendulous branches. It is a very fast grower, and does well here. Height fourteen feet.

HYMENANTHERA CRASSIFOLIA.—A low-growing and spreading shrub from New Zealand with leaves like the Dwarf Box, the flowers yellowish and insignificant. It has quantities of small white berries during the winter.

MUEHLENBECKIA COMPLEXA.—A twining climber from New Zealand with foliage very distinct both in shape and colour. It forms a dense prostrate bush, the flowers small, fruit transparent and waxlike.

PSEUDOPANAX CRASSIFOLIUM.—A New Zealand shrub with thick fleshy leaves twenty inches long and half an inch broad, dark green in colour, with a midrib of bright orange.

DACRYDIUM FRANKLINII.—The Huon Pine of Tasmania, a tree of pendent spreading habit with foliage of a dull green colour and very distinct appearance. It is said to grow to 100 feet in its native place.

DACRYDIUM CUPRESSINUM requires a sheltered situation. From California I have about a dozen plants ; a very handsome one is *Castanopsis chrysophylla*, the Golden Chestnut : it grows thirty feet high in the Cascade Mountains ; with me it is rather a spreading bush, the ovate leaves are light green above, and the under sides are covered with bright yellow powder. Plant it if possible on a height, so that you can see the colour of the under leaf.

UMBELLULARIA CALIFORNICA.—A very nice evergreen, valuable both for the beauty of its leaves and for their fragrance ; when bruised they emit a most aromatic and powerful perfume.

BERBERIS FREMONTII.—From the Southern States of America. A hardy evergreen shrub of very neat habit and delicate appearance. The leaves are of a glaucous blue colour : it is one of the handsomest and most distinct of the Berberis. It requires a light peaty soil, and it has but one fault—it is a terribly slow grower.

ABIES CONCOLOR, var. *ARIZONICA.*—This is the latest introduction of the Abies. The bark is exactly like a Cork tree, but whiter in colour. The plants are so small one cannot say much about them as yet, but they appear like *Abies concolor violacea.* (Fig. 107.)

PINUS TUBERCULATA.—A most singular Pine : it produces cones in clusters along the main trunk, as well as on the branches, and they remain on the tree for years before dropping. The foliage is bright green and six inches in length.

CEANOTHUS CUNEATUS, from California, is a fast-growing shrub with small light-green leaves and clusters of pale blue flowers. It grows eight feet high.

CEANOTHUS AZUREUS.—From Mexico. Flowers early in summer. Height nine feet.

CEANOTHUS GLOIRE DE VERSAILLES is a very fine variety.

HETEROMELES ARBUTIFOLIA.—A synonym for *Photinia*, the Californian Maybush. A handsome small-growing evergreen with serrated leaves ; flowers white, petioles and young branches bright red.

NUTTALLIA CERASIFORMIS.—The earliest plant in the garden. In February, often in deep snow, it begins to show its delicate pale green leaves. The flowers are small and white. It is very hardy, and will succeed in almost any soil or position.

Fig. 106.—Senecio Forsteri.

FIG. 107.—ABIES CONCOLOR VIOLACEA.

Fig. 108.—Abies bracteata.

FIG. 109.—CUPRESSUS LAWSONIANA.

DESMODIUM ARGENTEUM.—A fast-growing deciduous shrub with silvery trifoliate foliage and long spikes of rosy-pink flowers. It is very distinct and handsome.

ABIES BRACTEATA.—This stately Californian Fir does very well with me, though it is said to be difficult to grow in some places. It is a fast grower, making about twenty inches annually. A specimen fifteen years old is now twenty-three feet high and feathered down to the ground. The young growth has never been injured by spring frost. (Fig. 108.)

ABIES AMABILIS.—A very fine Fir with dark green foliage, silvery underneath.

FRAXINUS VELUTINA, from Arizona, is a graceful quick-growing deciduous tree, only lately introduced.

GARRYA THURETI.—A handsome dark-leaved evergreen, a hybrid from *Garrya elliptica*, a well-known Californian plant, generally grown on a wall. It has catkins ten inches long. Colour of leaves greyish green.

From Chili we have fifteen good things. One of the best is *Tricuspidaria hexapetala*, which is better known as *Crinodendron Hookerianum.* It grows to about five feet high, the foliage dark green, the flowers a rich crimson on long peduncles. This is a beautiful plant when in flower, and we used to keep it in the house in winter, being afraid of losing it; but we have had it in the open for many years now. It flowers regularly and is perfectly healthy.

FABIANA IMBRICATA.—An erect evergreen Heath-like shrub producing white flowers in June. It does best in a sheltered position.

PHILESIA BUXIFOLIA.—A small dark-leaved shrub bearing flowers somewhat like *Lapageria rosea.* It should have peat and leaf soil, equal parts, in a damp shaded border.

MITRARIA COCCINEA.—A dwarf evergreen shrub producing most brilliant scarlet flowers in succession for several months; quite hardy; it forces well. We always have some large plants in 12-inch pots to flower in the orangery in March.

BERBERIDOPSIS CORALLINA.—A very pretty climbing evergreen. The flowers are crimson, in drooping racemes.

EUCRYPHIA PINNATIFOLIA.—One of the finest of the autumn-flowering shrubs. It has a profusion of large pure-white flowers with yellow anthers. It grows to a height of eight feet here.

ABUTILON VITIFOLIUM.—A quick-growing evergreen plant with large Vinelike leaves and light blue flowers. It is very showy during the summer.

CESTRUM PARQUI.—A late autumn-flowering shrub; the flowers in spikes, about six inches long, are of a creamy-white colour.

EUGENIA UGNI.—A dwarf evergreen from South Chili with dark green leaves and edible purple fruit.

LARDIZABALA BITERNATA.—A wonderfully vigorous climber with very handsome large glossy dark green leaves and clusters of white and purple flowers.

DESFONTAINIA SPINOSA.—A very fine evergreen, sometimes called the Chilian Holly, the leaves being very similar to the common Holly. It produces its flowers very freely from July well into November. They are tubular and of a crimson and yellow colour. The soil and climate here seem to suit it well. The largest plant is eleven feet high and fifty feet in circumference. It is planted in peat and loam. Young plants a foot or two high flower freely. It is most easily raised from cuttings.

RHAPHITAMNUS CYANOCARPUS.—A distinct prickly evergreen shrub from Chili. The flowers are produced in May, and are of a beautiful pale blue colour. It has dark blue berries in autumn. It grows to a height of seven feet and must have shelter; if exposed to the east wind the bark is liable to crack, and then the branch withers and dies. Although I have had it out of doors five or six years, I should only call it half-hardy.

PSORALEA GLANDULOSA is a tall-growing bush of open habit with bluish flowers borne in spikes nine inches long. It is fourteen feet high. It flowers in autumn and remains in flower for a long time.

LIBOCEDRUS CHILENSIS.—A very fine and distinct evergreen tree; the leaves, of a light glaucous green, are scale-formed and compressed. The whole effect of the tree is very delicate and graceful. It grows with me to about fifteen feet high.

PODOCARPUS CHILIANA, better known as *P. andina*, the Plum Fir, is a distinct and beautiful evergreen conifer, the leaves being linear and flattened, dark green above and slightly glaucous beneath. It grows here to twenty-five feet high.

From China I have nineteen plants worth noticing.

GLYPTOSTROBUS (or *TAXODIUM*) *HETEROPHYLLUS* is a most beautiful and graceful deciduous shrub of pyramidal form, with light green foliage, changing to yellow in autumn. It grows to ten feet in height in China; with me it is five feet high; and when in leaf it looks more like a huge Fern than a shrub. Mr. Veitch tells me he thinks that this is the rarest coniferous shrub in British gardens. More is the pity, for it is certainly one of the most beautiful. It is never injured by frost.

SCHIZANDRA CHINENSIS.—A quick-growing wall climber, rather like *Rhus Toxicodendron*, whose leaves change to a most brilliant scarlet and yellow in autumn.

ACTINIDIA KOLOMIKTA.—A very good twining plant with heart-shaped leaves, five inches long, which change in autumn to white and red.

LARIX KAEMPFERI.—A very fine Larch with leaves much larger and handsomer than the common one. In spring they are of a beautiful soft light green colour, and in autumn a golden yellow. I have a very old one which has a spreading habit, and is only eleven feet high, while its circumference is ninety feet. It is perhaps a layered plant.

CEPHALOTAXUS FORTUNEI.—A fine bush about six or eight feet high, with foliage like a Yew, only light green in colour. It bears great quantities of fruit something like an Olive but smaller.

CUNNINGHAMIA SINENSIS.—A broad-leaved Fir which grows to 50 feet high; but in this country, unless it is placed in perfect shelter, the foliage becomes a rusty brown. It is hardly worth growing.

MARLEA PLATANIFOLIA.—A fine-foliaged shrub of slow growth. Its fine Plane-like leaves render it one of the most effective of dwarf-growing shrubs. It requires shelter.

TRACHELOSPERMUM JASMINOIDES (formerly called *Rhynchospermum*).—This is an old occupant of our stoves and greenhouses, but it does perfectly well in the open air if planted against a wall, producing in abundance its white sweet-scented Jasmine-like flowers during the summer.

SPIRÆA CANTONIENSIS is a graceful bushy shrub, something like a Willow in habit, and having white flowers. It is a very quick grower and easily propagated.

CEDRELA SINENSIS.—The Bastard Cedar. A fast-growing handsome tree. Its wood has an aromatic scent.

CARYOPTERIS MASTACANTHUS. A free-flowering dwarf shrub of bushy habit. It grows four feet high. The flowers, which are borne on the points of the shoots, are blue. It is valuable on account of its flowering very late in the year.

NANDINA DOMESTICA.—A very pretty shrub which is common both to China and Japan. It has white flowers and berries like Peas. It grows with me five feet high, and is not injured by frost. It is so pretty and distinct in appearance that every one should have it. The flowers are creamy-white. The newer variety, *N. purpurea*, is a decided acquisition.

LAGERSTROEMIA INDICA ALBA.—An upright-growing deciduous shrub, six feet in height, bearing in April spikes of pure-white flowers.

ILLICIUM RELIGIOSUM.—A neat, compact, dwarf evergreen shrub of a light green colour. The seed is burnt as incense by the Chinese in their temples. It grows two feet high. I have had it planted out in peat, loam, and leaf soil, equal parts, for four years, and it appears to be quite hardy. It bears creamy-white flowers.

CLERODENDRON FŒTIDUM.—A dwarf shrub bearing large heads of rose-coloured flowers in August.

LONICERA FRAGRANTISSIMA.—A spreading bush with light green leaves growing about four feet high and producing white sweet-smelling flowers in March.

HOLBOELLIA LATIFOLIA.—A beautiful evergreen climber from China, with large leaves and sweet-scented flowers.

XANTHOCERAS SORBIFOLIA.—A handsome shrub having white flowers blotched with purple, something like those of a Lilac.

TRACHYCARPUS EXCELSUS, formerly known as *Chamærops*, comes from China and Japan. It is a very distinct, striking-looking Palm, and is quite hardy here, growing to about nine feet in height.

SPIRÆA ARGUTA (the Meadow Sweet).—A distinct and graceful variety producing long slender sprays of white flowers.

From Mexico I have nine plants. The most remarkable are :—

PINUS MONTEZUMÆ, named after the last of the Incas.—It is very striking in appearance from the size of the needles, which are ten inches long, of a bluish-green colour. It is a strong grower, making shoots from eighteen to twenty-four inches long, and as it is supposed to be delicate it is very difficult to get in this country; in fact, no nurseryman seems to have it. When I first got it I nursed it very carefully, bringing it up under glass in the winter. I have had it out now for several years, and it seems to be as hardy as any other Pine. Mr. Veitch does not agree with this, as he says that "in the south and west of England it leads a struggling existence owing to the climate."

CHOISYA TERNATA.—A compact-growing shrub with smooth shining leaves of a bright green colour bearing white sweet-scented flowers in July. Planted against a wall it is quite hardy here, and grows to about eight feet high. When standing on the grass in the open, however, it is affected by the cold in a severe winter, and turns yellow, but it recovers again next summer. I have never had it killed or permanently injured.

SENECIO GIESBRECHTII.—A large-leaved plant of a deep green colour with handsome toothed or indented leaves and purple stem.

MAURANDIA ERUBESCENS.—A climbing plant with light green leaves and rose-coloured bell-shaped flowers about two inches long.

FURCRÆA BEDINGHAUSII.—A Yucca-like plant which requires a very dry sunny position. It is a strong grower and soon makes a handsome specimen.

PINUS CEMBROIDES.—A Mexican Pine of dwarf bushy habit. It is quite hardy. It bears large edible seeds which are much used by the Indians. It does not succeed very well in this country.

I have only two plants from Patagonia which are worth mentioning.

ESCALLONIA PTEROCLADON.—A variety of an upright habit of growth and a free flowerer. It flowers twice a year, and after the spring flowering it should be cut hard back to shape it, otherwise it will grow loose and straggling. The flowers are small, of a pink and white colour. It grows here to a height of twelve feet.

FITZROYA PATAGONICA.—A distinct and handsome conifer, with long weeping branchlets, of a deep-green colour. It requires occasional pruning to remove straggling branches. Height twelve feet.

Ten plants from the Himalayas and Nepaul comprise :—

BERBERIS NEPALENSIS.—A very handsome shrub of fine bold habit of growth, of a light colour and with serrated leaves. It is eight feet high.

SARCOCOCCA HOOKERIANA.—A dwarf evergreen shrub from the Himalayas, with brilliant green leaves and pale yellow flowers.

NEILLIA THYRSIFLORA.—An upright deciduous shrub bearing racemes of white flowers early in summer. It is six feet high and comes from Nepaul.

JUNIPERUS RECURVA.—A distinct-looking variety, of grey-green colour and pendulous habit. It is liable to the attacks of red spider, and should be therefore placed in a damp situation in a low sheltered part of the garden with a moist subsoil; it has grown here to a height of thirty-three feet, with a circumference of 100 feet. It is a fine thing, both on account of its colour and its habit.

PICEA MORINDA, or *SMITHIANA.*—The Himalayan Spruce, a very beautiful conical-growing tree having dense foliage of a light green colour ; the tassel-like branchlets, hanging vertically, give it a peculiarly graceful appearance. It grows in Bhotan at an elevation of 10,000 feet. It is very vigorous and healthy in its growth here.

ARUNDINARIA SPATHIFLORA.—A most graceful and beautiful Bamboo from the Western Himalayas, where it grows at a height of from 7,000 to 10,000 feet, its only drawback being that it is semi-deciduous.

ARUNDINARIA FALCATA grows in the Himalayas up to 12,000 feet.

DIOSMA GRACILIS.—A compact upright shrub growing four feet high with white flowers and leaves like a heath. It flowers early in spring. The leaves when bruised have a most pleasant perfume. I had my doubts about this being hardy, but it has been out several years now. Large plants of it. It comes from the Cape.

CESTRUM AURANTIACUM.—A pretty evergreen from Guatemala, bearing orange flowers in August.

BENTHAMIA FRAGIFERA.—A fast-growing evergreen shrub from Nepaul with pale green leaves. Very handsome when in fruit.

CAMELLIA THEIFERA, the Tea plant, has been out here for many years, but I cannot say that it grows vigorously. I don't think it gets sun enough in our climate to do it justice.

MARGYRICARPUS SETOSUS.—A dwarf-growing shrub from Peru with small white berries. It is best as a rock plant.

AMORPHA FRUTICOSA.—A fast-growing shrub of upright habit from North Carolina. The flowers of a purple colour are borne in terminal spikes of about a foot long in July.

AMORPHA CANESCENS.—Of a dwarfer habit. The flowers are of a bluish-purple colour.

AZARA MICROPHYLLA.—A fine evergreen shrub from Valdivia with small dark-green glossy leaves. The yellow flowers, which are produced on the under side of the branches early in spring, have a strong spicy fragrance. Fifteen feet high.

PIPTANTHUS NEPALENSIS.—A rampant-growing evergreen with yellow flowers. The seed pods are like the Laburnum. The seeds are fertile.

MAGNOLIA CONSPICUA, the Yulan of China, is a fine tree with a profusion of large white flowers in spring. Here it is seventeen feet high and sixty-four feet round.

MAGNOLIA SOULANGEANA has flowers of a deep purple colour. It flowers later than *M. conspicua.*

MAGNOLIA TRIPETALA.—The Umbrella tree of Pennsylvania. Flowers white; leaves grow to large size; does best in deep moist soil.

MAGNOLIA HYPOLEUCA, from Japan, has not flowered with me yet. The leaves are over a foot long, of a dark green colour and silvery underneath.

MAGNOLIA STELLATA.—Also from Japan. Its flowers are snowy white. The flowers of all the Magnolias are sweetly scented.

INDIGOFERA GERARDIANA has graceful feathery foliage with pink flowers. It is the most hardy of the tribe. It comes from India.

ESCALLONIA MONTEVIDENSIS.—A fine evergreen with leaves of a light green colour and pure-white flowers in clusters borne in October. Eight feet high and the same in diameter. Grows luxuriantly here.

ESCALLONIA PHILLIPIANA.—A fine deciduous shrub from Valdivia with rich green leaves slightly serrated; flowers white, in July.

ESCALLONIA ORGANENSIS.—A beautiful evergreen, from the Organ Mountains, with dark green glossy leaves and pink flowers. Five to seven feet high.

LYONIA PANICULATA.—A dwarf deciduous shrub from North America, four feet high, bearing small white drooping flowers in the summer.

LEMBOTROPIS SESSILIFOLIA.—A slender flowering shrub from Southern Europe, with yellow flowers borne in May very profusely.

CLETHRA ARBOREA.—A handsome evergreen from Madeira producing spikes of white flowers in September. It loses some of its leaves in the frost, but breaks out again in the next summer.

BUPLEURUM FRUTESCENS.—A spreading evergreen bush with slender wiry shoots. It comes from Spain and flowers in autumn.

ELÆAGNUS ANGUSTIFOLIA VARIEGATA.—A neat-growing bushy evergreen from South Europe with small green and white leaves; very hardy.

ELÆAGNUS FREDERICI.—A most distinct and brilliant variegated form, also quite hardy.

GLEDITSCHIA TRIACANTHOS.—The Honey Locust of the Southern States of America. A medium-sized tree having fine Fern-like foliage.

DEERINGIA CELOSIOIDES VARIEGATA is a very handsome, loose-growing, variegated shrub from New South Wales. As a wall-climber it is very ornamental.

VACCINIUM PENNSYLVANICUM.—The leaves turn to a brilliant scarlet in the autumn.

RHAMNUS CROCEA is a shrub from California having bright shining leaves and scarlet berries.

WIDDRINGTONIA WHYTEI from the Kilimanjaro Mountains, in Central Africa, is an upright-growing tree with foliage somewhat like a Larch. It is of too recent introduction to say much about it yet.

AMPHIRHAPIS ALBESCENS.—A low spreading bush about four feet high with whitish purple flowers. The leaves have a strong, unpleasant perfume when touched.

ANDROMEDA CASSINEFOLIA.—A dwarf shrub from Northern Europe, one of the most lovely of all flowering plants that I know. It bears trusses of white flowers, exactly like Lily of the Valley, in May and June. It is deciduous.

PICEA PUNGENS KOSTERI.—This is, I think, the best of the Piceas. Its foliage, of silvery blue colour, is more glaucous than any of the others I have seen.

We grow thirty-nine varieties of Bamboos altogether, but they have been so admirably described by my friend Mr. Mitford in "The Bamboo Garden" that any one who is interested in them has only to consult that work to find all the information that can be required. I cannot help saying, however, that the introduction of the Bamboo in quantity of late years, for which we are largely indebted to him, has been the very greatest addition to the beauty of our gardens that has occurred in my time.

HIMALAYAN RHODODENDRONS are most valuable when planted out, because they flower so much earlier than the hybrids. The finest of all is undoubtedly

R. NUTTALLII.—It is a very straggling grower and a shy flowerer, but for size, shape, and colour there is nothing to compare with its great yellow and white bells. I was told when in India that the reason it is so scarce is that it is not safe to go into the country it grows in for a European, and the authorities do not like to order natives to take the risk of doing so. It is a native of Bhotan.

R. FULGENS and *R. BARBATUM* are the best for brilliant scarlet and crimson colour: they flower in April.

R. NIVEUM, a bright mauve in colour, is also fine. It flowers at the same time. But perhaps the most useful of all is *R. Thomsonii*. It is twelve to fifteen feet high here, and the same in diameter. One plant had 335 trusses on it, with from five to eight flowers in a truss. Nothing can be finer than the bell shape of the flowers and their deep crimson colour. *R. Aucklandii*, *R. argenteum*, *R. campylocarpum*, and *R. campanulatum* are good also. All these have been grown out of doors for the last twenty years, and have not suffered the least from frost. I have never been able to understand why some people write so violently against the practice of grafting Rhododendrons. I can only say that for many years we have grafted from 800 to 1,000 every year; that we have them now from six inches to fifteen feet high; and that we find no fault with them whatever. There is only one thing to remember, and that is to keep the place where the scion is inserted below the surface of the soil, so that the stock may not shoot; but if it does, nothing is so easy as to rub the shoots off. Grafting is so much easier and quicker than layering, and so much more satisfactory in every way, that I don't see how the two methods can be compared.

THE INDIAN AZALEAS are most useful for making masses of brilliant colour out of doors: they were kept under glass for years, until they got too big for the houses; then we tried them out, a few at a time; and as they were never injured, we have them now in quantity out of doors. They look best when planted in large loose clumps. They flower in May. The following are the names of those we find quite hardy here. *Azalea* 'Duc de Nassau,' *A. indica alba*, *A.* 'Criterion,' *A. Iveryana*, *A.* 'Stella,' *A.* 'Flag of Truce,' *A.* 'Madame de Verschafelt.' The flowers are brighter in colour than when grown under glass.

MENISPERMUM CANADENSE.—A deciduous and very curious wall climber. The leaves are blotched with white in a manner so exactly like the droppings of a bird that I was obliged to examine it closely before I was satisfied that this was not the case.

CUPRESSUS BENTHAMI, a very elegant and fast-growing variety of upright and graceful habit, from Mexico.

GENISTA PUNGENS, a handsome dwarf Broom. Early in spring it is quite covered with bright yellow flowers.

HEDYSARUM MULTIJUGUM.—A straggling growing shrub from Mongolia with Pea-shaped purple flowers.

FEIJOA SELLOWIANA.—A new fruit tree from Brazil: it has only been lately introduced into our gardens. The fruit is like a small oblong Melon, and has a pulp of a pure-white colour which is deliciously scented, something like a Pine-Apple. The flower is very pretty, the petals white and mauve, and the stamens a brilliant Turkey red. It is nearly five feet high, and has not flowered with me yet. As it does not flower in the South of France till late in the autumn, I should doubt whether it will be of much use here except under glass.

Of the illustrations not noticed before,

CUPRESSUS LAWSONIANA (fig. 109) is probably the best known and most universally popular conifer in British gardens. It comes from Mount Shasta, and was introduced by Messrs. Lawson in 1854. The plant in the illustration is one of those first sent out, and is now about sixty feet high.

CUPRESSUS LAWSONIANA LUTEA (fig. 110).—A yellow variety of the above, and equally hardy.

CUPRESSUS MACROCARPA LUTEA (fig. 111).—The original comes from Monterey in California; and this golden variety, from its rapid growth and brilliant yellow colour, is one of the very best of late introductions. Under favourable conditions its growth is so quick that it is liable to become top-heavy and to be blown over by a gale.

ABIES NORDMANNIANA (fig. 112).—A most stately Pine from the Caucasus, introduced into our gardens about 1848. Although the particular specimen photographed is in perfect health, yet fully ninety

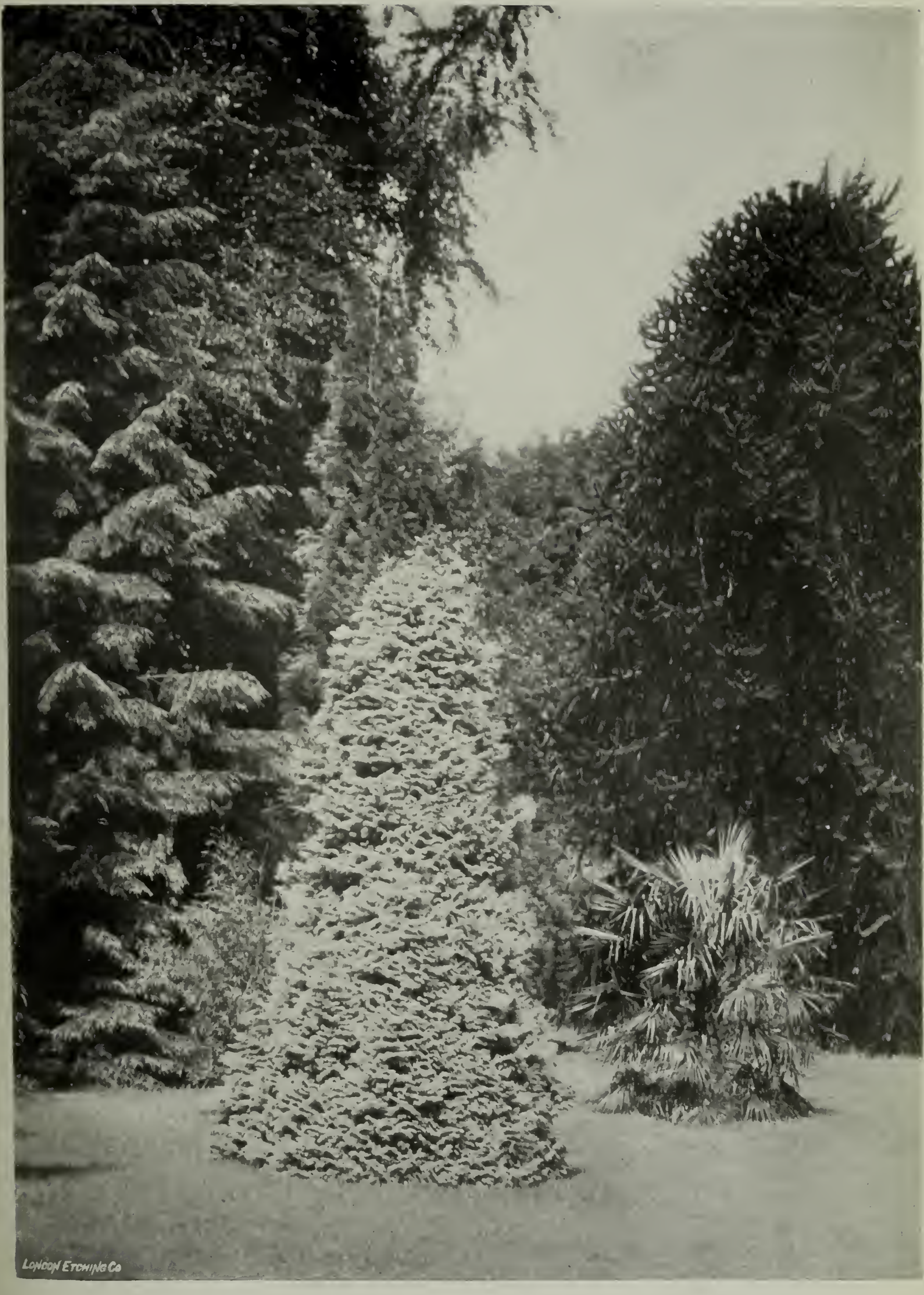


Fig. 110.—Cupressus Lawsoniana lutea.

Fig. 111.—Cupressus macrocarpa lutea.

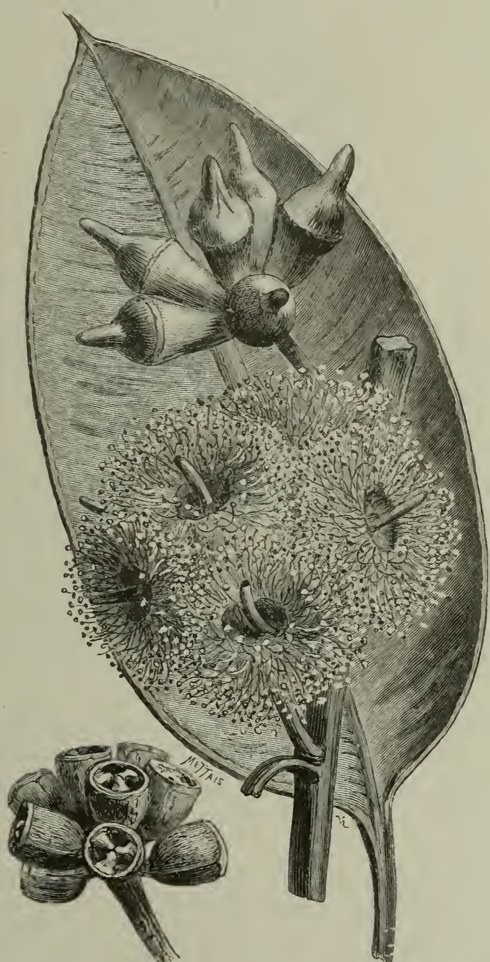
FIG. 112.—ABIES NORDMANNIANA.

Fig. 113.—Cupressus nootkatensis lutea.

per cent. of this Pine have fallen victims to disease here; in fact, we have quite given up planting it on that account.

CUPRESSUS NOOTKATENSIS LUTEA (fig. 113).—The original was introduced about 1850 from Alaska, and is perhaps better known as *Thujopsis borealis.* This yellow form is a most desirable tree from its luxuriant growth, the young leaves changing from green to a greenish yellow. It is a garden variety introduced about seven years ago.

I have now mentioned many of the most interesting of the plants which we find hardy in the garden here. Of course we cannot compete with Cornwall and the isles of Scilly, with their semi-tropical climate; but for a garden which is 300 miles further north than Cornwall I think I may say that we can grow a fair number of half-hardy and tender plants.



ON A DISEASE OF THE CARNATION CAUSED BY *SEPTORIA DIANTHI* (DESM.).

By Professor M. C. Potter, M.A., F.L.S.

For the past four years I have had under continuous observation a leaf and stem disease of the Carnation, caused by *Septoria Dianthi*. As this fungus has not hitherto been recorded as occurring in Britain, a short note of the manner of attack would seem desirable.

The Carnations affected by the disease were observed in an old garden in one of the moated houses to be found in Warwickshire. The moat, being always full of water, naturally insured a certain amount of humidity in the atmosphere, and provided suitable conditions for a con-

Fig. 114.—Leaves of Carnation attacked with *Septoria Dianthi*. A, B, upper and lower surfaces of the same leaf. *a*, the only portion still remaining green; *b*, the pycnidia. Nat. size.

tinuance of the fungus. When I first noticed the *Septoria* it was impossible to trace the source from which the Carnations had been obtained or to gain any idea as to the length of time the disease had been prevalent in the locality. Apparently its presence had not been noted.

The disease may be recognised by the discoloration of the affected parts, which are of a light straw colour and of a dull surface, without the ordinary glaucous appearance of the leaf. The discoloration is not confined to small patches, but extends from the point of attack towards the tip, along the whole surface of the leaf. The tissues also are much shrunken, and the leaf often curled longitudinally. (Fig. 114.) The fungus is most commonly seen upon the older leaves, but it is by no means rare to find the younger and more vigorous leaves attacked as well as the leaves and nodes of the flowering stem.

On the diseased areas, on both sides of the leaf, numerous small black pycnidia are present, plainly visible to the naked eye, and from these the spores escape by means of an apical pore. The pycnidia (fig. 115) vary in size, some measuring $200\ \mu \times 140\ \mu$. They are embedded in the leaf, being formed in the respiratory cavity below a stoma, and are at first spherical, but as they mature they become flask-shaped; the apical pore then projects above the epidermis. The peridium of the

FIG. 115.—Longitudinal section of a leaf of Carnation with pycnidium of *Septoria Dianthi*. The epidermis is not shown. Zeiss Obj. D, Oc. 4, paraffin sect.

pycnidia is black, and composed of a layer of two or three cells in thickness, and immediately inside the peridium is a series of short parallel hyphæ from which the spores are abstricted. The pycnidia have been observed at all seasons of the year.

The spores (fig. 116) are colourless and very long, $32\ \mu \times 4{\cdot}3\ \mu$ when measured in water directly after issuing from the pycnidia, straight or slightly curved, and sometimes divided by a transverse septum. They issue from the pycnidia as a viscid mass, and are rapidly dispersed in water. The spores germinated readily in a hanging drop or on nutrient gelatine, protruding a long germ-tube. I have also followed the germination upon a Carnation leaf.

When the spore is sown in a drop of water on a young and vigorous Carnation leaf still attached to the plant, the germ-tube is similarly protruded, and has been observed to enter the leaf through a stoma. Fig. 116 represents a few cells of the epidermis stripped from a leaf twenty-four hours after sowing. The spore has germinated and the germ-tube is seen entering the leaf through a stoma. At the spot where the spores are sown, the discolouration due to the action of the hyphæ becomes apparent in about fourteen days, and gradually spreads in all directions, but more especially towards the apex of the leaf. Sections across the area of discolouration showed the hyphæ ramifying in and among the cells, and the whole leaf between the apex and a little below the point of infection was permeated with the hyphæ and killed. The pycnidia first appear some three weeks after sowing.

I have frequently produced this disease at definite spots by artificial inoculation from the spore, the disease appearing only at the place where the spores have been sown.

In rainy weather drops of water collect upon the leaves, especially at any bend of the surface and at the axils, and it is just at such places that the fungus is ordinarily to be found. Artificial infection can easily be effected by sowing the spores in a drop of water thus naturally

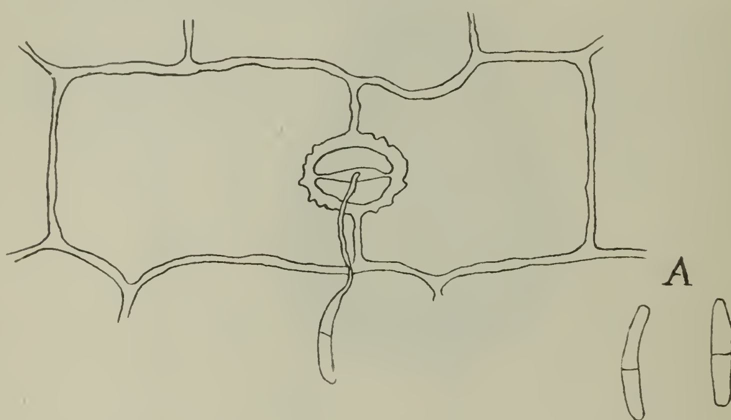
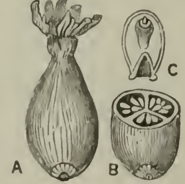


Fig. 116.—Cells from the epidermis of Carnation leaf upon which a spore has germinated. The germ-tube is seen entering a stoma. A, spores. Zeiss Obj. D, Oc. 4.

collected upon the leaf. In young leaves, however, water will not readily lie upon the surface, but if the bloom is rubbed off by gently brushing with a wet camel-hair pencil a drop of water will then adhere to the leaf in which the spores can be sown.

My infections were made, with material brought from Warwickshire, upon plants in my own greenhouse in Newcastle; and it is quite clear that the disease is very readily communicable from one plant to another. It has wrought considerable havoc in the old garden from which I first obtained my specimens, but so far I have not found it in any other locality in England. This fungus causes great damage to Carnations in North America, and is also known as a troublesome pest in Europe (especially France, Italy, and Portugal), South Africa, and Australia.



ROSE SHOW AND CONFERENCE HELD AT HOLLAND HOUSE, KENSINGTON.

June 24 and 25, 1902.

The Earl and Countess of Ilchester had most kindly offered their beautiful gardens and park at Kensington High Street to the Society for a Rose Show, to be held on the two days immediately preceding the Coronation, and on the morning of Tuesday, June 24, everything promised a most successful gathering. The weather was simply perfect, and though it was a little early for the Roses, and the spring had been unfavourable, still there was no lack of the Queen of Flowers; and the other departments of the Show, which included everything besides Roses, were full to overflowing with masses of glorious blooms, equalling, if not surpassing, those seen annually at the Society's Show in the Inner Temple Gardens. The judging was carried through most smoothly and expeditiously. At 1.30 one hundred and ninety of the Council and Committees of the Society and the invited guests sat down to luncheon, and all was going merrily as a marriage bell, when, suddenly, a sort of chill swept through the whole assembly, and the sad news passed rapidly from mouth to mouth: "The King is dangerously ill, and the Coronation is indefinitely postponed." It is impossible to describe the effect produced. It is true the sun still shone gloriously, and the flags still floated in the gentle breeze, but it seemed as if a sudden darkness and blight had fallen upon everything. People spoke with bated breath; many hurried off immediately, being unwilling to join in anything partaking of a pleasure gathering, whilst they knew not from minute to minute whether the King were yet living or had passed away; for the announcement of the serious operation necessary was quickly followed by a rumour that it had ended fatally, and everyone was sorrowing for and with the Queen our Patron. Happily, authentic word was soon brought from the Duke of Connaught, who was lunching at Holland House, that the worst reports were far from true, and that the King, although of necessity in imminent danger for some days to come, had passed through the operation even better than any had dared to hope, and was going on from hour to hour as well as the surgeons in attendance could desire.

On receipt of this better news it was decided to go on with the Conference and Show, but the whole life and enjoyment was gone from it, and it was impossible to prevent the Conference falling very flat, everyone's hopes and fears and thoughts being centred in the suffering King. The attendance of visitors to the Show in the afternoon was of course very small, as it was also on the second day, notwithstanding that the more hopeful news was again confirmed in the early bulletins posted at the Palace. It was felt that when the head of the nation lay in such a critical condition it was not a time for revelling of any sort, even though it were but the innocent enjoyment of revelling in flowers.

FIG. 117. THE RT. HON. THE EARL OF ILCHESTER, MEMBER OF COUNCIL.
(*Gardeners' Chronicle.*)

The Show must then be confessed to have been to some extent a failure, not in itself (far from it), but from the unavoidable circumstances that enveloped it.

The following is a report of the Show and Conference :—

JUDGES OF THE ROSES.

Classes **3–6**.

C. E. Cant.
A. Dickson.
A. Turner.

Classes **7, 8, 13**.

E. B. Lindsell.
E. Mawley.
J. H. Salter.

Classes **9–12**.

F. Cant.
J. Harkness.
A. E. Prince.

Classes **14, 23, 27**.

J. Burrell.
O. G. Orpen.
A. Tate.

Classes **15**.

Rev. F. R. Burnside.
W. F. Cooling.
G. Paul, V.M.H.

Classes **16, 17, 18**.

W. J. Jefferies.
Rev. F. Page-Roberts.
Chas. E. Shea.

Classes **19, 20, 21**.

J. Bateman.
H. P. Landon.
A. W. Paul.

Classes **22, 24**.

R. Irwin Lynch.
Mrs. Mawley.
Miss Willmott, V.M.H.

Classes **25, 26**.

Rev. A. Foster-Melliar.
G. Nicholson, V.M.H.
Rev. J. H. Pemberton.

Mixed Varieties.

Class **3**.—24 single blooms, distinct. *Amateurs.*

First Prize, Silver Cup, presented by the Rt. Hon. the Earl of Ilchester ; Second, £3.

1. A. Hill Gray, Esq., Beaulieu, Newbridge Hill, Bath.

Class **4**.—12 single blooms, distinct. *Amateurs.*

First Prize, Silver Cup ; Second, £1. 10*s.*

1. Rev. F. R. Burnside, Gt. Stambridge Rectory, Rochford.

Class **5**.—6 single blooms, distinct. *Amateurs.*

First Prize, Silver-gilt Banksian Medal and £1 ; Second, £1 ; Third, 10*s.*

1. T. B. Gabriel, Esq., Elmstead, Woking.
2. R. W. Bowyer, Esq., Hertford Heath, Hertford.
3. G. W. Cook, Esq., Muswell Hill Road, Highgate, N.

Class **6**.—6 single blooms of any one variety of H.P., H.T., or H.B. *Amateurs.*

First Prize, Silver-gilt Banksian Medal and £1 ; Second, £1.

No awards.

Fig. 118.—The East Front of Holland House. (*Journal of Horticulture.*)

Class **7.**—48 single blooms, distinct. *Open.*

First Prize, Silver Cup; Second, Silver-gilt Flora Medal.

1. Messrs. Frank Cant & Co., Braiswick Nursery, Colchester.
2. Messrs. D. Prior & Son, Myland Nursery, Colchester.

Class **8.**—24 single blooms, distinct. *Open.*

First Prize, Silver cup; Second, Silver-gilt Banksian Medal.

1. Mr. G. Prince, Longworth, Berks.
2. Messrs. R. Harkness & Co., Hitchin.

Teas and Noisettes.

Class **9.**—18 single blooms, not less than 12 varieties or more than 2 trusses of any one variety. *Amateurs.*

First Prize, Silver Cup and Veitch Memorial Medal; Second, £2.

1. A. Hill Gray, Esq., Newbridge Hill, Bath.

Class **10.**—12 single blooms, not less than 9 varieties or more than 2 trusses of any one variety. *Amateurs.*

First Prize, Silver Cup; Second, £1. 10*s*.

No competition.

Class **11.**—6 single blooms, not less than 4 varieties. *Amateurs.*

First Prize, Silver-gilt Banksian Medal and £1; Second, £1.

1. T. B. Gabriel, Esq., Elmstead, Woking.
2. R. W. Bowyer, Esq., Hertford Heath, Hertford.

Class **12.**—6 single blooms of any one variety. *Amateurs.*

First Prize, Silver-gilt Banksian Medal and £1; Second, £1.

1. A. Hill Gray, Esq., Newbridge Hill, Bath.

Class **13.**—18 single blooms, distinct. *Open.*

First Prize, Silver Cup; Second, Silver-gilt Banksian Medal.

1. Mr. G. Prince, Longworth, Berks.
2. Messrs. D. Prior & Son, Colchester.

Other Roses.

Class **14.**—36 bunches (consisting of not less than 5 trusses of each) of Garden Roses, distinct. Including China, Moss, Polyantha, Provence, and other summer-flowering Roses and their hybrids, and all those mentioned in the National Rose Society's "Catalogue of Garden Roses," and also all Teas and Noisettes not included in the National Rose Society's List of exhibition Roses;" *all Singles, however, excluded.* To be staged in 36 glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver Cup, presented by Sholto Hare, Esq.
Second, Silver-gilt Flora Medal; Third, Silver Flora Medal.

1. Messrs. Frank Cant & Co., Braiswick Nursery, Colchester.
2. Messrs. G. Cooling & Son, Batheaston Nurseries, Bath.
3. Messrs. B. R. Cant & Sons, The Old Rose Gardens, Colchester.

Class **15.**—18 bunches in not less than 12 varieties (consisting of not less than 5 trusses of each) of Garden Roses, distinct, including China,

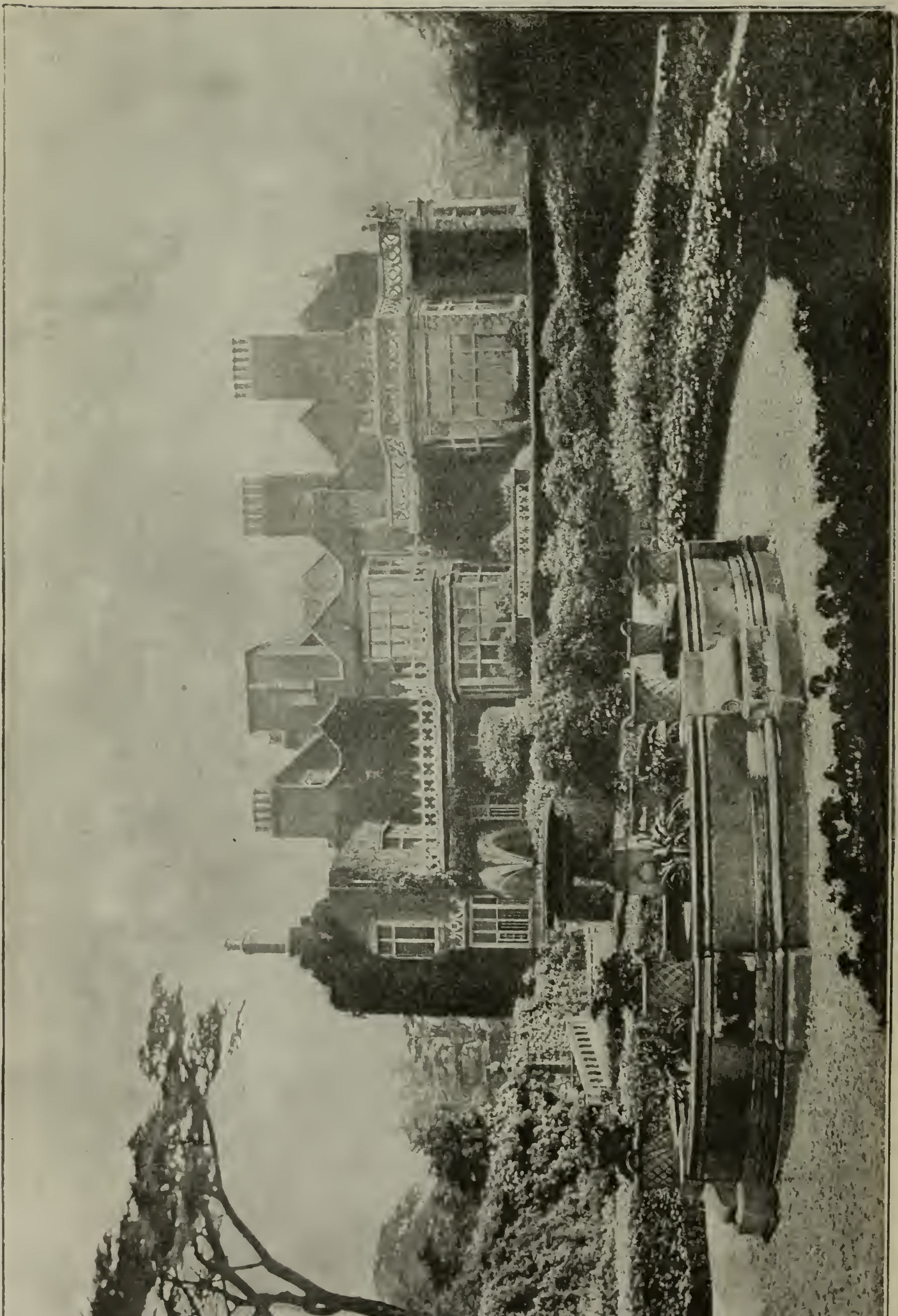


Fig. 119.—Holland House. (*Gardeners' Chronicle.*)

Moss, Polyantha, Provence, and other summer-flowering Roses and their hybrids and all those mentioned in the National Rose Society's "Catalogue of Garden Roses," and also all Teas and Noisettes not included in the National Rose Society's List of Exhibition Roses ;" *all Singles, however, excluded.* To be staged in 18 glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Amateurs.*

First Prize, Silver Cup and Veitch Memorial Medal; Second, £2.

1. O. G. Orpen, Esq., Hillside, West Bergholt, Colchester.

Class **16.**—9 bunches (consisting of not less than 3 trusses of each) of Rugosa varieties and its hybrids, distinct. To be staged in 12 glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver Flora medal; Second, Silver Banksian Medal.

1. Messrs. G. Cooling & Sons, Bath.

Class **17.**—6 bunches (consisting of not less than 3 trusses of each) of Bourbon varieties and their hybrids, distinct. To be staged in 6 glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver Flora Medal; Second, Silver Banskian Medal.

No awards.

Class **18.**—9 bunches in not less than six varieties (consisting of not less than 5 trusses of each) of Sweet Briar varieties and its hybrids. To be staged in nine glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver-gilt Flora Medal; Second, Silver Flora Medal.

1. Messrs. B. R. Cant & Sons, Colchester.
2. Mr. G. Prince, Longworth, Berks.

Class **19.**—12 bunches (consisting of not less than 5 trusses of each) of Single Roses, distinct. To be staged in 12 glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. Single Roses have only one row of petals. *Open.*

First Prize, Silver Flora Medal; Second, Silver Banksian Medal.

1. Messrs. B. R. Cant & Sons, Colchester.
2. Messrs. G. Cooling & Son, Bath.

Class **20.**—9 bunches (consisting of not less than 5 trusses of each) of Chinas and their hybrids, distinct. To be staged in nine glasses or jars not exceeding 3 inches diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver-gilt Flora Medal; Second, Silver Flora Medal.

1. Messrs. Frank Cant & Co., Colchester.

Class **21.**—12 bunches (consisting of not less than 5 trusses of each, not disbudded) of hybrid Teas according to National Rose Society's list, distinct. To be staged in 12 glasses or jars not exceeding 3 inches

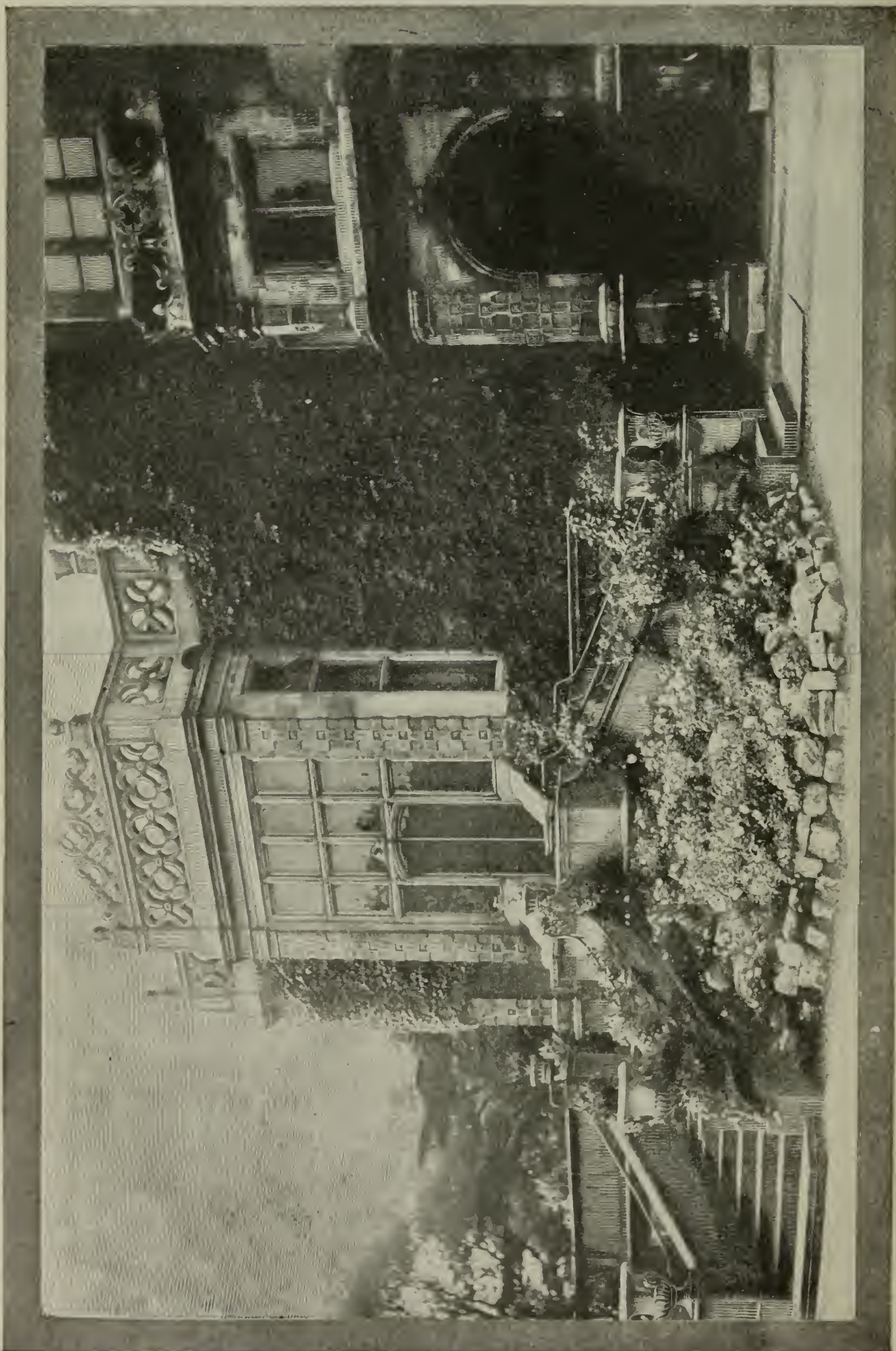


Fig. 120.—A Corner of Holland House. (*Gardeners' Chronicle.*)

diameter at the top; all stems to reach the water; each variety in a separate glass or jar. *Open.*

First Prize, Silver Flora Medal; Second, Silver Banksian Medal.

No competition.

Class **22.**—Collection of Species staged as far as possible in bunches of 5 trusses of each as above, but the 5 trusses not actually obligatory. *Open.*

First Prize, Silver Cup: Second, Silver-gilt Banksian Medal.

2. Messrs. Paul & Son, The Old Nurseries, Cheshunt.

Class **23.**—New Roses of any Class not yet put into commerce; not less than 3 blooms or trusses of each. *Open.* The National Rose Society offers a Gold Medal in this Class; other Medals or Certificates according to merit.

Gold Medal, Messrs. Frank Cant & Co., Colchester, for H.T. 'Lady Roberts.'

Gold Medal, Messrs. Paul & Son, Cheshunt, for Weeping *Rugosa alba.*

Class **24.**—A bowl or vase of Roses ranged for effect. Rose foliage only to be used. Wire supports allowed, but the less they are in evidence the greater the merit of the arrangement. *Amateurs.*

First Prize, £2; Second Prize, £1. 10*s.*

1. O. G. Orpen, Esq., West Bergholt, Colchester.
2. Miss B. Langton, Raymead, Hendon.

Class **25.**—A representative Group of Roses placed on the ground (inverted pots &c. may be used as usual for elevating separate plants) in a space not exceeding 400 square feet, including as far as possible H.P.'s, Teas, Noisettes, H.T.'s, Bourbons, Chinas, Garden, Climbing and Moss Roses, Species and Hybrids, in pots, or cut flowers in plain glasses, vases, or jars, and not in exhibition boxes. The foliage used with cut blooms must be that of the variety itself and no other, but Ferns, Palms, Grasses, &c., in pots, may be used as edging and background. *Open.*

First Prize, R.H.S. Gold Medal and £10 Silver Cup, presented by the National Rose Society; Second, Gold Medal; Third, Silver-gilt Flora Medal.

1. Mr. Chas. Turner, Royal Nurseries, Slough.
2. Messrs. Paul & Son, The Old Nurseries, Cheshunt.

Class **26.**—As in Class 25, but in space not exceeding 200 square feet.

First Prize, R.H.S. Silver-gilt Medal and £5 Silver Cup presented by the National Rose Society; Second, Silver Cup; Third, Silver-gilt Banksian Medal.

1. Mr. G. Prince, Longworth, Berks.

Class **27.**—24 Climbing or Pillar Roses in bloom in not less than 12 varieties, nor more than 2 plants of any one variety; exhibited in pots to show character and habit. *Open.*

First Prize, Silver Cup; Second, Silver-gilt Flora Medal.

No competition.

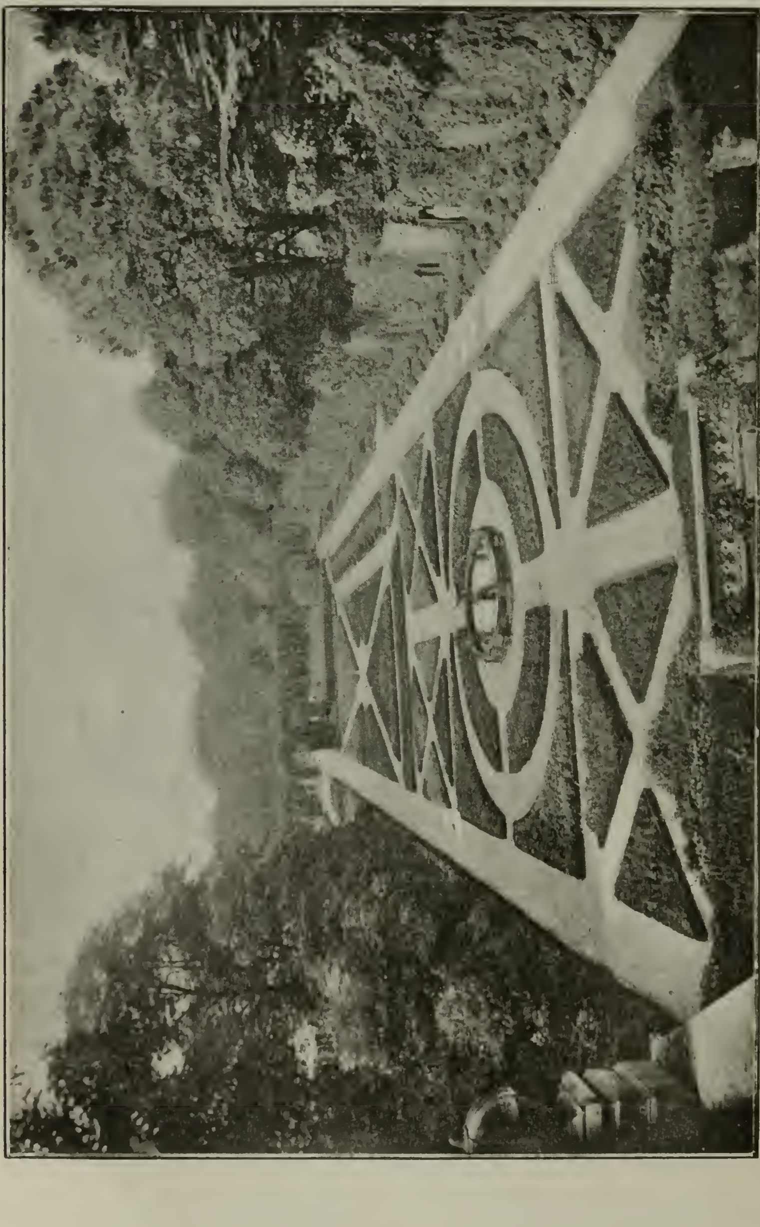


Fig. 121.—The Dutch Garden, Holland House. (*Journal of Horticulture.*)

JUDGES OF PLANTS OTHER THAN ROSES.

ORCHIDS.

Messrs. H. J. Chapman.
Jas. Douglas, V.M.H.
J. Gurney Fowler.
H. Little.

FRUIT AND VEGETABLES.

Messrs. T. Challis.
W. Crump, V.M.H.
G. Norman, V.M.H.
A. H. Pearson.

GROUPS IN OPEN AIR.

Messrs. John Jennings.
J. McLeod.
H. B. May.
Jas. Smith, V.M.H.

HERBACEOUS ROCK PLANTS AND ALPINES.

Messrs. E. Beckett.
W. H. Divers.
Rev. G. Engleheart, V.M.H.
Mr. C. E. Pearson.

FOLIAGE PLANTS.

Messrs. W. Bain.
C. R. Fielder.
J. Hudson, V.M.H.
R. Wilson Ker.

FLOWERING PLANTS.

Messrs. W. Bates.
R. Dean, V.M.H.
E. Hill.
W. Howe.

MISCELLANEOUS.

Messrs. C. Dixon.
E. Molyneux, V.M.H.
J. W. Odell.
Owen Thomas, V.M.H.

AWARDS GIVEN BY THE COUNCIL AFTER CONSULTATION WITH THE JUDGES.

The order in which the names are entered under the several medals and cups has no reference whatever to merit, but is purely accidental.

The awards given on the recommendation of the Fruit, Floral, and Orchid Committees will be found under their respective reports.

Gold Medal.

To Martin R. Smith, Esq., Hayes (gr. Mr. C. Blick), for Carnations.

To Messrs. Sander & Sons, St. Albans, for Orchids, new and rare plants.

To Messrs. J. Veitch & Sons, Ltd., Chelsea, for greenhouse plants, Bamboos, and Aquilegias.

To Mr. James Cypher, Cheltenham, for decorative plants.

To Messrs. B. R. Davis & Sons, Yeovil, for Begonias.

To Messrs. T. Rivers & Son, Sawbridgeworth, for fruit trees in pots.

To Messrs. R. Wallace & Co., Colchester, for Lilies, Pæonies, Calochorti, and Irises.

To Messrs. W. Cutbush & Sons, Highgate, for flowering plants and clipped trees.

Silver Cup.

To Sir F. Wigan, Bart., East Sheen (gr. Mr. W. H. Young), for Orchids.

To Messrs. Cannell & Sons, Swanley, for Cannas and Aquilegias.

To Messrs. Barr & Sons, Covent Garden, for hardy flowers and pigmy trees.

Fig. 122.—Bridge in Japanese Garden, Holland House. (*Gardeners' Chronicle*)

To Messrs. J. Carter & Co., High Holborn, for Gloxinias and vegetables.

To Messrs. Fisher, Son, & Sibray, Ltd., Sheffield, for stove and greenhouse plants.

To Messrs. J. Hill & Son, Lower Edmonton, for Ferns.

To Messrs. G. Bunyard & Co., Maidstone, for fruit trees in pots and cut flowers.

To Messrs. J. Charlesworth & Co., Bradford, for Orchids.

To Messrs. J. Cheal & Sons, Crawley, for flowering shrubs.

To Mr. Amos Perry, Winchmore Hill, for hardy flowers and aquatics.

To Messrs. J. Waterer & Son, Bagshot, for Rhododendrons and Kalmias.

To Messrs. Blackmore & Langdon, Tiverton-on-Avon, for Begonias.

To Messrs. Dobbie & Co., Rothesay, for Pansies and Aquilegias.

To Messrs. T. Cripps & Son, Tunbridge Wells, for Japanese Maples.

Silver-gilt Flora Medal.

To Jeremiah Colman, Esq., Reigate (gr. Mr. Bound), for Orchids and stove plants.

To Messrs. J. Laing & Sons, Forest Hill, S.E., for miscellaneous plants and shrubs.

To H. B. May, Esq., Upper Edmonton, for Ferns and flowering plants.

To Mr. John Russell, Richmond, Surrey, for hardy trees and shrubs.

To Messrs. H. Low & Co., Bush Hill Park, Enfield, for Orchids and miscellaneous plants.

To Messrs. W. Fromow & Sons, for Japanese Maples and Liliums.

To Mr. M. Prichard, Christchurch, Hants, for hardy flowers.

To Messrs. J. Cowan & Co., Gateacre, Liverpool, for Orchids.

To Messrs. Stanley Ashton & Co., Southgate, for Orchids.

To Messrs. Sutton & Sons, Reading, for Gloxinias.

Silver-gilt Knightian Medal.

To Mr. S. Mortimer, Farnham, Surrey, for Tomatos, Melons, and Cucumbers.

Silver Flora Medal.

To Messrs. J. Peed & Sons, Norwood Road, S.E., for Gloxinias and Begonias.

To Messrs. Kelway & Son, Langport, for Pæonies and Delphiniums.

To Messrs. Jones & Son, Shrewsbury, for Irises and Sweet Peas.

To Messrs. G. Jackman & Son, Woking, for herbaceous and Alpine plants.

To Messrs. T. S. Ware, Ltd., Feltham, for herbaceous and Alpine plants.

To Messrs. Reamsbottom & Co., King's Co., Ireland, for Anemones.

To Messrs. B. S. Williams & Son, Upper Holloway, for hardy flowers.

Silver Banksian Medal.

To Messrs. Paul & Son, Cheshunt, for herbaceous flowers.

To Mr. H. J. Jones, Lewisham, for Begonias and Pelargoniums.

To Mr. R. C. Notcutt, Woodbridge, for *Arctotis grandis*.

To Mr. A. W. Wade, Colchester, for hardy flowers.

FIG. 123.—JAPANESE GARDEN, HOLLAND HOUSE. (*Gardeners' Chronicle.*)

To Mr. W. Iceton, Putney, for Lilies of the Valley and flowering plants.

To Mr. C. Aubrey Watts, 30 Mark Lane, E.C., for Lilies and Sweet Peas.

To Mr. W. J. Godfrey, Exmouth, for Oriental Poppies.

To Percy Waterer, Esq., Fawkham, Kent, for Sweet Peas.

To Mr. R. Sydenham, Tenby Street, Birmingham, for Sweet Peas.

The Conference on Roses.

The following was the programme for the Conference :—

1. Opening Address, by the Very Rev. the Dean of Rochester, V.M.H.
2. Professor M. J. Gérome, of Versailles, on "M. Crépin's Arrangement of the Genus *Rosa*."
3. Mr. J. G. Baker, F.R.S., V.M.H., on "Two very distinct New Roses from the South-West United States."
4. Monsieur Viviand-Morel, of Lyons, on "The Production of New Hybrid Roses."
5. Miss Anne Dorrance, F.R.H.S., of Dorranceton, U.S.A., on "Rose Forcing in America."
6. Monsieur Maurice de Vilmorin, F.R.H.S., Paris, on "Wild Asiatic Roses."
7. Miss Jekyll, V.M.H., on "The Beautiful Use of Roses in Gardens."
8. Mr. Wm. Paul, V.M.H., on "Ever-blooming Roses for Garden Decoration."
9. Mr. George Nicholson, V.M.H., on "Recently Discovered Chinese Roses."
10. Mr. Edward Mawley, V.M.H., on "The Sensitiveness of Cultivated Roses to Changes of Weather."
11. Rev. J. H. Pemberton, M.A., on "Hybrid Teas."
12. Mr. George Paul, J.P., V.M.H., on "Exhibition Roses."
13. Mr. Frank Cant, F.R.H.S., on "Decorative Tea Flowering Roses and how to grow them."
14. Mr. George Mount, F.R.H.S., on "The Cultivation of Roses under Glass."
15. Mr. James Hudson, V.M.H., on "Roses in and about London."
16. Mr. Alex. Dickson, F.R.H.S., on "Hybrid Teas."
17. Mr. Osmond G. Orpen, F.R.H.S., on "Tea Rose Trifles."

The following Rosarians had also been invited to take part in the proceedings, and we were glad to see several of them present.

Professor L. Bailey, Cornell University, U.S.A.
Professor François Crépin, Brussels.
Professor Sergeant, U.S.A.
Monsieur J. Gravereaux, L'Haÿ, Paris.
Mr. C. E. Cant.
Mr. W. F. Cooling.
Rev. H. Honywood D'ombrain, M.A., V.M.H.
Rev. A. Foster-Melliar, M.A.
Mr. George Gordon, V.M.H.
Mr. W. Botting Hemsley, F.R.S.
Dr. Henry.

Fig. 124.—View in the Gardens, Holland House. (*Gardeners' Chronicle.*)

Sir George King, K.C.I.E., F.R.S., V.M.H.
Mr. E. B. Lindsell.
Dr. Maxwell T. Masters, F.R.S.
Rev. F. Page-Roberts, M.A.
Mr. A. E. Prince.
Mr. A. Tate.
Miss Willmott, V.M.H.

In opening the Conference the Very Reverend the Dean of Rochester, President of the National Rose Society, said :—

My lords, ladies, and gentlemen, by an opportune and happy arrangement, for which we are indebted to the Royal Horticultural Society, the

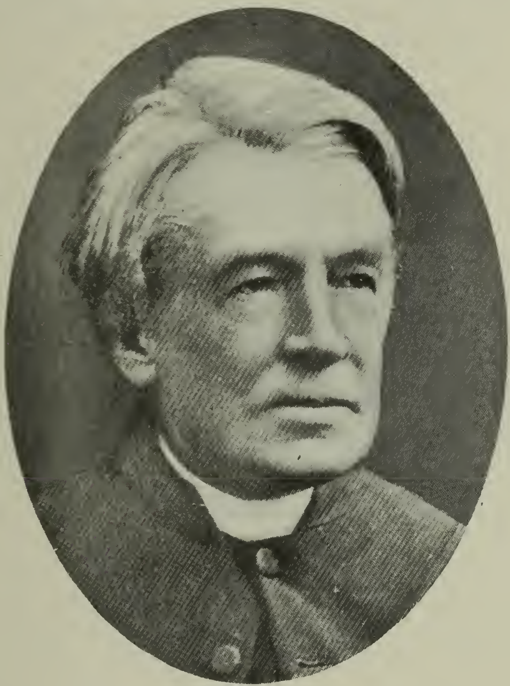


Fig. 125.—The Very Rev. S. Reynolds Hole, D.D., Dean of Rochester. (*Journal of Horticulture.*)

Queen of Flowers, with her lovely ladies in waiting and chief officers of her court, has come to London in honour of the Coronation of the Queen of England. There is a charming resemblance between these royal sisters—both beautiful and alike beloved. None doubt their royal supremacy. I can just remember a time when the Champion of England rode forth and threw down his glove as a challenge to all comers who should deny the claims of the rightful heir to the throne. In this case either Queen is "monarch of all she surveys ; her right there is none to dispute." For a combination of all that is excellent in a flower—form, colour, and fragrance—the Rose "brooks no rival near her throne." She receives universal homage. I know that the King himself has ordered many thousand plants of one variety, 'Hermosa,' for the royal garden at Windsor, and from peer to peasant, millionaire to mechanic, she reigns in loving hearts.

Hewers of wood and drawers of water grow Roses in perfection as well as the lord of the forest and the lady of the lake. She is as bountiful as beautiful, and no other flower competes with her in abundance or endurance. Easily forced under glass, we have Roses *al fresco* from May to December. I have been credibly informed that on more than one occasion at Christmastide the royal table at Sandringham has been decorated with the Rose of which I have spoken, 'Hermosa,' gathered in the open ground. And where shall we find such variety in form, from 'Perle d'Or' to 'Paul Néron,' 'Cécile' to 'Ulrich Brunner,' 'Aglaia' to 'Maréchal Niel,' or in colour from 'Niphetos' to 'Prince Camille de Rohan'?

You will forgive my enthusiasm. I could not say less, and I must not now say more, because we are met, not for

> Mere verbiage, the tinsel clink
> Of compliment,

for eulogies and admirations of our queen, but that we may extend her dominions and offer her a more intelligent and worthy service. We have before us a programme for which we have again to thank the Royal Horticultural Society, and which seems to be exhaustive, on those subjects which are most deeply interesting to us who love the Rose, and they give us information from those experts who are most capable of instructing us on the genealogy, the habits, and successful culture of the flower. You have the list before you, and I need hardly remind you that it includes the names of those rosarians who have been our chief benefactors in the introduction of new Roses and in their cultivation under glass and in the garden. I must no longer detain you. As Chaplain-in-Ordinary to our Queen I have said grace before meat. Let us enjoy the feast. "May good digestion wait on appetite, and health on both."

ESSAY UPON A SYNOPTIC TABLE OF THE SECTIONS OF THE GENUS *ROSA* ACCORDING TO THE CLASSIFICATION OF M. CRÉPIN.

By M. J. GÉROME, Professor of the École Nationale d'Horticulture, Versailles.

FOR convenience of study the multitude of botanical species of Roses have been divided into a certain number of sections, more or less distinct. The number of these sections, their limitations, and the species included in each have varied according to the point of view adopted in the classification by different botanists, and also according to the nature and value of the original characteristics which they have taken as the basis of their method and system.

The species cultivated in gardens belong to almost all the sections of the genus; it is therefore desirable that the horticulturist should be able to see his way without much trouble amongst this genus, the complete study of which is very difficult.

Amongst the best known classifications, the most recent are those of Mr. Baker and M. Crépin, the latter being the most generally adopted. That of Mr. Baker, of the Kew Herbarium, was published in the *Gardeners' Chronicle*, Vol. xxiv. p. 199. His work includes an analytical key of the groups and an enumeration of the species and subspecies.

The classification made by M. Crépin, Director of the Botanical Gardens at Brussels, was published in 1889 in the JOURNAL of the Royal Horticultural Society, Vol. xi. p. 217, and it has since been republished with certain modifications in the *Journal des Roses*, 1891, but in neither publication does M. Crépin give an analytical key or a synoptical table of the sections, both of which are really necessary to enable the reader to notice quickly the characters common to certain groups as well as those which are peculiar to each. This omission I endeavoured to supply for the use of the students at Versailles, and it may be of sufficient interest to include it in the Conference Report.

Before giving this synoptical table it will be as well to notice the characters on which Mr. Baker bases his classification. They are:—

1. The leaves: from the point of view of their form (simple or compound) and of the greater or lesser number of leaflets.

2. The stipules: whether present or absent.

3. The styles: whether combined in a column and prolonged beyond the disc, or free amongst themselves and not prolonged beyond the disc.

4. The stipules: their different conditions, almost free and quickly falling, or adnate (*i.e.* to the petiole) above the middle, persistent, &c.

5. The thorns: with regard to their position, whether in pairs at the base of the leaves, or scattered and numerous, passing gradually into very small thorns and bristles, or scattered and comparatively few and of the same size. Also with regard to their very different shapes, long and thin, short and thick, straight, hooked, or bent.

6. The fruit : whether hairy or glabrous.

7. The leaves : whether wrinkled or leathery or glandulous, or not presenting any of these characters.

The majority of these characteristics have also been employed by M. Crépin, but he has in addition made use of certain other very important ones, derived from the reproductive organs, which modify Mr. Baker's classification considerably.

The new points which M. Crépin has taken into account besides the preceding are :—

1. The method of the insertion of the ovaries upon the receptacle.

2. The size of the disc (the circular portion, flat or conical, situated round the orifice of the receptacle and extending as far as the base of the sepals).

3. In the group of Roses with free styles M. Crépin distinguishes between those whose styles project above the disc and those which are enclosed (the stigmas overlapping the orifice of the receptacle).

4. The position of the sepals *après l'anthèse* (that is to say, after the opening of the corolla) ; they may be reflexed, horizontal, or erect ; their duration, whether they fall or remain adhering to the receptacle which they crown.

5. The number of the leaflets of the average-sized leaves of the flowering branches.

6. The shape of the flowers and of their bracts.

7. In one particular species the type is tetramerous : that is to say that there are four parts to the calyx and the corolla, whilst there are five in all the others, the flowers being pentamerous.

A glance at these different characteristics easily shows that the two classifications of Mr. Baker and M. Crépin are very different, and that the latter has taken into consideration those parts of the flower and fruit which are less likely to vary.

The following table is made for the purpose of showing M. Crépin's classification in such a way that eye and mind alike may grasp it both as a whole and in detail, and be able to judge rapidly of the resemblances and differences of the various sections. In every case this arrangement proves that in order to arrive at a correct decision one must first of all know what are the most important characteristics of the group which should be investigated, and also arrange them in the order of their relative importance.

As will be seen from examining the table, I have only had in view the determination of the *sections* of the genus *Rosa*, for a table of the species would have entailed a work of such dimensions as only a "rhodologue" could make ; it is to be hoped that such a work, limited to Roses of interest to gardeners, may soon be published, as it would be of great assistance to both amateurs and professionals.

The species used as examples in each section are those most commonly grown ; it is by no means intended to be a complete list, such as might be found in more extensive works.

A word of explanation may be useful here on the subject of the arrangement of the sections into two groups of unequal importance, the one containing ten sections, the other only six.

Sections I. to X., which are bracketed together, may be considered as consisting of Roses which display the *normal* characteristics of the genus, whilst Sections XI. to XVI. consist of those which separate themselves from ordinary Roses by distinguishing characteristics. It will be noticed that Section XI. consists of one species having tetramerous

FIG. 126.—WILD FORM OF ROSA INDICA. (*Gardeners' Chronicle.*)

flowers; in the others, the number of the leaflets (of the average-sized leaves in the majority of Roses not exceeding from five to seven) is either decreased to three leaflets, as in Section XIV., or increased from seven to nine in Sections XII. and XIII., and from eleven to fifteen in Section XV. Section XVI. consists of a *simple* leaf, quite exceptional in the genus, and having no stipules. Some of these Roses are still further distinguished by the size of the disc, and by the manner in which the ovaries are inserted in the receptacle.

In concluding this note it will be of service to summarise in what the classification of Mr. Baker differs from that of M. Crépin with regard to the allocation of the species to the different sections.

To begin with, Mr. Baker includes in a single section, under the name *Systylæ*, Sections I. and II. of M. Crépin. From a horticultural point of view this is of no great importance, as *Rosa stylosa* is almost destitute of ornamental interest.

Mr. Baker places M. Crépin's Section III. (the Teas and Bengals) with the *Caninæ*, because he has taken no account of the free exserted styles which are distinctive of *Rosa indica* (fig. 126) and *R. semperflorens*, whereas the Dog Roses have free *included* styles.

He couples *R. lævigata* with *R. Banksiæ*, whereas it differs from the latter in having leaves composed of three leaflets, and its sepals erect instead of reflexed.

Mr. Baker's group of *Villosæ* is merged by M. Crépin with the *Caninæ*, the only difference being that the thorns are stronger, which is a characteristic of little moment.

Amongst the *Cinnamomeæ* Mr. Baker has included the types which M. Crépin has used in making the following distinct sections:

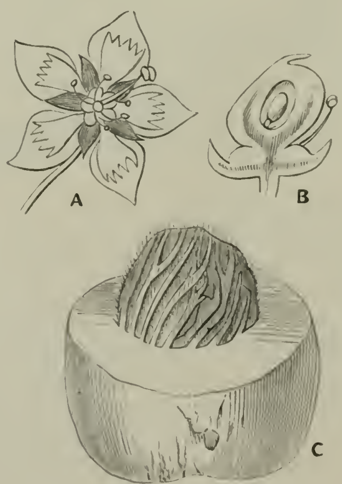
1. The *Carolinæ* (Section VII.), whose sepals are horizontal instead of being erect.

2. The *Microphyllæ* (Section XV.), on account of the ovaries being always inserted on a mound at the bottom of the receptacle.

3. The *Sericeæ*, on account of their tetramerous flowers.

On the other hand, many species placed by Mr. Baker among the *Pimpinellifoliæ* are transferred by M. Crépin to the *Cinnamomeæ* (Section VIII.). Those which are described as of these two groups are very distinct on account of their thorns and their inflorescence.

Mr. Baker has included the yellow Roses (*lutea* and *sulphurea*) with the *Rubiginosæ*, from which they differ both in their colour and in having their sepals erect instead of reflexed.



Synoptic Table of the Sections of the Genus 'Rosa.

- **1st GROUP.**
  - Styles coherent, exserted above the disc in a slender column about the same length as the interior stamens.
    - Inflorescence often many-flowered; stems sarmentous, climbing, or creeping . . . . I. **Synstylæ.**
      Examples: R. *arvensis*, *sempervirens*, *moschata*, *multiflora*, *anemoneflora*, *Luciæ*, *Wichuraiana*, *Watsoniana*, *setigera*.
    - Inflorescence generally few-flowered; stems slightly sarmentous.
      Example: R. *stylosa*. II. **Stylosæ.**
  - Styles free
    - Exserted above the disc, about half the length of the interior stamens; sepals reflexed; inflorescence generally several-flowered . III. **Indicæ.**
      Examples: R. *indica* (Tea Roses), *semperflorens* (Bengal).
    - included, with stigma covering up the orifice of the receptacle.
      - Sepals reflexed after flowering.
        - Stems with slender climbing shoots.
          - Inflorescence many-flowered in a false umbel; stipules free, caducous; sepals caducous before the maturity of the receptacle . . . . IV. **Banksiæ.**
            Example: R. *Banksiæ*.
        - Stems erect.
          - Inflorescence one-, rarely several-flowered; stipules adnate, the upper not dilated; thorns intermixed with prickles and pedicellate glands; sepals caducous before maturity of the receptacle, the exterior strongly appendiculate laterally.
            V. **Gallicæ.**
            Example: R. *gallica* (Provins, Centfeuille).
          - Inflorescence usually several-flowered; stipules adnate, the upper larger than the lower; thorns very rarely straight, not intermixed with prickles and pedicellate glands.
            VI. **Caninæ.**
            Examples: R. *canina*, *ferruginea*, *rubiginosa*, *tomentosa*, *villosa*, *micrantha*, &c.
      - Sepals spreading.
        - Ovaries inserted exclusively at the bottom of the receptacle; inflorescence usually several-flowered; stipules adnate; stems erect; leaves 7–9 foliate; thorns straight or hooked, regularly in pairs under the leaves, very rarely all alternate.
          VII. **Carolinæ.**
          Examples: R. *carolina*, *humilis*, &c.
      - Sepals erect again after flowering, crowning the receptacle during maturation, and persistent; stems erect.
        - Inflorescence usually several-flowered, rarely many-flowered; stipules adnate; stems erect; thorns straight (rarely hooked or arched), usually regularly in pairs under the leaves, very rarely wanting or alternate . . . . . . VIII. **Cinnamomeæ.**
          Examples: R. *cinnamomea*, *rugosa*, *alpina*, *laxa*, &c.
        - Inflorescence nearly always one-flowered, ebracteate; stipules adnate, all narrow, auricles suddenly dilated and divergent; middle leaves usually 9-foliate; stems erect; thorns straight, scattered, intermixed or not with prickles . IX. **Pimpinellifoliæ.**
          Example: R. *pimpinellifolia*.
        - Inflorescence often one-flowered, ebracteate; flowers yellow; edge of receptacle surmounted by a thick ring of hairs; stipules adnate, the upper a little dilated, auricles divergent; thorns alternate, intermixed or not with glands . . X. **Luteæ.**
          Example: R. *lutea*, *sulphurea*.

Flowers tetramerous; styles free, exserted; inflorescence one-flowered; sepals erect again after flowering, persistent upon the receptacle; stems erect; thorns straight, regularly in pairs under the leaves . . . . . . XI. **Sericeæ.**
Example: R. *sericea*.

2nd GROUP.

Flowers pentamerous, styles free, included.

Middle leaves 7-foliate; sepals again erect, entire, persistent; ovaries inserted exclusively at the bottom of the receptacle; inflorescence one-flowered, ebracteate; upper stipules with auricles very dilated and divergent; stems erect; thorns slender, straight, alternate, intermixed with numerous prickles.
Example: R. *minutifolia*. XII. **Minutifoliæ.**

Middle leaves 9-foliate; sepals reflexed, entire, caducous; disc very large; stamens very many; inflorescence several-flowered, with large and incised bracts; stipules shortly adnate, deeply pectinate; stems erect, somewhat sarmentous; thorns hooked or straight, regularly in pairs below the leaves, intermixed or not with prickles . . . . XIII. **Bracteatæ.**
Examples: R. *bracteata, clinophylla*.

Leaves trifoliate, sepals again erect; disc large; stamens many; inflorescence one-flowered, ebracteate; stipules nearly free, at last caducous; stems long and sarmentous, climbing or creeping . . . . . XIV. **Lævigatæ.**
Example: R. *lævigata* (Rose Camellia).

Middle leaves 11–13–15-foliate; sepals again erect, persistent, the extremities strongly appendiculate; ovaries inserted exclusively upon a projection at the bottom of the receptacle; inflorescence usually several-flowered; stems erect; thorns straight, regularly in pairs, below the leaves . . XV. **Microphyllæ.**
Example: R. *microphylla*.

Leaf *simple* instead of being composed of several leaflets, exstipulate (the single species of this section has formed the genus *Hulthemia*, a name but little used in horticulture) . . . . XVI. **Simplicifoliæ.**
Example: R. *berberifolia*.

ON TWO NEW ROSES FROM THE SOUTH-WESTERN UNITED STATES.

By J. G. Baker, F.R.S., V.M.H.

The two Roses of which I exhibit drawings came from the south-western United States, and have only been discovered lately. Amongst well-known European types their nearest alliance is with *R. spinosissima.* The following descriptions will show their leading characteristics :—

Rosa minutifolia.—Engelm. in *Bull. Torrey Club,* Vol. ix. pp. 97, 127 ; S. Wats. in *Proceed. Amer. Acad.* Vol. xx. p. 346. Stems erect, much branched, two to four feet high ; prickles very unequal, dense, the largest slender and nearly straight, $\frac{1}{6}$ inch long, passing down gradually into copious small, slender, straight aciculi. Leaflets usually five, the end one suborbicular, $\frac{1}{6}$ inch long and broad, deeply incised, firm, nearly glabrous on the upper surface, densely pubescent beneath, with a strong rib running into each tooth ; rhachis pubescent, not glandular ; stipules narrow, adnate, not at all gland-ciliated, with a small deltoid free tip. Flowers solitary ; peduncle short, pubescent, not hispid. Calyx tube small, globose, densely prickly ; sepals lanceolate, usually simple, $\frac{1}{4}$ inch long. Petals bright red, about as long as the sepals. Styles free, villose. Fruit globose, $\frac{1}{3}$ inch diameter, crowned with the persistent sepals. (Fig. 127.)

Hab. Coast hills of Lower California. *Parry* ; *Anthony* ; *Pringle* ; *Palmer,* 619.

Rosa stellata.—Wooton in *Bull. Torrey Club,* 1898, p. 152, tab. 335 ; Crépin in *Bull. Herb. Boiss.* Vol. vi. p. 725. Stems short, slender, much branched ; prickles unequal, stramineous, deflexed, nearly straight, the largest $\frac{1}{4}$ inch long, with copious aciculi between. Leaflets three, nearly sessile at the apex of the petiole, obovate-cuneate, $\frac{1}{6}$ inch long, firm in texture, deeply toothed at the tip, glabrous on both surfaces ; rhachis glabrous, not at all glandular ; stipules adnate, with a large free tip. Flowers solitary ; peduncle short, not at all hispid. Calyx tube globose, aciculate ; sepals simple, lanceolate, $\frac{1}{3}$ to $\frac{1}{2}$ inch long. Petals bright red, longer than the sepals. Styles hairy. Fruit small, globose, aciculate, crowned with the persistent sepals. (Fig. 128.)

Hab. New Mexico : White Mountains, Lincoln County, 6,000 ft., *Wooton,* 193 ; Organ Mountains, Doña Ana County, 5,200 ft., *Wooton,* 126.

FIG. 127.—ROSA MINUTIFOLIA.

Fig. 128.—Rosa stellata.

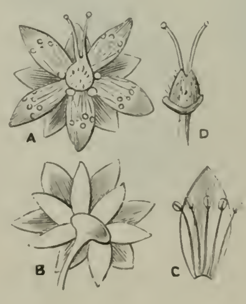
THE COLLECTION OF ROSES AT L'HAŸ, NEAR PARIS.

Monsieur J. Gravereaux, the happy owner of what is probably the largest and most complete collection of Roses in the whole world, sent to the Conference the list of Roses growing in his garden at L'Haÿ in 1902. It forms a large octavo volume of 232 finely-printed pages, interspersed with many full-page illustrations. The type, the printing, and the paper of this volume are simply perfect, and Monsieur Gravereaux is not only to be congratulated on the possession of such a unique collection of plants, but also to be thanked for having printed such a carefully-arranged list of his possessions, numbering 6,781 different species and varieties of Roses! The list is arranged in three main parts or divisions. The first part consists of the wild Roses of the world, with their varieties and hybrids, and is broken up into sixteen sections, representing the Crépin-Gérome arrangement, which will be found on pp. 453–4. Nine hundred and sixty-nine different Roses are treated in this first part.

The second part consists of garden Roses, and includes all the varieties, both old and new, which Monsieur Gravereaux has been able to collect. No less than 4,689 varieties are catalogued; the name of the raiser or introducer is in almost all cases given, and when possible the date of each variety being first sent out, together with its colour.

The third part is devoted to more or less Climbing Roses, of which 731 varieties are included. There is also a list of a large number of wild Roses which are on trial, their position having not yet been definitely determined; and a further short but most interesting chapter on Roses for Perfumery, describing the instruments and methods employed in distillation, &c. And the volume concludes with two admirable indices, the purely botanical species, and their varieties, being kept distinct.

The best thanks of all Rose-growers are due to Monsieur Gravereaux for this magnificent "List of Roses grown at L'Haÿ." The volume has been deposited in the Society's Library, where all who are interested in Roses may consult it.



ROSE-FORCING IN AMERICA.

By Miss Anne Dorrance, F.R.H.S.

It is, perhaps, impossible for me to express the pleasure with which I accepted the invitation of the Council of the Royal Horticultural Society to make an effort to add to the pleasure of this Conference—to attempt to add to its knowledge is quite beyond my power. I have chosen as my subject Rose-forcing in America for several reasons, among which may be mentioned my lack of experience with out-door Roses, and the fact that we must all look to England for them. Her Roses and the work of her rosarians stand so near the ideal that I think we practically consider them synonymous. But, having accepted, I hope to offer something of my branch, though a very small and humble something, so microscopic that it hardly seems worth while.

Whether your beautiful Roses are due to climatic conditions, or to something in your hearts, as your prince of rosarians has said, I know not. If it be climatic, we of the eastern part of America are lost; if it is in the heart we can take courage, for we have a goodly share of that, and, growing upon what it feeds on, it is becoming more and more of a factor. Who can look upon a Rose without feeling its power? Who can live among Roses without coming completely under their sway, captivated by their beauty, perfection of form, colour, fragrance, and size?

In America the art of forcing flowers of any sort is scarcely more than a hundred years old—a day, to a nation which has just celebrated the thousandth anniversary of her Alfred; but to a nation whose whole life is summed up in but few years more than the aforesaid one hundred, quite remarkable indeed do the strides seem. The bulk of Rose-forcing is done by those who make it not only their life work but also their means of livelihood. Consequently they enter upon it with all the alertness, eagerness, and energy which in this age of strenuous living go to make up success. In the recital of it all I shall try not to include the aphis.

The following quotation from the opening address of the president of the Society of American Florists at its annual meeting a year or two ago may serve to throw some light on the subject:—"In the western part of the country the population has increased over 400 per cent., while the increase of glass devoted to floriculture is over 1,100 per cent." Of course, by no means is all this given over to Rose-forcing. In 1800 there was but one establishment devoted to commercial horticulture, a fact explicable by the youth of the nation, when every man was needed for the development of the country, for actual hardships and labour, when patriotism was shown by the giving of life to one's country on the field of war, not only with other nations of the world, but also with the savage aboriginal tribes. During this transition from colonial to national life many of the pleasures and graces were laid aside, but not forgotten, to be taken up again at the earliest possible moment when stern necessity gave way. In Philadelphia, the first capital of the country, we find the earliest attempts at forcing flowers. It was the centre of wealth for the land, consequently of all the refinements which wealth legitimately brings. Attracted by this, the gardeners coming from the old world settled there and brought with them their beauties. The Philadelphia climate was not so rigorous as that of New York city and of Boston. Boston followed Philadelphia's lead as methods of heating became more complete; ranking next came New York city, developing more slowly, but progressing further.

The marked period of growth began about 1825 and has led to the establishments of to-day, so that at one and the same time we are able to find ranges of greenhouses varying in size from a "lean-to" on a New England farmhouse (reminding one of certain Nottinghamshire houses long since made famous), to houses containing many hundred thousand square feet of glass. Some Rose-growing establishments produce cut flowers for the wholesale market, while others, and not among the smaller, grow nothing but plants for the retail trade. Using the Parcel Post as their

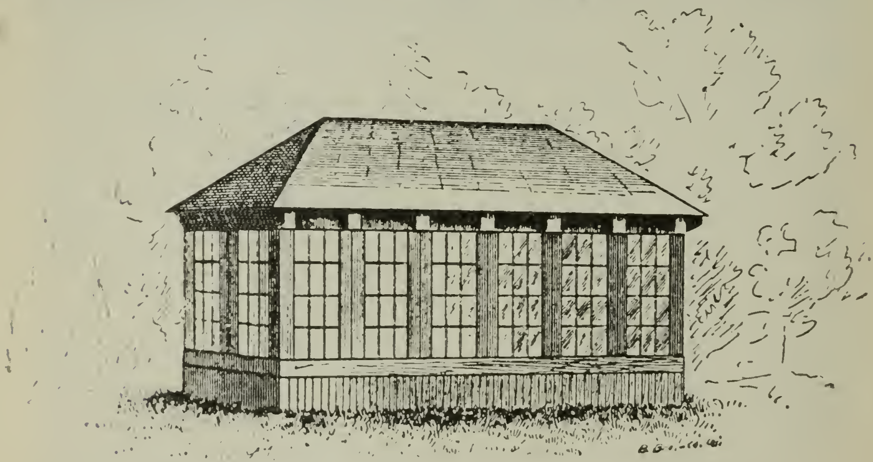


Fig. 129.—The First Greenhouse erected in America.

carrier, some of the latter sell plants for a few cents each, all they are worth, but making it possible for many to have Roses in abundance, who could not, were they dependent on those firms who supply only such plants as must be sent by goods train.

The first greenhouses in America were high-walled hotbeds, with a great number of windows for side light, or these might be dispensed with. Through the courtesy of the Department of Agriculture of the United States I am able to reproduce from the "Year-book" for 1899 a drawing of the first greenhouse in America. (Fig. 129.)

Small glass, single thickness, was used; this was butted in glazing after the edges had been dipped in copal varnish, and laid in putty to make a tight joint. The next step was the lean-to house, with the roof very slanting, thus giving more light and more roof area. All kinds of plants were grown in these houses at the same time. In place of the benching as now used, there was a staging reaching from the walk in the front of the house up to the roof; on the different steps were placed the plants, all in pots, and usually a 'Lamarque' Rose was planted at the back of the house and trained over it. The rafters were 2-inch by 12-inch plank ; the glass was 6 in. by 8 in. Compared with the houses of to-day, these were like dark cellars. About 1880 came the "Madison period," when the Roses sent from that New-Jersey town and its neighbours were the wonder of the American Rose world. It was there that the three-quarter span house was first built, with its larger glass and glass area, though still far from what builders of to-day consider fine houses. One range erected in 1880 is described as glazed with single-thickness glass 10 in. by 12 in., rafters of 3-inch by 4-inch hemlock timber, on which were nailed 2½-inch pine strips to glaze against. Since then rapid strides have been made ; 16-inch by 24-inch glass or larger, double thickness, is used, lapped or butted, and laid in putty, or one of the patented compounds which are supposed to take its place. The rafters are of iron, as light as is compatible with rigidity, and to carry the weight of snow put upon them by the blizzards to which all parts of the country are subject. The sash-bars are made from 1½-inch cypress timber, having a groove on each side running the full length of the bar

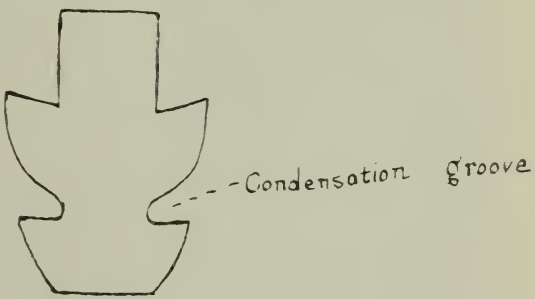


Fig. 130.—Section of Sash-bar, showing Condensation Groove.

to carry the condensation to the eaves and keep it from falling on the plants, thus avoiding all drip. (Fig. 130.)

A house 20 ft. by 150 ft., newly built and planted, is indeed a thing of beauty. Unusual are the few houses which are now being built 50 ft. to 60 ft. wide and 300 ft. to 600 ft. long. They are the freaks of to-day, as the normal house of to-day was the freak of yesterday.

The benching of the houses has developed in an interesting manner. Following the staging referred to above, came the raised benches of the Madison period. Tall houses necessitated benches on stilts in order to bring the plants near enough to the glass to get the full benefit of the light. The back bench was at least 6 ft. from the ground ; the next not so far by 18 in., separated from the first by a plank walk of 20 in. or 2 ft. ; the third bench is lowered by about the same distance as between the first and second, and separated from the second by a 12-inch footpath. At the front of the third bench comes a walk sufficiently wide so that a wheelbarrow may be run through, then a low bench directly under the eaves. These benches were so built that they sloped several inches, with the result that the rows of plants at the high side of the bench were always dry, while those at the other side were always too wet. In a house of this description there was ventilation at the ridge and at the front side. In the ridge-ventilation sashes of small size were superseded by larger ones of 16 ft. by 30 in., hinged either on the edge away from the ridge, or at the ridge and on the long span. The front ventilation was secured by putting a sash for the tier of glass between the eaves and the water-table. One or two of the disadvantages of this style of house were the expensive repairs required, especially in maintaining the benches and plank-walks, the amount of water used rotting out the supports and causing decay of the side-walls; the front and back benches were so near the glass that the buds touched it before they fairly showed colour, and were in consequence deformed.

To obviate this difficulty and yet keep one long span, a house was designed which might almost be called a hybrid between the three-quarter and the even span. This house differs largely in the benching, having the walks next the side-walls, thus giving more head room. There are three benches, separated by two walks. Convenient as these houses are, they have one great drawback: it is impossible to use a wheelbarrow in them. The benches may be all raised or solid, as pleases the builder, or the back bench may be raised, the middle solid, and the front sunken. The raised benches are built of hemlock timber, 5 in. or 6 in. deep, and raised on 2-inch by 6-inch pieces, to a height convenient for working. The solid benches are enclosed by 8-inch hemlock planks, wired together at given distances to prevent spreading from the weight of the soil, or the walls may be made of brick or concrete, making practically a long box, determined by the length of the house and the width desired. Into this broken stone is piled to give drainage, to a depth of 1 ft., then a light covering of ashes from anthracite coal to give an even surface. The bench is now ready for the soil. The construction of the sunken bench is very similar, only that a trench of 18 in. is dug and walled up in the same manner after the drainage stones have been put in place. This bench does not give such good results as the others. It is so low that it is shaded during the short winter days by the house in front and by the woodwork of the house itself. (Fig. 131.)

The even-span houses vary greatly in size and methods of benching. They are usually fitted with two side benches and one or two middle ones, dependent upon the width of the house; these may be raised or solid. When there are two middle benches they are separated by a footpath.

In one form of the even-span several houses are built side by side and not separated by partition walls. The front and back spans of these houses have walls to the ground; the other spans of any given number are held in position by special devices, as the "Garland iron gutter," or something similar.

Having touched very cursorily on the several usual types of houses, it may prove of interest to turn to the latest developments in greenhouse construction. Not long since it was my good fortune to spend a number of hours with Mr. Paul M. Pierson, manager of the greenhouses on that model estate, the Briarcliff Farms, thirty miles north of New York city. The establishment consists of a number of houses, most of them 50 ft. by 300 ft., some planted with 'American Beauty' Roses, some with Carnations; such a house contains 7,000 Rose plants. In the latter part of April the bushes testified as to the number of blooms which had been cut, while the Roses in the vault told of the fine quality which always characterises Mr. Pierson's Roses. The benches were all raised and of the usual form. There are four tiers of ventilators: two on the roof spans, hinged at the ridge; one in each of the walls, hinged at the eaves. More attractive than any of these was a short house, 28 ft. wide, built as an

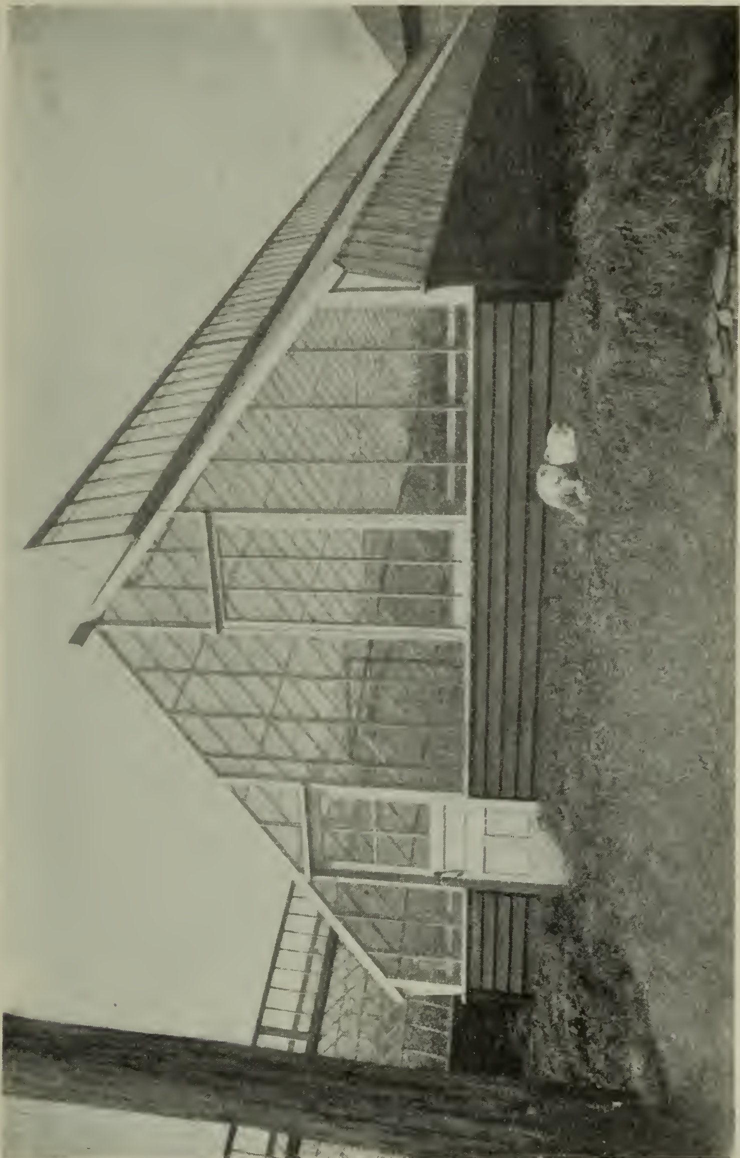


Fig. 131. · End View of Modified $\frac{3}{4}$-span House with long span to the South.

experiment. The size of the plants, 'American Beauty,' prohibited a photograph of this interior, but it was possible to get an end view of the exterior (fig. 132). This is a patented construction, Mr. Pierson's own invention, and a very pleasing one. The house is much lighter than the others, a result obtained by the use of iron sash-bars instead of wooden ones, thus dispensing with the comparatively heavy structure needed with the latter in the houses of to-day. The bars and glass are bent at the eaves, thus doing away with that angle, and leaving no place for icicles

FIG. 132.—END VIEW OF CURVED GLASS-HOUSE ON THE BRIARCLIFF FARMS, SCARBOROUGH, NEW YORK.

to form; consequently there is no breakage. The glass is 24 in. × 30 in., set the 30-inch way. The sash-bar is protected by patents, and is a half-circle of iron with wood inserted to glaze against, the wood being held in place by brass screws. The channel between the under edge of the wood and the iron tubing carries off the condensation to the water-table. When the house was being built the question arose as to whether the iron bars would hold the cold, and make the house freeze over; but Mr. Pierson says that, on the contrary, the iron seemed to hold the heat from within, and start the snow and ice after a heavy storm, so that the roof on this house was always the first cleared.

The following quotation from a letter of the Floral Exchange, speaks

FIG. 133.—INTERIOR OF THE MAMMOTH HOUSE OF THE FLORAL EXCHANGE AT EDGELY, PHILADELPHIA.

for itself and gives another point of view, from people who have had splendid success with large houses:—"We find that our wide house, 54 ft. by 300 ft., has been the most profitable on the place, both as to number and quality of flowers and ease of working it. The past winter has given it a very severe test, and the few weak points we found will be avoided in the house we are now building, which will be still wider than the one put up last year. This house will be 63 ft. 2 in. wide on the square section, but the ends being cut off 'bias' will measure 89 ft. In this house we do not use the long struts shown in the other plan, but have seven lines of posts, making the house stiffer. All fittings are *bolted* through the pipe instead of trusting to set screws. The sash-bars are full 35 ft. long, with only a cross section of $1\frac{3}{8}$ in. by $2\frac{3}{4}$ in., very light for that length. We use angle-iron purlines 2 in. by 2 in., and no rafters of any kind. Glass is 16 in. by 24 in., put 24-inch way, and the house is as light as a bright day. . . . You will please note that the Roses are planted in the field, and a strip of wood 2 in. high marks the edge. We used a horse and harrow to get the ground in shape. For our present house we have manured the whole plot, ploughed it up, and harrowed it to a level before the carpenters began work. In the house we put up last year we had 'Golden Gate,' 'Brides,' 'Bridesmaids,' and 'Beauties,' and all did well. We are cutting, on an average, 20,000 Roses a month from that house. The new house is for 'Queen of Edgely,' and will house 10,000 plants." (Fig. 133.)

Many important problems must be decided in choosing the position for a range of houses. Some of the chief are :—

1st. The necessity for securing as much sunlight as possible. So many schemes are there for doing this that one is almost tempted to believe that there are more ways than one for the sun to shine. Some advocate putting the short span to the south, some the reverse. A very good way, and one which has proved itself satisfactory, is to have the cross house run due north and south, with the houses opening off, due east and west. Thus there is very little shadow from the cross house, only that cast on the house to the eastward. The individual houses in the range are set far enough apart so that their shadows at their longest do not reach the house behind.

2nd. The ease of obtaining fuel, of which an unending supply is needed, for in the large places the fires are not out from year's end to year's end. Anthracite coal in one of its marketable forms is the best, for there is no smoke-deposit as there is from bituminous. Furthermore, the ash from anthracite is very useful in crocking pots and in making a foundation to set pots upon, holding moisture and being a dainty for which the roots eagerly seek. The ash from bituminous coal is poisonous to Rose plants.

3rd. The relation to the market, which to the commercial Rose-grower is a very important point, and, with its corollary, the means of transport, is often the deciding factor.

The development of the manner and method of heating, from the time when manure and straw mats furnished the heat, till to-day, is very great. All heating comes under the head of steam or hot water, but there the similarity seems to cease, so complicated and so varied are the systems. Theories are rife, and, as is often the case, practice in many instances gives the lie to theories.

Granted that the houses are built in good form, situation, exposure, piped for heat and water, the next step is to make ready for the planting. Preparation for this has been going on for a long time, if the range be not a new one : either in the propagating house, where the cuttings are rooted, or in the "Wardian case," where the secrets of the grafting process are unfolded. We assume all to be in readiness now. If the houses are not new it is customary to burn flowers of sulphur in each house before it is planted, to kill any germ-spores left from the preceding year. Then the ground under the benches is thoroughly sprayed with Bordeaux mixture to make the cleansing as complete as possible. All this is done from a conviction that it is better to keep the plants in healthy growing condition by providing a suitable environment than to try to cure some preventable fungous disease later on. The next step is to carefully cleanse the benches and give them a coat of whitewash, to which has been added thirty pounds of flowers of sulphur to each bushel of lime. When this is first put on it is bright yellow, but it becomes a clear white on drying. A thin covering of straw is laid on the benches to keep the soil from sifting out. Now all is ready for the soil; whence does it come, where and how? The Rose-grower may be fortunate enough to have the soil near at hand, so that a short waggon haul is all that is required. Perhaps the best Nature could do was to make a fine deposit some eight or ten miles away, so that a railroad haul is added to the waggon work. The soil unloaded, it is stacked,—two-thirds soil and one-third good cow manure. Some growers recommend only one quarter manure, while others recommend one half. It is cut down at once and well mixed if it be spring-laid soil; if autumn-laid, it stands over winter without being cut down. Just here is one of the puzzles of American Rose-growers. There is a difference between autumn- and spring-stacked soil, whether mechanical or not no one knows. It is probably due to the alternate freezing and thawing of the winter season. Spring-stacked soil is more satisfactory. Unfortunately, spring at times takes matters into her hands and rains steadily for weeks, so that if dependent on spring-stacked soil the planting is seriously delayed.

After the benches are filled with soil a sprinkling of air-slaked lime and ground bone is put on. About 100 pounds of bone are used to 150 ft. of house 20 ft. wide. Artificial manures, save bone and hard-wood ashes, are not used to any great extent. In the early spring a light coating of wood ashes is put on, giving the soil a greyish colour. After the middle of January liquid manure is given once in ten days, and later in the season once each week. If the feeding is not given in this form a top-dressing of well-rotted cow manure is put on when needed. This has the disadvantage of bringing many angle-worms into the house, as well as a great deal of litter and dirt. The liquid manure is made in a tank built for that purpose. Its sides are sloping and lined with bricks which have been coated with cement to make them watertight. At a point about two-thirds of the length of the tank the side-walls are carried out to form projections about 8 in. wide, and reaching to within 1 ft. of the centre of the tank. When the work is finished there are practically two tanks with a sluice-way between, whose dimensions are 2 ft. by 8 in. by the depth of the tank. Each side of the sluice-way is covered with wire screening, and the intervening space filled with straw. In this way all the solid matter is kept from the pump. The larger end is filled with manure, proportionately one load of stable manure, one of cow, and one half-barrel of hen manure. Sheep manure may be substituted for the hen. Water is run in at this end and soaks through to the smaller end. Some growers suspend a bag of soot in the water-end of the tank. When pumped through the pipes the liquid is the colour of strong coffee.

Whence come all the plants, sufficient to fill a range needing one or two hundred thousand plants? Heretofore it has been customary to plant with young stock every year, on the theory that one winter's forcing sapped the strength of the plants and gave the best blooms that the plant was capable of. Now there is a tendency to carry them over for two and even three years. The propagation of such a number of plants is in itself no small item either of time or labour. A small house having a northern exposure is set apart for this purpose; this has one bench running its entire length, boarded in underneath that the temperature may be evenly maintained. The bench, carefully cleansed after the manner of the large houses, is lined with slate and filled with clean, sharp, river-sand to a depth of about three inches. The temperature of the sand is kept from 65 to 70 degrees Fahr. Every precaution is taken to keep out the cutting bed fungus, a most unwelcome guest. In case of an attack, 1 part of mercuric chloride to 1,000 of water could be used. Personally I know nothing of this remedy except that it will kill plant life, the only question being whether it will not kill too much. The sand, thoroughly wetted, pounded and settled, makes a firm resting-place for the cutting after it has been made. The cutting should have at least two eyes. When the cuttings are made they are set in the sand with about one inch between them in the row and two or three inches between the rows. They are flooded into position and then watered as needed. At the end of three or four weeks they are ready to be taken out of the sand. The length of time depends on the variety. When sufficiently rooted they are potted in $2\frac{1}{4}$-inch pots, with finely-screened fibrous soil. In six to eight weeks they are ready to be shifted into $3\frac{1}{2}$-inch pots, with some manure and ground bone. In six weeks more they are ready to be planted in the benches; they are there kept in a growing condition, carefully disbudded, until they are good-sized plants. The first few weeks they are only allowed to mature the best buds, the "seconds" and "thirds" being cut off.

For grafting, Manetti is the most generally used stock in this country. Experiments are being made to see if one of our native varieties will not serve us better. The suckering of the Manetti is one of its worst faults, and if this energy could only be put into the right channels everyone would be very much better satisfied. According to reports made at the last meeting of the American Rose Society, as yet nothing has been found. The *modus operandi* is as follows:—The Manetti, on its arrival from English or Scottish shores, is carefully looked over and potted into $2\frac{1}{2}$-inch pots. It is then placed in a cool dark house and kept at a temperature of 40–45 degrees Fahr.; when the roots have started well the temperature is gradually raised to the growing point. The grafting is done with whip-grafts, except where the stock is so large that the scion cannot be made to fit, when cleft-grafting is resorted to. Then the next step is putting the plants into "Wardian case." For this several false ends are made, so that it may be divided into as many individual cases as are required, thus making it possible for each grafting of plants to have a compartment to itself and be treated satisfactorily. As there are questions of the *pros* and *cons* of grafted *versus* own-root stock, so there are questions of the treatment of the plants in the case. Following are two sets of rules :—

Rules of John H. Dunlop of Toronto :—

First seven days keep the case closed tight; but if the moisture is too great, or if there is too much condensation, give a small crack of air. It is important to shade from sun.

Eighth day give ½ in. air.	16th day increase to 4 in.
8th–12th day increase to 1 in.	17th ,, ,, ,, 6 ,,
12th–14th ,, ,, ,, 2 ,,	18th ,, ,, ,, 8 ,,
15th ,, ,, ,, 3 ,,	19th ,, give full air.

At the expiration of three weeks, or as soon as the plants become accustomed to the full air, they are taken from the case and thereafter treated as all other young plants are. While in the case the temperature should be 82 to 84 degrees Fahr. In watering when needed, dribble on with a hose, taking care that the foliage is not wet.

Rules of "Ribes," taken from the *Florists' Review* :—

"Success can be had under ordinary circumstances by keeping the temperature of the frame at 60 to 64 degrees Fahr. for the first eight or ten days, or until the majority of the scions are united. Some propagators use a higher temperature with good success; but for 'Brides' and 'Bridesmaids' this is sufficient. During this period it is a good plan to open up the frames for a few minutes morning and evening to change the air; it does no harm unless left open too long. As soon as uniting has taken place, air can be given gradually, and the temperature reduced until it reaches 56 degrees. This will require about five days, when they can be removed from the bench. While the plants are in the frames they require very little water until the air is admitted."

Verily there is the difference of the whole pendulum swing between these. In this case no opinion has as yet been handed down. The strong point in directions for planting grafted stock, namely, "to plant so that the union between the stock and scion be without fail under the soil, so that the scion may also strike root," seems almost to reduce the question to absurdity and only to complicate matters needlessly. It is a question for older heads than mine and wiser to settle. I have recently heard the man who forces the best roses in America say that for exhibition-flowers, own-root stock is better, but for a quantity of saleable flowers grafted stock is more satisfactory. This man believes it more profitable to have four or five first-grade Roses than one special. The report of the foreman of a place near Chicago having 150,000 Rose plants is that "grafted 'Maids' have done better than own-rooted stock, but some stock propagated in January and February 1900, carried practically dormant to the spring of 1901 in 3-inch pots, has given remarkably good results when it had once started. The only advantage of grafted plants is to get new blood and to effect a sort of rejuvenation of the stock." Manetti is not affected by eelworm, and this is another very strong reason for the use of grafted stock by those growers whose plants are much injured by that pest.

May to July is the time for planting those houses which are to bloom the next winter. For summer blooming the planting is done in March or April, in order that the plants may be well started and have made good growth when the time for cutting has come.

Given the houses, well planted in good season, soil and stock, the duties of the grower are ready to be taken up. With the exception of the twelve hours when the nightman is in charge, each grower is entirely responsible for the soil-conditions, water, temperature, and continued good health of the plants, and for the production of blooms of proper quantity and quality. This is for a given amount of glass, the usual method giving each man about six thousand square feet; in some places, however, one finds a much closer division of labour—a man for weeding, for tying up, for hose work, for cutting the Roses: in short, a man for each separate piece of work; a system through whose long division responsibility has been entirely lost, as well as that interest and competition which arise when each man has his own house or houses, backed by the ambition to make his 'Liberty,' 'Meteor,' 'Brides,' or what may be, the best on the place.

Each variety has its own temperature, the day being about ten degrees higher than the night. The changes are made gradually at both times. In order to keep the temperatures within their ranges, the night fireman makes trips through the range every two hours, changing his pipes and pushing his fires or shutting them down as is required. The day fireman pulls the fires, and wheels the ashes made in the preceding twenty-four hours. He keeps his fires in accordance with directions from men in the houses.

It may be interesting to give a brief outline of the daily routine in the greenhouses. The day begins at seven in the morning, unless a shift has come on at some unforeseen hour to make a shipment. The first thought is the temperature, that the houses have been properly kept during the night, which is ascertained by means of registering thermometers. The temperatures must be rising, so that the reduction caused by watering will not chill the plants. Following this the cutting is carefully done, counted, and registered on a sheet of paper ruled for that purpose, which is returned at the end of the month, that a record of the standing of each house may be made at the end of the year, and the amount of loss estimated. The Roses are carried to the grading-room and left in pots of water. The next work is the watering, if needed, or the syringing, if the day be propitious, for the red spider loves his deeds of darkness and fears only cold water. The remainder of the morning, if bright, is spent in spraying with some one of the fungicides, otherwise in tying up the bushes, cleaning the soil and working it, picking leaves, or some similar work. If necessary a second cutting is made before noon. From twelve until one is the dinner hour, after which work begins again with a repetition of the morning's work, save that of watering, syringing, or spraying. At five or a quarter past all hands are called to the packing-room to make the shipment which will reach the market the next morning. Before this may be described we will have to see what has become of the Roses which have been left in the grading-room at different times during the day. One or two women, as may be needed to handle the Roses, now take them in charge, carefully grading each bud:

by bloom, as to colour, size, shape, substance, and perfection of form; by stem, as to length, straightness, foliage, and then making the necessary correlation and putting each into its proper grade according to the following scale:—

Grading Scale for Teas and Hybrid Teas (except 'Cusin' and its sports).

Special, above	20 inches.	First, above	10–13 inches.
Fancy ,,	15–20 ,,	Second ,,	6–10 ,,
Extra ,,	13–15 ,,	Third, all under	6 ,,

Grading Scale for 'Cusins,' its sports, and Hybrid Perpetuals.

Special, above	20 inches.	First, above	8–13 inches.
Fancy ,,	15–20 ,,	Second ,,	6–8 ,,
Extra ,,	13–15 ,,	Third, all under	6 ,,

Grading Scale for 'American Beauty.'

Special, above	38 inches.	First, above	13–23 inches.
Fancy ,,	32–38 ,,	Second ,,	8–13 ,,
Extra ,,	23–32 ,,	Third, all under	8 ,,

After this is done the Roses are plunged up to their heads in cold water and put into a dark cooling-room for at least twenty-four hours to harden. The advantage of this can only be realised by experiment, and if our garden Roses were so treated we should have greater satisfaction from them. Dependent upon distance from market, the packing is done. Also upon this is regulated the development of the bud before cutting. In those places where shipment is simply a drive of an hour, Roses can be left on the plants longer than when a railroad journey of twelve or more hours must be taken. In the former case the Roses are laid in large baskets which have been lined with paraffined tissue-paper. When shipped by railroad a more complicated performance is gone through. Wooden boxes coming in the form of 'shooks' are made up into various sizes; a convenient size is 12 in. × 48 in. × 5 in. inside measurements. These boxes are lined with old newspapers, then with paraffined tissue; on this bed the Roses are laid. The higher grades are separated by strips of the waxed paper between the rows, and wedged into place by sticks a trifler wider than the box, thus preventing any shifting. Broken ice is put in the boxes to keep the temperature down as low as possible and prevent undue opening of the buds. Each box holds from 200 to 400 Roses, according to variety and grade. When the lids are nailed on, the boxes are tied up in twos, making packages of thirty-five or forty pounds; they are a bit awkward, but do perfectly well for long distances. This takes from an hour upwards, according to the size of the shipment, and ends the day's work, save for the temperatures taken by the foreman and his report to the night watchman.

This sketch is hardly complete without the tale of the constant warfare waged by the grower against insect and fungus foes. In the morning, provided the day is sunny, so that the plants will dry, the first foe to be met and conquered is the red spider. Water is the only weapon which will dislodge it from its foothold, and it must be syringed-on under great pressure. If the plants have had a dose of the dreaded 'black spot' a still harder fight has to be made. The leaves are picked and carefully burnt; care is taken that the foliage is not wet on dull days, and every effort made to keep the plants in as healthy condition as possible. As a preventive, and to kill whatever spores there may be around, on clear mornings a spraying is given with some one of the copper solutions, as the modified 'eau céleste' or the ammoniacal solution of copper carbonate. Many formulæ are given and all advise the use of the commercial copper carbonate, but we have found it better in every way to make our own salt, precipitating from aqueous solutions of sodium carbonate and copper sulphate, carefully washing out the sodium sulphate and dissolving the copper carbonate in ammonium hydroxid, 26° Baumé. This stock solution, securely corked, will keep indefinitely. Greatly diluted it is sprayed on the plants with a knapsack pump, or, best of all, one of those pumps now on the market in which the spray is driven out by compressed air. For mildew the standard remedy is flowers of sulphur, applied either on the plants themselves by means of a powder-gun, or mixed with water it is painted on the heating pipes for vaporisation. The sulphur is sometimes vaporised over an oil stove, a most unsatisfactory method and dangerous, as the sulphur is apt to catch fire and cause great damage. A troublesome kind of invader is the green fly—the aphis—which the ant so carefully treasures. It yields only to nicotine. Heretofore, stems fresh from the stripping room of the tobacco factory were used. They were burnt in a metal "smoker," but not allowed to blaze, and drawn through those houses which were planted with varieties sufficiently sturdy to withstand the heat and dense smoke of the burning stems. In those houses containing the more delicate varieties, the stems were laid in every way imaginable (trying to make the best of a poor arrangement) on the benches and under them, in wire-net baskets for ease in renewing them. At the present time it is almost impossible to get good stems, as they are leached to extract the nicotine used in the manufacture of the preparations which are gradually supplanting them. These do away with much of the discomfort and disorder attendant upon the use of stems, and of the danger from fire from the superheated "smoker." The various liquid extracts are not satisfactory; the strength of the solution becomes so concentrated on standing that it gives an unduly strong fumigation, resulting in disaster in the hands of heedless employés. The soap-forms are made for spraying, with the disadvantage that it is not always possible to wet the plants when the aphis is worst. As satisfactory a preparation as is made at present is that sent out by the Scaboura Dip Company of St. Louis under the name "Nikoteen Aphis Punk." A stick of punk is a strip of paper dipped into the nicotine solution of proper strength, dried, rolled, and packed in boxes containing one dozen sticks. The sticks are lighted and, smouldering in the house, give off a pungent, penetrating odour which seems to be the sure death to the aphis for which all stony-hearted Rose-growers are seeking. Smoke from the aphis punk does not injure in the least the most delicate Roses. An illusive microscopic pest is the eel-worm, which enters the plant from the soil. The only remedy is burning the infected plants and removing the adjacent soil. For the thrip, which deforms the bud and is so hard to reach, pyrethrum powder is burnt.

The experiments which are being carried on are most interesting when they are known. The unfortunate part is that one rarely hears of them being performed on other than the home range. It would be well if Rose-growers could imbibe a little of the scientific spirit and let all who love the Rose know what each and everyone is doing, realising that strength lies in numbers. The three important questions which are now perplexing American Rose-growers are grafted stock *versus* own-root stock, replanting or carrying over the old plants, and the sterilisation of the soil. I have already spoken of the grafted stock question. Regarding the carrying over of the old plants, with or without moving them, all that can be said is that it is done, and that each grower follows his own method. Certainly 'Brides,' 'Bridesmaids,' and 'Golden Gates' are further ahead in the early winter of the second year than plants of that year's propagation, in the quality and quantity of the bloom. 'Golden Gates' carried over for the third year have proved fairly satisfactory, breaking well when moved and bent, or cut down to hard wood. The results when cut back have been more satisfactory. Some growers, in carrying over, withhold the water until a complete check has been given and the leaves are gone. Some lift the plants from one bench to another, cutting back severely to keep the equilibrium between the roots and the foliage. Some do not entirely withhold the water, but allow the plants to get on the dry side, strip off the leaves, and cut back to hard wood.

Last, but not least, from the furore which its sponsors have made over it, comes the sterilisation of the soil. This, I am under the impression, originated in New Jersey. It is the panacea for eelworm. It does not seem to occur to its promulgators that the fearful heat and live steam to which the soil is subjected in the sterilising machines of various forms, kills all those wonderful little plants which make the nitrogen available. Then, too, after the soil has been carefully baked and sterilised the proper proportion of manure is added, and why does this not inoculate the soil and so undo whatever may have been gained by the sterilisation process ?

Nothing of importance has been done with sub-irrigation in the growing of Roses.

In building last summer we were belated in some mysterious fashion, so that two houses, each 21 ft. × 150 ft., were not finished until after frost, consequently we are trying an experiment on a rather larger scale than we should have from choice. Early in August last we planted in the field the 'Brides' and 'Bridesmaids' intended for the houses. They received good cultivation and made fine growth. The houses were finished in November, so that one was planted the first week, the other about the twentieth. The plants put into the first house were survivors of fairly heavy frosts, but still had some good bottom shoots. These, however, did not grow. The growth all winter was very slow, and now (March 24) they have just begun blooming, but with splendid bottom shoots. The second house was filled with plants taken from the frozen ground with balls of ice on their roots. These were started much more slowly than the plants in the first house, but now equal them.

When 'Madame Caroline Testout,' 'Souvenir du Président Carnot,' 'Kaiserin Augusta Victoria' &c. are grown for summer blooming, for which they are best fitted, they are given a rest of six weeks. This is done soon after Christmas. Water is withheld, the temperature gradually lowered; after the leaves have fallen the heat is entirely taken off. At the end of the rest they are slowly started for the summer blooming.

In America, Roses were first forced in the early fifties, and the variety was 'Hermosa.' The following story, interesting because of its connection, is told by Mr. Ernst G. Asmus, our foremost Rose-grower, who has seen the whole development of the art; in fact, at his door might be laid the greater portion of the whole, and to his kindness is largely due whatever there may be of interest in this paper. He was a boy in a florist's establishment on Broadway in New York city and overheard this conversation between his employer and a customer: "Just think of it, we are going to have Roses for New Year's day!" The eyes sparkled with the anticipation of that triumph. New Year's day came and with it the Roses, not more than six 'Hermosa' buds, barely showing colour, with stems about three inches long; but Roses they were, and taking into consideration the difference in equipment of that day and this, the achievement was equally creditable, if not more so than the marvellous displays which the same season produces to-day in New York.

Following 'Hermosa' came 'Safrano.' Its tiny buds and stems of four or five inches, with an occasional ten or twelve inches, were an advance. Everything that showed colour was a Rose; no disbudding was done, no long stems demanded, which mean the loss of many buds. Foliage was not very necessary. The florist had for his formal bouquets Stevia, Camellia, Begonia sprays, Bouvardia, Heliotrope, Neapolitan Violets, wires and "wooden toothpicks" without number. Of what avail were stems and foliage under these circumstances? Foolish indeed the man who disbudded his plants or cut them unmercifully and so destroyed future Roses.

The next Rose was the 'Boston Tea Rose,' known to you as 'Bon Silène.' It gained its *sobriquet* because it was grown in Boston, and was so dubbed at a fair held in New York city for the benefit of the sufferers in the Franco-Prussian War. It was a great advance over its predecessors and created a tremendous excitement among Rose-lovers. Following this came 'Niphetos,' which was considered a great acquisition; its size earned it the name of enormous. Never had such a Rose been seen. With these two Roses 'Isabella Sprunt' was grown. Soon after came 'Catherine Mermet' and 'Perle des Jardins.'

At this time Hybrid Perpetual Roses were forced more than any other class. The method of doing this is very interesting. The plants were in houses which we, to-day, should call hotbeds, so crude were they. When cold weather was at hand the sash was removed and the plants allowed to freeze, thus giving them the rest they required. Soon after Thanksgiving Day the sash was put on and the plants given a heavy top dressing of manure to bring and keep up the temperature. At night the sash was covered up with braided straw mats to help keep the cold out. After a snowfall all hands were piped out, and quick hard work it was to get the snow off and lose as little heat as possible. The following varieties were the forcing Roses of the period,—'Magna Charta,' 'Mme. Alexandre Bernaix,' 'Beauty of Stapleford,' 'Duke of Connaught,' 'Anne de Diesbach,' 'Anna Alexieff,' 'Comtesse de Brabantane,' 'Mme Charles,' 'Mme. Falcot,' 'Ma Capucin,' 'Mme. Welche,' 'Charles Rovolli,' and 'La Sylphide.' 'Anne de Diesbach' took the place of of 'American Beauty.' 'Mme. Falcot' is now being grown in Philadelphia and the Roses called "débutante buds." From the period beginning in 1880 progress was very marked in houses, methods of heating and culture, and in varieties. The first Rose of this new time was 'General Jacqueminot.' Together with this 'Ulrich Brunner,' 'Cornelia Cook,' and 'Souvenir d'un Ami' were grown. 'La France' was one of the remarkable Roses and was considered a great advance. It is grown now only to a very limited extent, as its constitution has become so weakened that the stems cannot support the heads. Soon after 1883 John Henderson introduced 'Papa Gontier,' which was received with joy. In 1885 there came from the gardens of George Bancroft that Rose which, under the care of experts, has become the pride of American Rose-growers. It was unwittingly renamed 'American Beauty'; it is 'Mme. Ferdinand Jamin.' To-day some Rose-forcers claim that the Rose has varied so much under cultivation that it is itself a distinct variety and is worthy a name of its own. Introduced in 1885, it was not until 1890 that she was grown to any extent, for she was coy and had to be petted and courted with all the wiles that man could summon before she smiled and gave her wonderful blooms on stems without end. So well does she grow that at the March 1902 Show of the American Rose Society a prize was offered for 'American Beauty' Roses with stems not less than 5 ft.; the winning Roses crowned stems over 9 ft. long, straight and covered with fine foliage. Under the reign of 'American Beauty' all other Hybrid Perpetuals save 'General Jacqueminot' and 'Ulrich Brunner' gave way; 'American Beauty' having the great advantage of blooming constantly.

'Catherine Mermet' was grown very extensively until her daughter 'Bridesmaid' supplanted her in 1892. 'Bridesmaid' was introduced by Frank Moore of Chatham, New Jersey, on whose place it originated. It has given such general satisfaction that new Roses are often advertised as the pink or yellow 'Bridesmaid.' It is a very satisfactory Rose, save that occasionally the stems cannot support the heads, and a weak neck throws a Rose into the second grade whatever may be the perfection of its bloom and the length of its stem.

American Rose-growers owe much to 'Catherine Mermet' not only for the best pink Rose but also for the best white, the 'Bride.' As all brides precede their maids, so this one should come first, as it sported in 1885, and was then introduced by John N. May, who bought it from its originator. 'Bride' was the first American sport to prove itself of any value as a standard variety. There are other competitors for the two places mentioned above, but as yet these two stand supreme in their class. Unfortunately, in the heat of summer the buds open before they are fully matured and are very tiny. Contrasted with these are the unsuccessful sports from 'Catherine Mermet.' In 1891, the Waban Rose Conservatories, near Boston, introduced one which they called 'Waban.' Introduced with blare of trumpets, this Rose took the course of the proverbial rocket. 'Maid of Honour,' a sport from 'Bridesmaid,' is another failure because of its predisposition for mildew. It was first named 'Clara Barton,' but its name was changed to avoid confusion with a Hybrid Tea having first claim to that name.

Previous to all of these were two sports from 'Bon Silène,' 'Flag of the Union,' and 'American Banner'; they were great failures, for the American people, proud though they be of the Stars and Stripes, like self-coloured Roses.

'Madame Cusin' has been and still is one of the standard forcing Roses. The thorns are somewhat poisonous, and have been its greatest drawback. Generous with its blooms, it has been equally generous with its offspring, and has given us one valuable forcing variety and two still waiting to be proved. The first sport is 'Mrs. J. Pierpont Morgan,' and was introduced by J. N. May in 1895. It is much darker than its parent, and has a rather purplish tinge; it is equally prolific. Two others, one a child, the other a grandchild, are yet to be mentioned. The child, 'Sara Nesbitt,' originated on the place of Benjamin Dorrance in 1899; it is smaller than its parent; its white petals are tipped with pink, so that in appearance it is like a beautiful shell or the dainty attractiveness of the apple blossom. It is a remarkable keeper, frequently lasting a week in the living-rooms of a dwelling, and growing more beautiful as the petals open out and allow full development of the centre. The grandchild, 'Mrs. Oliver Ames,' a sport from 'Mrs. Morgan,' originated in 1901 near Boston with a Mr. Montgomery. It is not necessary for me to speak of this Rose, for recent report states that it has been on the R.H.S. tables for your inspection, sent over by J. N. May, who is introducing it. Other sports from 'Madame Cusin' have been registered but nothing has been heard from them.

Several years ago, at the place of John Burton near Philadelphia, originated 'American Belle,' a sport from 'American Beauty,' pink in colour, with smaller foliage; with this, however, nothing was done. A year or two ago a similar sport appeared for the Floral Exchange of Philadelphia, which was named 'Queen of Edgely.' This Rose is being wonderfully well treated by its introducers, but has never been put on the general market. It has also been seen in England.

'Golden Gate' has given us 'Ivory,' a sport which is said to have the characteristics of its parent. It is to contest with 'Bride' for the title of "best white Rose"; it will find a foeman worthy of its steel. It is this year being distributed from the place of the American Rose Company, of Washington, D.C., where it originated two years ago. The American Rose Society has given it its first silver medal for Roses of American origin which show merit.

Another sport which the American Rose Company has recently registered is 'Miss Alice Roosevelt,' from 'Madame Abel Châtenay.'

'Lady Dorothea,' a sport from 'Sunset,' originated with J. H. Dunlap, of Toronto, in 1895. It is not quite so large a flower as its parent, nor is the plant so strong a grower. The colour is better, deep peach pink on the outside of the petals, delicate soft pink on the inside; the foliage is a deeper red than 'Sunset.'

The following are miscellaneous sports which are of American origin;

some have been very valuable and still are so for other than forcing purposes, some are still to be proved :—

'Setina,' a sport from 'Hermosa,' which originated in 1859, and was introduced by Peter Henderson & Co.

'Isabella Sprunt,' a yellow Tea, for many years a most valuable forcing variety, a sport from 'Safrano,' originating with the Rev. Dr. James Sprunt, of Kenansville, in 1865.

'James Sprunt,' a climbing sport from 'Agrippina,' originated with the Rev. Mr. Sprunt in 1850. It is not so free a bloomer as its parent.

'Vick's Caprice,' a variegated sport, pink and white, from 'Archduchesse d'Autriche,' originated in 1889 with James Vick, of Rochester, New York.

'Rainbow,' 1891, striped white and red sport from 'Papa Gontier,' originated with John Sievers, of San Francisco, California.

'Ruby Gold,' originating with T. O'Connor, of Providence, Rhode Island, in 1892, is interesting because of its history. Mr. O'Connor grafted 'Catherine Mermet' on 'Maréchal Niel,' and from this graft came 'Ruby Gold.'

'Climbing Perle des Jardins,' a sport from 'Perle des Jardins,' originated with John Henderson, of Flushing, New York, in 1890.

'Sunset,' another sport from 'Perle des Jardins,' is a rich salmon shade with pink centre, a good forcing Rose, and was introduced by Peter Henderson & Co.

'White Cochet,' a sport originating in 1896 from 'Maman Cochet.'

'Admiral Dewey,' a flesh-coloured sport from 'Madame Caroline Testout,' originated in 1899 with J. H. Taylor, of Bayside, Long Island.

In the class of seedling Roses the list is unfortunately short. We have not our Dicksons, Pauls, and Bennetts yet, but we are working, and work, sooner or later, brings success. The heart and enthusiasm are here, and time will tell which are the prizes, and, alas ! which are the failures. On almost every range can be found a spot devoted to the Lares and Penates of the place, the ripening hips, the seedpan, and the seedling Rose plants. Great indeed is the interest and anticipation which crosses the blooms, watches the development of the hip, the germination of the seeds in the pan, and reaches its climax in the first glimpse of colour and the counting of the petals.

Perhaps the most important Rose which has come from America is the 'Noisette.' The credit for this has always been given to the Noisettes of Charleston, South Carolina, but as authorities differ I shall quote from "The Rose," by H. B. Ellwanger, which book is the standard American treatise on Roses :—"The Noisette or Champney Rose (*Rosa moschata hybrida*) is of American origin. From the seed of the White Musk Rose fertilised by the Blush China (Bengal), John Champney, of Charleston, South Carolina, raised a variety, which was called 'Champney's Pink Cluster.' A few years later Philippe Noisette, a florist, also of Charleston, raised from the seed of 'Champney's Pink Cluster' a blush variety, which he sent to his brother, Louis Noisette, of Paris, France, under the name of 'Noisette Rose,' not giving credit to Mr. Champney as the originator of the class, which has ever since borne the wrong title of 'Noisette Rose.' Louis Noisette received it about the year 1817." *

The most prominent American seedling to-day is 'Golden Gate.' This was introduced by Dingee and Conard. It was raised by Mr. Jones of New Orleans about 1888; its parentage is very uncertain, probably 'Cornelia Cook' fertilised by the pollen of 'Niphetos,' 'Safrano' or 'Duchess of Brabant.' This is largely speculation from characteristics shown in forcing.

'Cornelia Cook' was long a favourite white Rose. A seedling of 'Devoniensis,' it was introduced by A. Cook of Baltimore, Maryland, in 1855. It held its place as the best white forcing Rose until 'Bride' supplanted it.

'Souvenir de Wooton' is a free-flowering, crimson, fragrant seedling of 'Bon Silène' × 'Louis van Houtte.' It was raised by John Cook of Baltimore.

'Mrs. Robert Garrett' is another seedling of John Cook's, whose parentage is 'Mme. Caroline Testout' × 'Sombreuil.' It blooms freely with large pale pink flowers. Mr. Cook has also sent out 'Baltimore,' a pink seedling of the 'Testout' order. I do not know the parentage of this Rose.

In 1854, 'Cloth of Gold' produced a seedling, 'Isabella Grey,' which is said to have been one of the parents of 'Maréchal Niel.'

'America,' a Noisette, originated by C. G. Page in 1859, is a pale yellow with large full flowers; it is not so free a bloomer as its parents, which are 'Solfaterre' and 'Safrano.'

'Harrison's Yellow' was originated by the man whose name it bears in 1830. It is golden yellow, medium size, semi-double. It is supposed to be a hybrid of 'Austrian' × 'Scotch.'

From the nurseries of Ellwanger and Barry, of Rochester, New York, have come many Rose treasures, not the least of which is 'Marshall P. Wilder,' originated in 1884, a seedling of 'General Jacqueminot.' It is too well known to need any description.

'Rosalie,' another of the Ellwanger and Barry seedlings, is from 'Marie van Houtte'; flowers deep pink and of good substance.

'Jubilee,' a brilliant crimson Rose, introduced in 1897 by M. H. Walsh, of Wood's Hole, Massachusetts, is from 'Victor Hugo' × 'Prince Camille de Rohan.'

'Marion Dingee,' a free-blooming, glowing red seedling from 'Duchess of Edinburgh' × 'Caserta,' was introduced in 1892.

Other Roses, perhaps the most remarkable of any which have come from America, are the Wichuraiana Hybrids which have recently been sent out by W. A. Manda of New Jersey. In 1897 he sent out 'Manda's Triumph,' pure white; 'South Orange Perfection,' white with pink edges; 'Universal Favourite,' deep pink. These Mr. Manda improved in 1899, giving us hardy climbers or trailers which are practically evergreen: 'Gardenia,' very large single flowers, soft cream-colour; 'Jersey Beauty,' flowers unusually fine and very sweet; 'Evergreen Gem,' flowers white,

* *The Rose: a Treatise, &c.* By H. B. Ellwanger. Revised edition. New York: Dodd, Mead & Co. 1893. Pp. 54–55.

double, with distinct Sweet-brier fragrance. All are very vigorous growers, with splendid foliage.

'Dorothy Perkins' is a Wichuraiana Hybrid × 'Mme. Gabriel Luizet.' This originated at the nurseries of Jackson and Perkins, of Newark, New York. Its habit is similar to 'Crimson Rambler.' It received much favourable comment at the Pan-American Exposition. The bloom is a clear shell pink, does not fade for a long time, and then into a deep rose; and it is fragrant.

Concerning the following varieties the record is so incomplete that that I am unable to class them either as sports or seedlings:—

'Brighton Beauty,' 1891, a bright red free-flowering Hybrid Tea, originating with Richard Bagg.

'Belle Américaine,' Hybrid Perpetual, with small, deep pink, well-formed flowers, originated with Daniel Boll of New York, in 1837; 'Mme. Boll' originated with the same man in 1859; it is carmine rose and belongs to the 'Baronne Prévost' type.

'Mrs. Degraw,' Bengal, originated with William Burgess, of Glen Cove, Long Island, in 1885. It resembles 'Apolline' in growth; rich glossy pink, prolific, continuous bloomer, and fragrant.

'Pearl River,' large, ivory white, originated with Dingee and Conard, in 1890.

'Anna Maria' originated with Mr. Feast in 1843. Its blooms are pale blush in colour, changing to white.

'Caroline Allen' originated also with Mr. Feast in 1843.

'Queen of the Prairies,' which Mr. Feast put on the market in 1843, is rosy red, a white stripe frequently showing on the bloom. It is a large flower. In the same year another 'Prairie Rose' was put on the market by Mr. Feast: it was named 'Superba.' Its colour is pink, fading to blush, small and full as to flower.

'Baltimore Belle,' Prairie, introduced by Mr. Feast of Baltimore in 1843; pale blush changing, to white.

'Dinsmore,' a Hybrid Perpetual similar to 'Mrs. Charles Wood,' was introduced in 1886. It is scarlet-crimson, large, double, and fragrant

'Mrs. William C. Whitney' was introduced by J. N. May in 1894 It is a Hybrid Tea, clear deep pink in colour.

'Beauty of Greenmount,' a rosy-red flower, originated with James Pentland, of Baltimore, in 1854. With the same man originated also 'Dr. Kane,' sulphur yellow, large free flowers, but difficult to grow. Mr. Pentland's gardener gave us a Bourbon Rose, 'George Peabody,' probably from 'Paul Joseph,' a rosy-crimson medium or small-sized flower, full and fragrant.

In 1850 Joshua Pierce, of Washington, D.C., sent out two Roses, both 'Prairies': one, 'Mrs. Hovey,' blush, changing to white, resembling 'Baltimore Belle,' which Mr. Feast sent out in 1843, but hardier; the other, 'Triumphant,' rosy pink flowers of medium size, and double.

By way of recapitulation, the following varieties are the most generally forced Roses in America to-day:—

'Bride,' 'Bridesmaid,' 'Golden Gate,' Teas of American origin.

'Mme. de Watteville,' 'Mme. Hoste,' Mme. Cusin,' Teas of French origin, with the sport of the last named, 'Mrs. J. Pierpont Morgan,' which is of American origin.

'Kaiserin Augusta Victoria,' Tea of German origin, a fine white Rose for summer blooming, but worthless in the winter-time.

The best red forcing Rose has been 'Meteor,' an English Rose, raised by Bennett. 'Liberty' is now trying hard to supplant this Rose. During the winter months 'Meteor' is very apt to turn blue, and gives a large number of so-called bull-heads, black buds which do not open. 'Liberty' does not do this. 'Meteor' is a fine summer-blooming variety.

'Liberty,' a Dickson Rose, which has been grown but three years, is rapidly forcing itself to the front rank, adding to its many good qualities the charm of fragrance. It is nearer the ever-blooming 'Jacqueminot' than any Rose we have had yet.

'Mme. Caroline Testout,' a hybrid Tea of French origin, is very good during the summer and early winter, but needs a rest during the winter.

'Souvenir du Président Carnot' is one of the best of the summer Roses. It is a Hybrid Tea of French origin, and needs treatment similar to 'Testout' and 'Kaiserin Augusta Victoria.'

In addition to the above should be given the following list of Roses which can be successfully forced, but which are not so often grown. The list is taken in part from the first bulletin of the American Rose Society, p. 3, "The Forcing of Tea and Hybrid Tea Roses under Glass," by Ernst G. Asmus.

'Maid of Honour,' 'Ma Capucin,' 'Perle des Jardins,' 'Sunset,' 'Bon Silène,' 'Safrano,' 'Niphetos,' 'Mme. Abel Châtenay,' 'Papa Gontier,' of the Teas.

'American Belle,' 'Souvenir de Wooton,' 'La France,' 'Duchess of Albany,' 'Mme. Augusta Guinoisseau,' 'Admiral Dewey,' 'Mrs. Robert Garrett,' of the Hybrid Teas.

Mention at least must be made of the success with which 'Crimson Rambler' plants are forced, and the great pleasure a well-formed and well-grown plant gives, not only to the one who has succeeded in forcing it, but to the one who sees the finished work.

It is worth while to devote a few words to the disposal of the blossoms after they reach their destination. The development of the large commission houses has been gradual. In early days the retailer dealt directly with the grower, paying a definite sum for each week's output, or buying on commission. Gradually, as the number of growers increased, and as they could not all make personal contract with the retailer, the commission man came into being. This took place some time in the eighties. The method was more or less satisfactory according to the ability and honesty of the man. The Roses were shipped for sale on a commission of 15 per cent. on the gross sales, the shipper standing the loss from all causes. Returns were made weekly, payments monthly. All went famously until a large house failed, whereupon the growers made a stand for daily returns and weekly payments. They carried their point. As time went on the wholesale value of the individual Rose decreased, a matter of vast importance to the grower, but which did not seem to make a proportionate difference to the commission man. Consequently several of the largest growers banded together, formed a joint-stock company, and sold their own produce. The history of this company, dating from its inception in 1895 to the present, is very interesting. Each stockholder paid, in addition to his stock, a deposit of one cent per square foot for all the glass from which he was cutting flowers and shipping to that market, and further paid a commission of 10 per cent. on the gross sales. The deposit was recoverable with 5 per cent. interest if at any time the connection with the company as selling agent were broken. The first year the flowers were pooled, a very fair arrangement, putting all on an equal basis. The second winter they were sold on their merits, a scheme which did very well for the man who grew good flowers and lived near enough to the market to insure fair play ; this, of course, did not give satisfaction. Now each grower employs his own salesman, who attends to all details of selling ; each man further pays the company a commission of 5 per cent. for guaranteeing and collecting all accounts. After the dividends have been paid the remaining earnings are divided among the consignors *pro rata*, so that, for the year just preceding this, one of the large growers estimates that it cost him less than 5 per cent. to market his product, without mentioning the satisfaction attendant upon being master of his own business. This New York Cut Flower Company handles the best Roses that go into New York city each year, and by its orders flowers of all kinds are shipped to the large cities in the United States and in Canada, quite a contrast to the old days when 15 per cent. commission was the law and the commission men were lords of the jungle. The financial year of a commercial Rose-growing establishment runs from July to July, from planting season to planting season.

The American Rose Society stands for the desire on the part of all Rose-lovers in the United States and in Canada to do their best for the Rose, to increase her following, and to have the finest Roses, forced and garden, and to help others to do the same. It is a young society, having been reorganised in 1899. It endeavours to carry out its aim in three ways : by the banding together of those who love the Rose, amateur and professional ; by the dissemination of literature which treats of the Rose and its culture ; and by holding two shows annually, one in March for forced Roses, one in June for garden Roses. There have been published four bulletins containing articles written by authorities, the last one being devoted to the diseases of the Rose. The shows have been held regularly, and have proved a source of inspiration and pleasure.

In conclusion I wish to express my indebtedness to many of my *confrères*, to some of whom I have already made acknowledgment ; to others too numerous to mention, but equally appreciated ; and finally to my father, Benjamin Dorrance, through whose success and by whose knowledge I have been led to enter the ranks of the Rose-growers, through whose inspiration I hope to reach higher levels, and who has been my valued critic in the writing of this paper.

A

SOME WILD ASIATIC ROSES.

By Maurice L. de Vilmorin, F.R.H.S.

The introduction into European gardens about a century ago of several Asiatic Roses was a decisive step in the way of the renovation and improvement of our Rose collections.

The Tea-scented or *Indica* Rose, the *Rosa semperflorens*, the dark-coloured *Rosa chinensis*, the *Moschata*, have been the means of the creation of several series of new and beautiful shades of colour, and of the perpetual bloomers; while the double *Rosa lutea*, or Persian yellow, the *Rosa sulphurea* are supplying new and rich tones.

Are we to look to the opening of the present century for a similar transformation by the crossing of some of the present varieties with the *Rosa rugosa*, a species inferior to none in respect of the size and continuity of the flowers, beauty of the foliage, and hardiness? We may, indeed, hope to see some achievements in that line, when we consider some of the results obtained by the hybridisers of different countries, and, for instance, some Roses recently originated in the garden of my respected friend, M. Gravereaux, at L'Haÿ.

But my subject is to speak of the wild Asiatic Roses, and I have to adhere to the schedule. This is comprehensive enough, and I must leave much of the subject untouched. All the wild Asiatic Roses are not yet introduced into cultivation, although some new ones are coming, as Mr. George Nicholson is soon to explain; all the introduced ones are not in my garden, and on some of my Asiatic Roses there is no present matter for remarks that would interest amateurs. I shall accordingly speak of only some few species which are peculiarly familiar to me and worthy of cultivation.

The introduction of the Musk Rose (*Rosa moschata*) into the gardens of France is said to date from the last years of the sixteenth century, and this well-known Rose has been naturalised in the countries that encircle the Mediterranean Sea. But the type that is most familiar to us comes from India and Persia. The varieties I have raised from Chinese seeds are, in my judgment, superior to that type. The shoots are somewhat shorter, more numerous, curved, and bear an abundant and rich foliage; more rounded, consistent and glossy, than in the Indian plant. The flowers are somewhat larger and more substantial, and the dark tint of the foliage makes them appear of purer white. This variety is as hardy as the Indian type, possibly hardier, and will succeed in sunny positions in the South of England. It blooms and seeds after three or four years. (Fig. 134.)

The *Rosa Soulieana* of Crépin is closely allied to the *Moschata* so far as the structure of the flower is concerned. In both cases the bud is of a pale yellow colour before it opens, the flower turns promptly to a pure white, and the styles are pressed into one narrow column, but the general aspect is totally different. With its thick branches, bearing a number of

Fig. 134.—Rosa moschata, var. densa.

rather short, very prickly branchlets, and the leaves of a dull green, the plant bears all the appearance of a very bushy Dog Rose. It flowers late but profusely. The corymbs of the white flowers, not larger than the Roses of the common Brier, mixed with the yellowish buds, make it beautiful for some time. It then passes through an unattractive period. The petals generally adhere too strongly to the receptacle and wither on the fruit. This, however, is soon passed, and in the autumn the bush is gay with a mass of small orange berries.

The creeping Japanese Rose (*Wichuraiana*) is well known and appreciated as a pillar rose. Of its horticultural hybrid products I have not to speak. I only mention the result of an experiment to ascertain how long the screen of its drooping shoots could practically be. I planted a row near the top of a 6 to 8 feet deep trench, one side being a vertical wall edged by somewhat overhanging stones. In these conditions the shoots reached the bottom of the trench the second year after planting, but on account of the prevailing winds they were continually thrown back over the wall, and some artificial devices were needed to attain the desired effect.

Of the Roses in the *Indica* group I express, with many others, the wish to see some day true native plants from countries where they grow uncultivated, particularly the several types of the series: *Rosa indica fragrans*, *R. semperflorens*, *R. chinensis*.

I have not succeeded with attempts to grow the *Rosa gigantea* of Collett in the open, even against walls in my garden in Central France. The plant thrives in one or two places on the French Riviera. Interesting crossings are being made by M. Cayeux at the Botanical Garden of Lisbon.

We must now join the larger battalion of the corps of the Asiatic Roses, the *Cinnamomeæ*, and it is not possible to pass further without saluting that grand Rose, the *Rugosa*, one of the finest, if not the finest, of all the Wild Roses. It is second to none of the hardy Roses for the size of its flowers, and the richness and the design of its foliage; and if it is beautiful when the summer brings back the time of its long blossoming season, it is equally worth admiration when autumn colours the large fruits with scarlet and the foliage with gold-and-fire touches.

A closely allied species, but much smaller, *Rosa coruscans* (Link), is well worth cultivation. The foliage is very abundant, and its form is still more elegant; the pink flowers are comparatively very large and the fruits very fine. I should suggest to cut back its branches halfway, and the oldest ones even shorter, to procure their renewal; but I think *Rugosa* will be finer without any, or with a very discreet, pruning.

The *Beggeriana*, a native of Persia and Turkestan, is not commended by its size, and still less by the odour (a decidedly bad one) of its flower. The undue spreading of its bush is obviated by grafting it on the stock of the Dog Rose. The plant will then bloom from July to the cold days of October. The small, round, red fruit early drops the remains of the calyx, and its appearance gains thereby. The black fruited variety is curious.

Rosa macrophylla of Lindley is one of the most remarkable species of the genus and one of the most variable. The type, as figured in the

FIG. 135.—ROSA MACROPHYLLA, LINDL., VAR. CRASSEACULEATA.

monograph of the Roses by Lindley, is a tall bush, moderately prickly, with long leaflets of a bluish dark green, with medium-sized pink flowers.

In the collections of M. Alphonse Lavallée, under the name of *Rosa*

FIG. 136.—ROSA MACROPHYLLA, LINDL., VAR. CRASSEACULEATA.

Korolkowi, I found a still taller variety, with large, round, straight, almost thornless shoots, and an ample glossy foliage nearly as large as is found in the Tea-scented Roses. The flower is comparatively large, but the shade is of a lighter pink. The fruit is very large, sometimes two inches long. The variety is well worth cultivation.

But the following varieties are still more curious and attractive, in my opinion. The first was reared from seed coming from Se Tchuen. It is a bush with few, strong, diffuse branches, covered all over with enormous spines, very close together, sometimes an inch long, and shaped

FIG. 137.—ROSA MACROPHYLLA, LINDL., VAR. ACICULARIS.

like a blade, bearing a small point in the middle. The flowers are rather large and pink. (Figs. 135, 136.)

The second variety is from Yunnan. Its shoots are, on the contrary, very slender and gently curved, with acicular spines at the base and scarcely any along the stems. The foliage is elegant, the leaflets being long and narrow. The flowers are rather numerous, drooping, borne on very slender and long peduncles. Their size is not large, as the corolla is little more than half an inch across, but the colour is a dark red; and the calyx, with the long and narrow blades of its divisions, spreads out star-like two inches wide. The panicles of flowers are very nice in a small bouquet. (Figs. 137, 138.)

FIG. 138.—ROSA MACROPHYLLA, LINDL., VAR. ACICULARIS.

Fig. 139.—Rosa macrophylla, Lindl., var. rubrostaminea.

The last variety is Tibetan. It is an early-flowering plant; the branches are spreading; the foliage abundant, although the leaflets are rather small. The flowers, two inches in diameter, are of a fine red colour or carmine-pink; the filaments of the stamen are red also, and the anthers orange-coloured: the whole bears an unusual appearance. The fruits, very long and numerous, are quite ornamental in the autumn. Were it not for M. Crépin's authority I should have doubted this strange plant being a *Macrophylla*. (Fig. 139.)

Webb's Rose (*R. Webbiana*, Wallich) is also a very nice and variable Rose. The plant I received first from the Himalayas bears, according to the description, light-rose flowers borne on a hispid receptacle; but I obtained two other distinct forms from Chinese seeds. One is a very compact bush, the branches bearing a quantity of small, curved, extremely thin ramifications, with rather long, fine, and pointed ivory-white spines, and abundant but very small leaves; with a quantity of small whitish-rosy flowers, crowded together at the extremity of the branches. The fruits, very small also, are smooth.

The other form has flowered this spring for the first time. It is a vigorous bush with abundant foliage, and in that way superior to the type. The flowers are also larger and of a vivid pink colour. As is the case with the preceding variety, the fruits and peduncles are smooth.

There remains for me to speak of a very curious and interesting Rose, the *Rosa sericea*, known for its strange anomaly of presenting flowers with four divisions instead of five in the calyx and the corolla.

The first seeds I had came to me from the much-regretted botanist the Abbé Delavay, then living in Southern China (Yunnan). The first packet bore the inscription, "Rose with decurrent prickles," the second only "White-flowering Rose."

From that second packet a Rose issued which only produced flowers after ten years. The flower is white when completely opened; after some hours the expanding flower is pale yellow. In this variety the branches are arched, the bark very smooth and orange-brown, and the prickles are straight and rather few.

It is the reverse in the Rose with decurrent (underhanging) prickles. In that variety the base of each leaf is accompanied by two long parallel blades, which bear a very curious appearance, being vastly different from the customary shape of spines. In some branches, however, instead of being one or two inches long, they are nearer to the usual form and mingled with acicular spines. The thorns when young are of a fine red colour, and when the young shoots are lighted up by the sun from behind, the prickles, being somewhat transparent, shine like jewels.

The *Sericea* flowers very early; in some plants the fruit is formed and red by the beginning of July. The two above-mentioned varieties from Yunnan have red fruits. The seeds received from Se Tchuen gave a majority of plants with yellow fruits. The bushes from that province have generally very long and elegant shoots. The foliage of this Rose is extremely nice, the leaves being composed of numerous little leaflets of a very pleasing and fine green. Few scaly buds are visible in this species, their place being marked by two opposite leaves, a notable addition to the mass of the foliage. (Fig. 140.)

Fig. 140. - Rosa sericea, Lindl.

Unlike the *Webbiana*, which is a mountain species, and should be protected from too burning exposure and from drought, the *Sericea* seems to enjoy the full sunshine in a soil retentive enough to preserve some moisture. It is quite hardy also, and will quickly form bushes five to six feet high and very compact. It is one of the most interesting of the Asiatic Roses.

From most of the preceding Roses which cannot be found in nurseries, I could easily save some seeds for amateurs who would like to try their cultivation, hoping they will take as much pleasure as I have done in those fine children of a remote country.

NEW HYBRIDS TO AIM AT.

By Monsieur VIVIAND MOREL.

"IT is the dead who need killing," said some romantic person of Casimir Delavigne, one of the last classics. Without knowing it, perhaps, this critic, under this funereal but original form, meant to say that everything has its time and that the expression of an idea goes on modifying itself continually, so that it is unwise to tie oneself entirely to things of the past. Old ideas give rise to new ones, and they in their turn produce others. This is the great law of Progress already pointed out by Pascal in the following phrase: "Humanity is a man who lives for ever and is always learning." Nevertheless for man, whose life is short, progress is slow. One generation evolves an idea, another studies it better, and the following reaps the full benefit of it.

The preceding may serve as an introduction to the paper I have been asked to write upon the production of new Roses; for any intelligent gardener who will resolutely strike out on new lines, different from those pursued by our forefathers, is certain to secure excellent results.

This is not the place to write the history of the variations, as beautiful as they are striking, which Rose-fanciers have caused the most beautiful flower made by the Creator to assume—a volume would not suffice! On account of the general law, that the different species reproduce themselves from seed without any great variation, since a single cross hardly mixes their characters, Roses were in past ages, for the most part, such as they had been in form since the period of their creation. In the forests, on the hillsides, amongst the underwood on the mountains, wherever in fact they existed in a wild state, the single Roses remained single. On introducing the most beautiful of them to our gardens sundry of them soon began to double, triple, and quadruple the number of their petals under the influence of a higher cultivation. These were increased and there were several dozen varieties, very remarkable, no doubt, but for the most part differing little from each other. This is all that the gardeners of past ages have left us.

During the last century a new departure was taken, which altered the condition of things. On the discovery of the laws governing natural fertilisation we have established, though still in a somewhat superficial way, the theory of hybridisation. At the same time great travellers have introduced new species and races, with a lengthened season of blossoming, and of vigorous growth. The crossing of the European Roses with those of India produced the infinity of varieties which may now be found in all gardens.

It is for the most part to successive crossing and recrossing of Roses, and to the produce of their offspring, that the progress realised in the production of new varieties is due.

But it appears that the source of novelties threatens soon to give out unless the hybridisers seek a less beaten track than the one they have been exploiting for the last half-century. It is to the investigation of this new path that we wish to encourage all Rose-growers.

Have you noticed that several classes of beautiful Roses, after having produced several fine improvements, have suddenly come to a stop as if they had become sterile? Beluze has only given us one single 'Souvenir de la Malmaison'; and no one has followed him. You may say that

FIG. 141.—ROSE AIMÉE VIBERT. (*The Garden.*)

this Rose is perfect; if so I cannot agree with you. But do you not see that it is by no means easy to find a 'Malmaison' as pink as 'La France,' as velvety as 'General Jacqueminot,' or pure white like 'Aimée Vibert'? (Fig. 141.)

And if one could add to it a scent like that of the Provins or the Teas, would not that be a decided improvement?

But from whence sprang the 'Malmaison'? That is the question.

It is necessary to discover the ancestry of this Bourbon, and I do not think it will be impossible if we look back.

Monsieur J. B. Guillot discovered the marvel which we call 'La France.' This accomplished nurseryman, who has enriched our collections with some superb varieties, has left a good disciple in his son, Monsieur Pierre Guillot. Can he not create for us other varieties of the same ancestry, but of different colours ?

The elder Monsieur Pernet found us 'Baroness Rothschild,' and happily, by a sport from it, 'Merveille de Lyon.' But we should like to see a scarlet or golden-yellow 'Baroness.' Is the mould in which this superb Rose was cast broken up ? Is its mother-parent unknown ?

Monsieur Levet produced 'Paul Neyron,' but we should be pleased if this immense Rose had been willing to give us some offspring.

If it were not for the fact that in most cases the production of new varieties is owing to chance, it might be possible to experiment again by crossing anew the same Roses which had already given such exceptional results—veritable chiefs of the line—without any great number of descendants. It will doubtless be said that one is never certain of the results which will be obtained from hybrids or their descendants. This is often probable, but not always certain.

However, let us leave the well-known Roses (on which, nevertheless, there is much to be said) and go on to the well-defined types, from which it appears to me that we have not yet obtained all the improvements possible.

In the study of hybrid Roses several alternatives present themselves,* amongst which the following are the principal :—

1. The product of the cross between two species may be absolutely sterile.

2. The product of the cross between two species may be sterile with its own pollen, but may be fertilised by one of its parents, or occasionally by both of them, or again by a variety which is entirely foreign to them.

3. A species which is sterile with its own pollen may fertilise, or be fertilised by, another species, or a variety of mixed descent.

About 1830 Monsieur Hardy, head gardener at the Luxembourg Gardens, hybridised two interesting Roses, *Rosa berberifolia*, Pallas, and *R. clinophylla*, Thory. This cross gave a singular result, of which I shall speak somewhat at length.

Rosa clinophylla, Thory (syns. *R. involucrata*, Roxb., *R. Lindleyana*, Tratt.), is a species from India and China, and belongs to the section *Bracteatæ*. It was figured by Redouté and in the *Botanical Register*.

Rosa berberifolia, Pallas, is such a peculiar species and so different from other Roses that several authors have thought that it ought to be placed in a different genus. Thus Dumortier made from it the genus *Hulthemia*, Lindley that of *Lowea*, and Bunge *Rhodopsis*.

This species is a native of Persia and Chinese Tartary. It is found in

* Under the title of Hybrids, I mean the product of the crossing of any two species, and not the special section generally known under the name of Hybrid Perpetuals. To me the Bourbons, the Noisettes, the Polyanthas, &c., are also Hybrids.

abundance near Hamadan and in the fields at the foot of the Elvend Hills. It there grows to a height of three feet. Its branches are slender. Its leaves are sessile, narrow, simple, oval, and serrated at the tips, covered with a fine down, without thorns and without stipules. Its flowers are solitary, the fruit fluffy, almost round, and covered as far as the sepals with fine unequal thorns. Sepals downy and entire. Petals of a rich yellow, with a crimson spot at the base.

Rosa Hardii was described for the first time in 1836 by Cels ('Annales de Flore et de Pomone,' p. 372), by Paxton in 1843 (*Magazine of Botany*, x. p. 195). It has only retained the flowers of *R. berberifolia.* It is a small bush, growing two or three feet high. Its branches are spreading, slender, flexible, reddish, slightly velvety, armed at the insertion of each petiole with two twin thorns with a single one underneath them, forming a triangle. The deep-green leaves are composed of six or seven lanceolate and narrow leaflets, sharply serrated. The flowers are single and numerous, larger than those of *R. berberifolia,* with golden-yellow petals, the base covered with a purple spot larger than in *R. berberifolia.* These flowers are occasionally in bunches of two or three, but more generally they are solitary. The peduncle is short and slightly mossy; the calyx is globular and bristling with numerous fine thorns. The stamens are very numerous and of a beautiful yellow, a little lighter than the petals. *Rosa Hardii* was put into commerce in 1836 by Messrs. Cels frères.

This Rose of Hardy's, which is spotted with purple like a *Cistus ladaniferus*, is sterile; moreover it has a single flower like that of its two parents. The presence of the spots at the base of the petals is an interesting fact from a horticultural point of view. Do you not see the means offered by this peculiarity of adding this characteristic to some of the finer varieties with double flowers? To ask the question is to answer it. And why should not this singular peculiarity be fixed? M. Pernet-Ducher, in a hybrid of which I shall speak later, obtained a single-flowered Rose which, instead of purple spots, showed a pure white star at the base of pink petals.

HYBRIDS OF *Rosa lutea.*—This yellow Rose, with its brilliant colour, has been the subject of numerous attempts at crossing, of which most have given only negative results.* Monsieur Alégatière and numerous other hybridisers were completely stranded when attempting to use this Rose as the seed-bearing parent. The reverse cross, on the other hand, appears to have some happy surprises for anyone who will try it afresh with various seed-bearing parents. Already M. Pernet-Ducher the younger, with 'Soleil d'or,' has shown the direction to be taken. In 1894 M. Pernet showed at the Bureau de l'Association Horticole Lyonnaise two hybrid Roses about which I published the following description† :—

Hybrids of the Yellow Rose.—The beautiful Roses of hybrid origin which adorn our gardens do not always offer a well-marked scientific

* *Rosa Harrissoni* passed with certain people as a hybrid between *R. lutea* and *R. pimpinellifolia.* See the *Journal de la Société Nationale d'Horticulture de France,* 1901, p. 884.

† *Lyon-Horticole,* 1894, p. 266.

interest. Their parentage is generally not certainly known. They are "crossbreeds"—quadroon bastards—whose exact position in the Rose world is uncertain. Even if one can say of some of them that they are the result of one known variety crossed with another, it means little, as the father and mother are generally hybrids themselves, whose origin is lost in the darkness of mixed generations. It is then with real satisfaction, which all who are interested in the subject of hybridisation will doubtless share, that I proceed to make known a hybrid Rose whose father is known to be of a type not hitherto made use of, a type quite pure, with marked characteristics. This hybrid is due to our able colleague Monsieur Pernet-Ducher the younger, a rosarian at Lyons, one of the luckiest raisers in our country, to whom we owe some very fine varieties, especially amongst hybrid Teas—the section of the future.

The hybrid I speak of, obtained by Monsieur Pernet the younger, takes two forms: one a single flower, which all botanic gardens and lovers of scientific curiosities ought to possess; and the other a double flower, which is worthy to contribute to the ornamentation of our gardens.

The following is the origin of the hybrids in question:—The pollen parent is the Rose known under the name of 'Persian Yellow'; the mother is the variety 'Antoine Ducher.' The 'Persian Yellow' Rose, imported from Persia in 1833 by Willock, passes as a double variety of the Yellow Rose (*Rose lutea*) cultivated for more than three centuries under different names.* The 'Yellow Rose' type, which has often been confounded with the 'Sulphur Rose,' presents a fixed variation, to be found in collections under the name of the 'Capucine Rose' (*R. punicea*, Mill.). All gardeners know this variation. I say variation and not variety, as it is not unusual to find both sorts of flowers on the same bush. I will not give here the scientific description of *Rosa lutea* and its derivatives, 'Persian Yellow' and 'Capucine,' which those who are interested in the matter can find in all the books. I will only point out that amongst the characters which allow it at first sight to be distinguished from all other species are that the colour of the bark is of a fallow brown and shining, the flowers numerous but solitary, giving out a smell of bugs, which is anything but pleasant.

The Rose 'Antoine Ducher,' which has served as the seed-parent to the two plants about which I am now speaking, is in itself a Hybrid

* The following are the chief synonyms of this species published by Pronville:—
R. lutea. Dodon. Pempt. 187.—Bauh. Hist. 2. 47.
R. lutea simplex. Bauh. Pin. 483.—Besl. Eyst. vern. ord. 6 fol. 5.
R. Eglanteria. Linn. Sp. 703.—Wibel. Werth. 263.—Roth. Germ. 1. 217-2. 553.—Decand. Fl. fr. 4. 437.—Pers. Syn. 2. 47.—Mer. Par. 189.—Redout. Ros. 1. 69. t. 23.
R. lutea. Mill. Dict. n. 11.—Duroi. Harbk. 2. 344.—Mœnch. Meth. 688.—Willd. Sp. 2. 1064.—Lawr. Ros. t. 12.—Curt. Bot. Mag. t. 363.—Ait. Kew. 3. 258.—Gmel. Bad.-Als. 2. 463.—Smith. in Rees in 1.—Rat. Enum. 157.—Pronv. Somm.
R. fœtida. Herm. Diss. 18.—Allion. Ped. 2. 138
R. chlorophylla. Ehr. Beit. 260.
R. cerea. Rœssig. Ros. t. 2.
Var. B. *punicea*. Floribus bicoloribus.
R. sylvestris austriaca. Flore puniceo. Hort. Angl. 66.
R. punicea. Mill. Dict. n. 12.—Duroi. Harbk. 3. 347.—Rœss. Ros. t. 5.
R. cinnamomea. Roth. Germ. 1. 217 and 2. 554.
R. lutea bicolor. Jacq. Vind. 1. t. 1.—Lawr. Ros. t. 6.—Sims. Bot. Mag. t. 1077.—Ait. Hort. Kew. ed. alt. 3. 258.—Smith. in Rees in 1.
R. Eglanteria punicea. Redout. Ros. 1. 71. t. 24.

Perpetual produced by Ducher in 1867, and remarkable for its large flowers, which are double, bright red, and of a globular shape.

The parents being thus known, now let us study the offspring. I have already said that they are two in number, the one single, the other double. The following are the descriptions of them as given in the Report of the Meeting on May 15, where they were both shown.

The single variety:—A very vigorous-growing bush with spreading branches, but more erect than in the *lutea* type; wood red-brown, furnished with thorns more in number but less projecting than those of the type. Leaves composed of lanceolate leaflets finely serrated like those of the 'Persian Yellow,' from which it differs by the colour being deeper and the shape less round, flowering in a bunch or corymb of from two to five flowers; bud oval; flower composed of two rows of petals of medium size, coloured yellowish underneath and carmine pink above; the base of the petals is much coloured with yellow and bleaches altogether when entirely expanded, forming a star in the centre of the flower. The reproductive organs, the pistils and stamens, are perfectly formed; nevertheless, so far, all the seeds have proved sterile as in *R. punicea*.

The double variety:—This flowered for the first time in 1894. It is a most valuable variety from a horticultural point of view.

The bush, less vigorous than the former, has a growth and habit reminding one of a Hybrid Perpetual. Its branches are erect, armed with thorns rather like those of *R. punicea*, but more numerous; leaves rounded, somewhat resembling those of the hybrid perpetual Roses.

Flowers solitary, large, globular, very double, of a fine golden yellow, shaded with apricot-pink in the centre, which colouring distinguishes it from "Persian Yellow."

One peculiarity alone suffices to show the hybrid origin of this variety: the flowers have a very pronounced odour of the *Centifolia* Roses, whilst that of *R. punicea* is disagreeable.

These two Roses suggest the following remarks:—

1. The influence exercised by the pollen of *Rosa lutea* on 'Antoine Ducher' is very remarkable. The influence shows that the pollen-parent in this instance has almost obliterated the characteristics of the seed-parent, the two hybrids in question having preserved most of the salient features of the Yellow Rose, *R. lutea*.

2. One notices in the single-flowering hybrid the introduction of a coloured star in the centre of the flower. A like star is also found in Hardy's Rose, which, we know, is a cross between a yellow Rose and one of another species—*Rosa berberifolia* × *clinophylla*.

3. In the case of the double Rose, the unpleasant scent of the 'Yellow Rose' has disappeared and has changed to the sweet smell of the *Centifolia* Roses, or of some of the Hybrid Perpetuals.

4. Compare with this the result of a cross made by myself with different species. *Rosa pomifera* crossed with the pollen of the Common Bengal Rose. The resulting plants have all been alike and have resembled throughout the seed-bearing parent. It is exactly the reverse of what happened in the case of the hybrid obtained by M. Pernet the younger.

5. From the foregoing remarks we may conclude that in the same

genus, but operating on different species, the results obtained by hybridisation are contradictory. In practice, then, we cannot foretell the influence which the pollen-bearing parent or the seed-bearer will respectively have upon the offspring.

It has been shown, then, that the pollen of *Rosa lutea* is capable of fertilising the Hybrid Perpetuals, if not all of them, at least one or two, and probably a very large number. There still remains, it is true, the sterility of these new hybrids, which it is necessary to partly overcome, even if it cannot be entirely suppressed. I have an idea that this can be

FIG. 142.—ROSA ALBA ODORATA. (*The Garden.*)

accomplished by varying the sections on which the new hybridisations are tried.

The following is the commencement of the trials which M. Allard, the able florist of the Maulévrie, made with seedlings of *Rosa Harrissoni*,* which is considered to be a hybrid, one of its parents being 'Persian Yellow' or *R. Eglanteria*. He obtained numerous specimens with single flowers, white, pink, and yellow, and one semi-double whose flowers approach closely, both in colour and shade, to those of *Rosa Eglanteria*; but all of them are in other respects like *Rosa pimpinellifolia*. *Rosa Harrissoni* likewise possessing most of the peculiarities of *Rosa pimpinellifolia*, and the flower of the 'Yellow Rose,' it is to be presumed that it is a hybrid between the two.

* *Journ. Soc. Nat. d'Hort. Fr.* 1901, p. 884.

Hybrids of the Macartney Rose.—From the Macartney Rose (*Rosa bracteata*) two garden varieties have been obtained, of which one is known by the name of 'Maria Leonida,' and the other as *R. alba odorata*. But nothing more has come of them, as they are sterile hybrids. (Fig. 142.)

Rosa bracteata, Wendl., shares with *R. involucrata*, Roxb., and *R. Lyellii*, Lindl., a section of the Indian Roses, to which it has given its name. It has the following synonyms:—*R. Macartnea*, Dumon de Courset, and *R. lucida*, Lawr., not Ehrh. It has a variety called *scabricaulis*, which might probably constitute a small species of its own. Authors are not agreed as to the name of the introducer of the bracted Rose. Some attribute it to Lord Macartney, Ambassador to China, others to George Staunton. Cels had it in his garden in 1795. It has been figured by Ventenat, Rœssig, Redouté, Wendland, and Miss Lawrence.

The Rose 'Maria Leonida' is supposed to be a hybrid between the single Macartney Rose and the Musk Rose—I imagine one with double flowers. If this origin is the true one, I expect it was the Musk Rose that supplied the pollen. I found this opinion upon what one knows about hybrids of the first generation between distinct species, that it is the seed-bearing plant which gives the principal characteristics of growth and habit. 'Maria Leonida' has preserved, in effect, almost all the botanical peculiarities of *Rosa bracteata*. Admitting as proved this origin of 'Maria Leonida,' a sterile hybrid, as so often happens when two distinct species are crossed, Rose-breeders may perhaps be able, by careful choice of pollen, to obtain, other remarkable varieties, or some fertile plants which by mongrel breeding would give us some new varieties.

Hybrids of Banksian Roses.—A long time ago I received from Monsieur Michelange Console some seed of the two double varieties, white and yellow, of this remarkable species. Having sown them, I obtained the identical plants pure and simple. No variation whatever occurred. Nevertheless it is probable that, since the double Banksian Rose produces seed, one could obtain crosses from it. Moreover, it has been suggested that a cross has already been made between it and *Rosa lævigata*, and that it produced *Rosa Fortuniana*, Lindley. This is an encouragement for those of our fellow-workers on the Mediterranean shores, where the Banksian Roses abound, to make experiments in this direction, either in using the pollen of them, or using them as the seed-bearing plants. Fig. 143 shows the single wild form of *Rosa Banksiæ*.

Noisette Roses.—We know that the Noisettes are of hybrid origin, and that their ancestors are supposed to have belonged to the Musk Roses (*Rosa moschata*) and the Indian Roses (*R. indica*). The descendants of these Roses, either from ordinary seeds or after fresh crossing, have given us the hybrid Noisettes, and very probably most of the bush Roses, which florists, for want of a better name, have classed amongst the Tea Roses. It seems as if the source from whence the Noisettes were obtained might be nearly exhausted. Perhaps we might infuse it with fresh vigour, by beginning new crosses either with different forms of *Rosa moschata* or with other species of the same class, such as *R. Brunonii*, *abyssinica*, *Leschenaultiana*, &c. It might be possible also to rediscover the original Noisettes, or their immediate descendants, with which different crosses might be tried; because, since the first varieties of this section were obtained, numerous different Roses have been either introduced or raised in our gardens, and in them we have new material to work with.

Rosa microphylla.—We cultivate, in France under the name of Chataigne (or Chestnut) Roses, several varieties of this Japanese species, which are remarkable from the fact of the calyx being always covered all over with straight thorns, set close together. It would be interesting

Fig. 143.—Rosa Banksiæ, wild form. (*Gardeners' Chronicle.*)

to try crossing this species with the ordinary or with the perpetual Moss Roses.

Bourbon Roses.—This family of Roses appears to have already made its supreme effort, stopped in its attempts at variation by the sterility of even its finest seeds, and by the disappearance of the seed-bearing powers which produced 'Souvenir de la Malmaison,' for example.

It would possibly be useful, for the sake of trying them afresh, to rediscover the first descendants of this type, or in default of this, to try to reproduce them again by crossing an Indian with a Damask Rose, since we are assured that this was the origin of the Bourbon Rose.

. . . .

From the observations I have already made (which, however, could be much more developed, if I were not afraid of abusing the patience of the Congress) we can draw the following conclusions:—Certain sections of the Roses cultivated in our gardens appear to have given the highest results of which they are capable. Seed, pure and simple, only produces, by atavism, very slight variations, often inferior to their progenitors. On the other hand, their crosses with each other, from being but little more fertile, seem unable—except in the case of some classes of Hybrid Teas—to produce any varieties very distinct from their parents. It is time then, I think, that Rose-raisers, having now at their disposal new material for hybridisation, should try crosses between types of Roses widely different, as regards form, colour, and habit, from those actually in cultivation in our gardens. There is particularly room for experiments among the old Noisettes, the Yellow Rose, the *Berberifolia* group, the Banksians, *R. pimpinellifolia*, *R. bracteata*, *R. rugosa*, *R. microphylla*, and such like.

THE GARDEN ROSES.

By Miss Gertrude Jekyll, V.M.H.

It would have been a great surprise to rosarians of twenty years ago could they have been told of the remarkable development that was to

Fig. 144.—A Pergola of Pink Rambler Roses. (*The Garden.*)

take place in the Rose world, and that there would be at the shows of future days the number of classes we now see for "Garden" Roses. It is one of the healthiest signs of the good growth of horticulture that the Garden Roses have come to their right place in public estimation. The demand is now so great that raisers can scarcely keep pace with it, for everyone who is really interested in good gardening is now clamouring for the Garden Roses, both old and new.

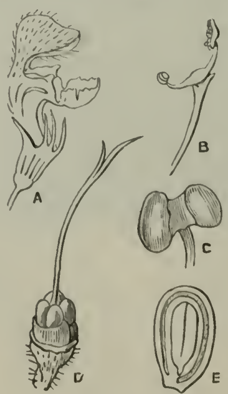
Some of the old varieties which have always been with us, but have been for a time neglected, are now valued as they should be, and, instead of merely existing in forgotten corners in some gardens only, they are being planted in fair quantity and with care and thought for their best use. So now we see in every good garden the old pink China, the Provence, Moss, Damask, and the fine old rambling Ayrshires side by side with the new Ramblers and the host of beautiful hybrids of various parentage.

The new Ramblers derived from *R. multiflora* at once became popular, and the hybrids of *rugosa* and *Wichuraiana* have already shown their value, while year by year new Roses for garden beauty are appearing.

The new hybrid Teas are among the most precious of Roses, doing well in many gardens where Teas are not entirely successful; many also are the lovely things among the new hybrid Chinas.

This wealth of beautiful material for simple garden use being now ready—and only a portion of it has been briefly referred to—it is interesting to see how desirous people are to make some good use of it. The quantity is so great, and the ways and habits of the different species from which the new Roses have come are so various, that there is scarcely a department of gardening in which some may not be rightly used. There are Roses for beds and borders, for large isolated specimens, for pillars, for arches, for arbours and pergolas, for trellises and screens, for walls high and low, for rambling into trees and over wild undergrowth, for crowning retaining-walls, for rock-gardening, and for trailing over banks or broken ground. There are Roses also for the stately terrace of refined architecture, and for such beautiful Rose gardens as have never yet been made.

To attempt to describe the best uses of all the beautiful Garden Roses would need the space of a book; on the occasion of this Conference it may suffice just to draw attention to the great importance of this new development of Rose-growing in its relation to the newly-arisen desire for the wider comprehension and interpretation of Rose beauty.



EVER-BLOOMING ROSES FOR GARDEN DECORATION.

By Wm. Paul, F.L.S., V.M.H.

If the lover of the Rose will refer to the botanist's account of the genus *Rosa* he will find two species, *R. indica* and *R. semperflorens*, both natives of China, described as blooming all the year round. Now from these species and their descendants, naturally or artificially hybridised, has arisen a whole host of seedlings, many of them possessing in a greater or less degree the invaluable quality of continuous blooming; it is only necessary to keep them growing and you keep them blooming, for every eye or leaf-bud that pushes into a branch produces a flower or flowers.

In the cultivation of ever-blooming Roses it is a point of the first importance to avoid drought. Absence of moisture in the soil arrests growth, and without growth there can be no flowers. Watering in dry weather is therefore a necessity, and the morning is recommended as the best time for the operation.

Loudon, in the "Encyclopædia of Gardening," published in 1822, tells us that the royal gardener at Monza had raised fifty varieties of *R. indica*, and there are in the Waltham Cross Nurseries at the present day scores of named varieties and thousands of unnamed seedlings from the same parentage.

These creations, as some have called them—but for which I think the word "inventions" would be a better name—vary much in character and quality, but are not all ever-blooming.

The Riviera Roses stand in the opinion of some as the truest representatives of these ever-blooming varieties, but the profusion and constancy of the Riviera Roses are due to the climate, soil, and system of cultivation rather than to the varieties. I have seen the Roses there at their best more than once and could find very few differing from those grown in England, and while the profusion of branches and flowers is overwhelming in its appeal to the eye and mind, I conceive that we could only realise the same conditions in England by bringing the Riviera soil and climate with the Riviera Roses. Further, we have many fine varieties which the growers there have not, and never have I seen there individual flowers gifted with the freshness and bewitching beauty they derive from the cooler and moister climate of our "island home."

I think few will question the assertion that the Rose is worthy of a garden to itself on account of its beauty, variety, fragrance, and adaptability to the numerous forms and contrivances recognised as desirable in ornamental gardening in England. But it is not of the "Rose garden" as a thing by itself that I wish to speak to-day. I pass that by as a desirable object of admitted interest and beauty. I wish on the present occasion to show that Roses may be advantageously introduced into the system of miscellaneous bedding in all gardens, large or small, but especially in those where, for want of space or numerous other reasons, a separate Rose garden cannot be realised.

It is only recently that we have obtained a group of Roses of various colours between the Tea-scented, Chinese, and Bourbon, the varieties of which are hardier than the original Tea-scented, and which bloom continuously from June till growth is arrested by the autumn frosts. Some of the most remarkable of these are :—'Aurora,' 'Boadicea,' 'Camoens,' 'Chameleon,' 'Comtesse Festetics Hamilton,' 'Corallina,' 'Dainty,' 'Empress Alexandra of Russia,' 'Enchantress,' 'Fairy Queen,' 'Fortuna,' 'G. Nabonnand,' 'General Schablikine,' 'Gloire des Polyanthas,' 'Gruss an Teplitz,' 'Madame Abel Châtenay,' 'Madame C. P. Strassheim,' 'Madame Eugène Résal,' 'Madame Laurette Messimy,' 'Mdlle. Germaine Raud,' 'Morning Glow,' 'Papa Gontier,' 'Princesse Alice de Monaco,' 'Queen Mab,' 'Salmonea,' 'Sulphurea,' 'The Alexandra,' 'Yvonne Gravier.'

Of course, in speaking of "ever-blooming Roses for garden decoration," I do not mean to imply that they will bloom all the year round in this climate *out of doors*, but they will do so if removed at the end of the Rose season to the warmth and shelter of glass houses.

Now there are thousands of Englishmen who see but little of their gardens except at the short period when in residence at their country seats, which is, with many, the late summer or early autumn, and at that season these Roses may be had in their fullest beauty.

The process of cultivation is simple in the extreme, and one which any ordinary workman in the garden may be deputed to carry out. If the prospective position of these Roses is defined when clearing away the remnants of the summer grouping plants (Geraniums, &c.) in October, these Roses may be made to take their place from other out-of-door positions, or they may be obtained by purchase. When planting, leave the earth rising well up among the lower branches, placing small branches of evergreens among them for shelter from the frosts and cold winds of winter. This is the least troublesome way of realising our object, and as a rule answers perfectly; but, although these Roses are much hardier than the old fashioned Tea-scented, we have yet to learn how they might fare wholly unprotected in the open during a winter of more than common severity. But should they be found to suffer seriously under such a contingency it would cost but a small amount of money and labour to repair the mischief.

Here, however, is another and a safer, although I could not say a better plan. Purchase the plants in small pots in May, repot them in June, and grow them on either under glass or in the open, planting them out with the bedding plants in the May following. Under this management, if the early flowers (June) are not wanted, it is a good plan to pinch the flower-buds out when about the size of a small pea, taking care not to remove or injure any of the leaves. Dig the plants up after the summer and autumn blooming, repot and remove to shelter, reintroducing them to any position in the flower-garden in the following spring.

Of course I am assuming that in the preliminary stages of cultivation the ordinary care and attention of good gardening are practised. Into this I need not enter here. Nothing more is required to ensure brilliant masses of flowers that will vie with any denizens of the garden, and last longer in an attractive form than many of them.

NOTES ON CHINESE ROSES.

By George Nicholson, A.L.S., V.M.H.

In the Chinese Empire there are about twenty-four species of the genus *Rosa* which have already been studied and described, and most of them have been introduced to British gardens. These species all belong to the first rank: that is to say, they are so distinct from each other that it is hardly probable that any botanist would attempt to unite any two of them. Incomplete material exists in herbaria which no doubt represents good species not yet described or introduced. Of the eleven groups into which Mr. J. G. Baker classifies the species of cultivated Roses, no less than eight are represented in the Chinese flora.

Group I.—*Simplicifoliæ.*—This contains but a single species, *R. simplicifolia* (*R. berberifolia*), which, although a native of Siberia, Afghanistan, and Persia, has not yet been found in China.

Group II.—*Systylæ.*—Seven species from China are included in this group, only one of which has not yet found its way into cultivation, viz. *R. Davidi*, related to *R. moschata*. *R. Davidi*, moreover, is one of some six or eight Roses which so far have never been found outside the Chinese Empire; others are *anemoneflora*, *Banksiæ*, *bracteata*, and *microcarpa*.

R. anemoneflora is here treated as a species, although it may prove to be a hybrid between *multiflora* and *lævigata*. So far it is only known in a double-flowered state.

R. Leschenaultiana is Indian as well as Chinese; it is a strong-growing handsome climber, which unfortunately is not hardy in the neighbourhood of London. Probably, however, it would thrive in the south-western counties.

R. moschata and *R. multiflora* are too well known to need detailed mention.

R. Luciæ approaches the Japanese *R. Wichuraiana* in general aspect; this latter has been received at Kew from Japan under the name of *R. Luciæ*. I have not yet seen the true plant in cultivation.

R. Soulieana, described by Crépin in the *Bulletin de la Société Botanique de Belgique* xxxv. (1896), 20–23, was sent from Shen-si by Father Soulié; it has small white flowers, resembling in structure and inflorescence *R. moschata*, but differing markedly from that species in the form of the leaves and in the width of the bracts and sepals—and particularly so in the form of the latter. I have seen *R. Soulieana* in the fine collection of M. Maurice L. de Vilmorin at Les Barres.

Group III.—*Banksianæ.*—*Rosa Banksiæ* is too well known as a wall plant in the South of England to need more than a passing mention.

R. microcarpa is a very distinct small-fruited Rose, perhaps not in cultivation now.

The third Chinese species of this group is the so-called 'Cherokee' Rose, *R. lævigata*; this frequently proved tender and flowered sparingly in the neighbourhood of London, but of recent years stocks have been received from Japanese sources which prove hardier and more floriferous than those—probably of Chinese origin—previously in cultivation.

Group IV.—*Bracteatæ.*—The 'Macartney' Rose (*R. bracteata*).

Group V.—*Microphyllæ.*—*R. microphylla.*

The above two groups are represented in China by one species each.

Fig. 145.—Rosa spinosissima, var. hispida. (*The Garden.*)

Group VI.—*Cinnamomeæ.*—Eight Chinese species are placed here, five of which are in gardens. *Acicularis* (*dahurica*, although regarded as a species by Crépin and others, is only a form of *cinnamomea* and so is not given specific rank in this enumeration), *Beggeriana*, *macrophylla* (*Prewalskii*, described by Regel as distinct, is only, according to Crépin, a form of *macrophylla*), *rugosa*, and *sericea* are so distinct and well-marked, and, moreover, so well known, that no description is necessary. *R. Biondii* and *R. Giraldii,* named by Crépin in honour of two Italian missionaries in China and described provisionally by him in *Bull. Soc. Bot. Ital.* 1897, 232–3, are not yet in cultivation. *R. Prattii* (Hemsley in *Journal of the Linnean Society,* xxix. t. 30) is a Western Chinese species yet to be introduced and a remarkably distinct plant, much resembling some *Zanthoxylum* in general aspect ; it is easily distinguished by its small flowers, reflexed calyx-lobes, and small linear-lanceolate, closely-arranged, obscurely-toothed leaflets.

Group VII.—*Spinosissimæ.*—Two species enter into this group, our common native *R. spinosissima* (Fig. 145) and *R. xanthina,* the latter first introduced into cultivation from Afghanistan by the late Dr. Aitchison.

Group VIII.—*Gallicæ.*—No representative of this section of the genus occurs in the Chinese Empire.

Group IX.—*Caninæ.*—The common Dog Rose of our hedgerows may be taken as the type of this section of the genus. In China only *R. indica* and *R. gigantea* come into this group. The last-named species was first discovered in Burma by the late Sir H. Collett, but more recently has been collected on the mountains of Yunnan, both by Dr. Henry and by Hancock ; we suppose that the name *R. Collettii,* which obtains in some gardens for this species, has been given to it by some one desiring to perpetuate the name of General Collett. It is important, however, to distinctly state here that there is a true *R. Collettii* which hails from the Shan States, and is as distinct from *R. gigantea* as two Roses can be from each other. *R. Collettii* (Crépin in *Bull. Soc. Bot. Belg.* 1889, 49) is a small-growing small-flowered Rose near *R. microcarpa,* and is remarkable for its free linear stipules, which are also fugacious. A good figure is published in the *Journal of the Linnean Society,* xxviii. t. x. On the other hand, true *R. gigantea* is a huge climber, with large leaves, and flowers five inches in diameter.

Group X.—*Villosæ.*

Group XI.—*Rubiginosæ.*

The first of these is represented in our gardens by the Apple Rose (*R. pomifera*), *R. mollis,* &c. ; the second by the Sweet-brier, *R. rubiginosa* ; the Chinese flora contains no representative of either group.

ON DIFFERENT WAYS OF STRIKING ROSES.

By Monsieur Viviand-Morel.

Old authors who wrote, though very briefly, on the cultivation of the Rose, mentioned that it was propagated by cuttings, by layering, from suckers, and by budding. They did not lay any particular stress upon cuttings. Miller, the author of the "Gardener's Dictionary," in particular, after having mentioned striking, without saying how it was done in his time, adds: "Plants which are propagated from layers are less likely to throw out suckers than those which are taken from around old plants; hence they are to be preferred, as they take up less space and blossom more profusely." It is only when we come down to our own time that we find the methods of striking clearly explained in horticultural writings.

Most varieties root easily; but some of the hard-wooded ones, like the Centifolias, the Mosses, and some of the Hybrids, are never very satisfactory as regards striking.

Cuttings may be made either in the green or woody stage; in either case they will root well. The green cuttings should always have some of their leaves preserved. The woody cuttings can be made either with or without leaves, according to the variety of Rose and the time of year when the cuttings are made. A large number of varieties will not root well unless they are struck with some of the leaves left on. It is desirable, or even necessary, to know the varieties in question, or at least the types or sections to which they belong. As a general rule, all Roses which hold their leaves for a long time at the end of the season and those which are almost evergreen, such as those classed with the Teas, Bengals, Bourbons, Polyanthas, Sempervirens, Banksias, Noisettes, and all derived from these, require to be struck with their leaves on. The Hybrid Perpetuals may also be struck with the leaves on, but will also do very well without them. The cuttings with leaves should be struck under cover; the cuttings without leaves may be struck in the open air.

I will now mention the principal methods of operating.

Soft-wooded Cuttings.—This sort of cutting is not often made, and only in some horticultural establishments. Pot Roses are put into a moderately warm greenhouse in February, and when the shoots have grown a sufficient length (from 5 to 7 centimetres *) they are torn off from the mother stem. The heel is trimmed with a pruning knife, and some of the leaves removed from the base; the cuttings are then planted in small pots and put at once under bell-glasses in a propagating pit, with a bottom heat of from 15 to 20 degrees centigrade. They are then treated the same way as cuttings of other plants—watering, watching the bell-glasses to guard against damping off, shading, &c. The cuttings take from thirty to forty days to strike root. They are hardened-off by gradually

* A metre = 39·37079 inches, or practically 3 feet 3 inches and a third of an inch. A centimetre = ·39371 of an inch, or practically two-fifths of an inch.

admitting air to the bell-glasses, after which they are uncovered and repotted in larger pots. They are then put at once into a frame until May, at which time of the year they may be planted out in well-

FIG. 146.—ROSE ARCH.

manured soil, where they will grow vigorously and blossom in the course of the summer.

Cuttings from soft shoots had once a good reason for being made use of for rapidly increasing the stock of any new Rose, but they have now been almost abandoned, since budding on the Brier stock is quicker and gives a much greater number of plants.

Cuttings from Ripened Wood.—Of all the different ways recommended for multiplying Roses, the best is that of employing shoots of ripened wood furnished with leaves. These cuttings are easy to strike in the open air as soon as the Roses have finished blooming, that is to say, from June to November; this allows of several sets of cuttings being made from the same plant. At the end of June the temperature outdoors is such as to make it possible to do without either hotbed or greenhouse.

Some people only begin to make cuttings of Roses in September, which is in fact one of the best times of the year, and that in which cuttings may be made by the least skilful workmen. But by taking certain precautions, and by knowing how to choose the right shoots to strike, one gains by beginning to make cuttings in June. Besides, we can work for a longer time in increasing several varieties of Tea Roses, and, above all, the old 'Souvenir de la Malmaison,' which is always in great demand.

Choice of Cuttings.—Those branches are good for cuttings in which the flower-bud is ready to open: this state may last for a longer or shorter time, and its duration varies with the fertility of the soil and its moisture, and also with the variety of Rose. As long as the eyes near the flower have not begun to start into growth, the branch which bears the flower is fit for a cutting. But when these eyes sprout to make other branches, it is with few exceptions a fairly certain sign that the branch is no longer any good for a cutting; it is better then to leave such subsidiary shoots to develop, and wait until they are themselves fit to strike.

Method of Operating.—Mons. Charles Grosdemange, in an article entitled "Culture of the Rose on its own Roots," has summed up in a very clear way the different operations in making cuttings. It is one of the best articles on this subject amongst the many that have been written. I shall reproduce it here, with notes where I do not entirely agree with the author:—

Soil and Position.—The soil used in striking Roses should be of a siliceous nature, and is made up of two-thirds fine river-sand with a little earth in it, one-third Fontainebleau leaf mould mixed with its own bulk of well-rotted manure from an old hotbed.*

The position of my striking-bed is between rows of *Biota orientalis*, 2½ metres high and 2½ metres apart. Thanks to this width, I can make the bed 1½ metre wide and furnish it with three rows of bell-glasses, having a clearance of ·05 of a metre each way. A ½-metre pathway is left on either side, and allows me easily to get at the bell-glasses, and shade or give them air when necessary†

When the time arrives for making cuttings I prepare the bed in the following manner:—I make an even trench, 20 centimetres deep, edging its borders with deal

* The nature of the soil is of small importance as regards the throwing out of roots. The best compost to employ is that which just holds the cuttings firm and allows the water to drain through. Pure sand containing a small amount of clay is to be recommended. Leaf mould and hotbed soil are of very doubtful utility.—V-M.

† My idea of the best striking bed is a border running from east to west, shaded by a wall which keeps the sun off the bell-glasses.—V-M.

planks 4 metres long and 20 centimetres wide, which are kept in place by means of small pegs. To the space thus prepared I take the sand and earth and the leaf mould and mix them up as thoroughly as possible; the bed is then made quite level with a rake, and the three rows of bell-glasses placed in a straight line by means of a cord.

Time for making Cuttings.—I only mean to describe here the striking of cuttings under bell-glasses in the open air, and for this one may say, generally speaking, that the best time is from about September 15 to the end of October, or even during the first fortnight in November.*

Choice of Shoots.—The choice of shoots is of the first importance, and may be summed up as follows:—All the shoots of a Rose are not equally fitted for making cuttings of: they should not be too thick or too slender †; it is to those of a medium thickness between the two extremes that preference should be given, as the more likely to take root. It should be noticed also that the cutting with a heel is more likely to root than one without; the more so, as there always exist at the base a certain number of latent eyes which will afterwards develop into vigorous shoots.‡

Making the Cutting.—I give the preference then to cuttings with heels, and I cut them with four eyes, their length depending on the distance apart of the eyes on the shoot, which varies a good deal in different varieties. The two lower eyes should be under the ground, the other two above are guarded to a certain extent by their leaves; it is sufficient to leave one pair of leaflets. Sometimes it happens that on account of extreme dryness the Rose bushes have lost most of their leaves, in which case cuttings made without leaves, but of the same length, will strike just as well.

Planting.—The cuttings are made separately according to their varieties, and distinctly labelled. Before planting them it is necessary to tread the soil well, that is to say, stamp it down sufficiently to make it adhere firmly to the base of the cuttings, and then to level it quite smooth so as to exactly fit the base of the bell-glasses. When this is done the planting of the cuttings is proceeded with. They are put in with a dibber about the size of one's finger. They are placed in lines about 2 to 3 centimetres deep, and from two to three apart. It is important that the earth be firmly pressed round the base of each cutting. The planting of the cuttings should at once be followed by a plentiful watering, since the success of the whole thing depends upon this. The bell-glasses are then put on and kept constantly closed to keep the cuttings close, that is to say, to keep them as much as possible from the air, and to keep their wood from shrivelling up and getting dry through evaporation, for every cutting whose bark shrivels may be considered as lost.

Later Treatment.—At the end of September the sun is sufficiently strong to make complete shading of the bell-glasses necessary. At this time of year, that is, for the first batch of cuttings, one shades for a fortnight with matting; afterwards with hurdles, as long as shade is required, which is to about the end of October. Look at the cuttings from time to time, and see that damping-off and mildew are not damaging any of them; remove any fallen leaves and any weeds that may have come up in the soil.

When the cold begins to get more severe, about the end of November or beginning of December, it is wise to cover the bell-glasses with dry litter, only leaving just the tops of them uncovered; and these should be covered at night with mats. In the winter, whenever it thaws, give them as much light as possible. Towards the second half of February, when the temperature becomes milder, entirely remove the straw from round the bell-glasses, go over the cuttings afresh, and give them air whenever the sun shines. In the latter fortnight of March the cuttings have rooted and begin to push their buds; at this time the glasses may be entirely removed in the daytime

* I make cuttings from the time when the blooming is over, so long as the frost has not hurt the leaves of the Rose bushes.—V-M.

† The reasoning of the author is very correct; but we have been forced to strike from all kinds of wood, and to sometimes try with wood that appeared too thick or too slender. When one wishes to get many cuttings and has but few plants one does not hesitate to try doubtful cuttings.—V-M.

‡ This is true only as regards Hybrid Perpetuals.—V-M.

and replaced at night if necessary. This is the manner of striking Roses, plainly stated. It only remains for me to say how I treat the cuttings after they have been struck.

Intermediate Stage.—In the first fortnight in April, instead of taking up the cuttings and replanting them immediately in the open, I make them undergo an intermediate stage by potting them in pots of $7\frac{1}{2}$ centimetres diameter and putting them into a close frame for from fifteen to eighteen days. This treatment, which at first sight may appear to be of little use, is nevertheless of more value than might be supposed, for it enables us to obtain stock sufficiently vigorous and strong to send out the first year. In the beginning of April, then, the cuttings are put into pots of $7\frac{1}{2}$ centimetres according to their different varieties. The soil used for this potting is of the same kind as that employed for the striking bed, but of a slightly heavier description. The pots are put close together in a cool frame, which is kept shut for about five or six days, at the end of which time the emission of roots will not have failed to have started again in the pots; you can begin to give them more and more air until the end of April, when the frames may be removed altogether.

Winter Cuttings with Leaves.—I have found it necessary on many occasions to make cuttings of 'Souvenir de la Malmaison' in the winter (always before the frost had touched the leaves) and in the open air, under bell-glasses against a north wall, and always with great success. The roots take a long time to form (about three or four months), but do so regularly, and what is very interesting about it is, that cuttings without heels take well, and that from some of the very strong shoots four, five, or even six cuttings may be made. When it is not too cold, the bell-glasses are not covered; on the other hand, if it is very cold they are covered with leaves and litter, only leaving their tops uncovered, unless the temperature should fall very low (12 to 15 degrees below zero centigrade), when they should be completely covered up. As to the other operations which follow the taking of the cuttings, they are the same as those described by M. Grosdemange. It would be impossible to put it better or to describe more clearly the method of making autumn cuttings. In certain cases, where the cuttings are fairly sure of taking, one can save the labour of repotting by striking them at once in pots.

An excellent plan I have adopted with a view of still further simplifying the number of operations is the following:—In the open garden we make a border running from east to west. It is lightly raked over, drawing part of the earth to about the depth of five centimetres on to the path. On this part, hollowed out in the border, we place the sand in which to plant the cuttings, and cover them with little deal frames about twenty centimetres high and fifty centimetres long by thirty wide. The cuttings are planted inside these frames, which are then covered with a sheet of glass. It is necessary, remember, to shade the cuttings thus made, either (if you have plenty of labour) with garden matting, which is put on every morning and removed every evening, or, what is better, by constructing a permanent shade out of some light hurdles, or by growing Scarlet Runners or Convolvulus on branches. The economy of this method consists in the doing away with the repotting. When the cuttings are rooted the sheets of glass and the little frames are removed, and afterwards the shading, and the Roses are allowed to grow in the open. This method creates plants which can be simply dug up as soon as the roots are sufficiently developed.

*Side-split Cuttings.**—This cutting is made in the ordinary manner with leaves on; then a longitudinal slit is made in the bark, from about three millimetres from the end, and of about three centimetres in length, from the bottom upwards. (Fig. 147.) This cut lifts up a strip of bark and wood two or three millimetres thick, which only remains attached to the cutting by its upper end. In a word, supposing you make an ordinary "layer," with a cut in it, and instead of leaving it still joined to the plant you treat it as an ordinary cutting, you will have an idea of the system. I use this method for small shrubs and other plants that are difficult to strike, and it succeeds admirably with Roses.

Those who are in the habit of layering many plants know that the

FIG. 147.—SIDE-SPLIT CUTTING READY FOR PLANTING.

roots form more rapidly on that part which is almost severed from the main stem, and to which it remains attached by its upper end only. Well, in the side-split-cutting (*bouture marcotte*), the result is the same: the roots always appear more quickly, and in greater number, on that part of the wood that has been partly severed, than on the base. Cuttings obtained in this manner are also stronger than those made in the ordinary way, because the callus (often very hard) which forms on the latter before the roots appear checks the circulation of the sap.

Notched Cuttings.—Varieties that are difficult to increase may be

* In French *boutures marcottes*, literally "cutting layers," but it seems better to invent a descriptive English compound word.—W. W., Translator.

prepared for cuttings by partially breaking them, or by cutting notches in them, as pointed out by Monsieur C. Potrat in the following passage:—

In the end of May and on into June the branches of those varieties you want to increase are pinched, which causes the pinched branches, in a marked manner, to throw out a number of secondary shoots, which are notched just at the bottom of the shoot: this cut tries to heal itself, and to shut itself up by forming a mass of cambium, which, when the branch is entirely detached, acts on the cut as the beginning of a callus and greatly helps to assist it in striking. Cuttings formed of branches thus treated give wonderful results, sometimes as much as 80 to 90 per cent. of plants; for the callus thus set going continues at once to increase as soon as the cutting is placed in the ground.

Cuttings planted upside down.—I must not venture to speak too ill of odd ways of increasing plants, as I have myself invented at least two, which I will make known later on. Their object is to avoid mildew, like the one which I now quote, introduced by Monsieur C. Potrat, who published it in the *Semaine Horticole*:—

You can work from the first fortnight in July until about September 10. The cuttings are detached either with or without heels, but instead of cutting them off immediately above the third eye, particular care is taken to preserve all the internode above it by not cutting till after the fourth eye. The part left is called the "claw." *

The cuttings thus prepared are planted under bell-glasses, in preference to frames, which in this case are not very suitable. A shaded plot of ground is chosen facing the north, and the bell-glasses are shaded in the daytime with matting. The soil ought, if possible, to be rather light. Generally one makes it oneself by using equal parts of river-sand and leaf mould mixed with old hotbed soil in about equal quantities, and the whole is covered with about 5 to 7 centimetres of pure washed river-sand. The position being chosen and the soil prepared, it only remains to mark out the places for the glasses and to dibble in the cuttings. This work should be done in exactly the reverse way to the natural law of planting. For the cuttings are inserted *head downwards*. In fact the cuttings are put into the ground upside down, so that the internode or "claw" preserved may be entirely under the soil, with the third eye of the cutting level with the ground.

When the circle made by the base of the glass is full of cuttings, they are lightly watered, and the glasses put on, and that is all for the present. Nevertheless, mark well, it requires a second operation to secure success.

A priori, you might think that the callus and roots must be formed and sent out at the end buried in the earth, but it is nothing of the kind.

If you follow step by step the progress of propagation, you will see that little by little the extremities of the cuttings, which are then in the air under the bell-glass form a whitish ring, as if of mucilage, between the bark and the wood. This is the "cambium," otherwise called the reproductive zone, which performs its duty and spreads little by little over the whole surface of the cut to form the callus. This formation takes place in the twelve or fifteen days after planting. It is then that the second operation must be performed, which consists in removing the bell-glasses and examining the cuttings. To do this the cuttings are pulled up one by one, and all the "claws" which have been planted in the earth are removed with *sécateurs* as far as the third eye. All those which have formed a good callus or offer a chance of success are put on one side, whilst the others, as well as the removed "claws," are thrown away. It only remains now to gently free the upper part from soil, and to replant the cuttings under the same glasses, but this time right side upwards, with the callus in the ground.

Cuttings laid upon the Soil.—These cuttings may be classed with those planted upside down, but they are at once planted in the ordinary

* French *onglet*.

way as soon as they have formed a callus, the first sign of the appearance of the rootlets. I owe the discovery of this method to chance. Not having had time to plant all the cuttings that I had made one Saturday evening, I put them anyhow under several bell-glasses, where they remained until Monday morning. Finding them to be in very good con-

FIG. 148.—ROSE 'THALIA' (WHITE RAMBLER). (*The Garden.*)

dition, I tried the experiment with fifty of them for a longer time, and they remained for more than three weeks under the bell-glasses without being planted; they all formed a callus, and I then at once planted them the right way up, with the exception of five, which were not removed from their horizontal position under the bell-glass, and these formed roots like the others. It is only fair to state that these leafed cuttings were syringed as if they had been planted in the ordinary way. Monsieur Mortinier Scholz described in the illustrated *Garten Zeitung* a way of increasing Roses on their own roots, which consists in laying the branches on the ground during the winter and covering them over with leaves. In the spring, in April, some of the branches will have rooted; and it is only necessary to cut them through to get Roses on their own roots. This method has been proved a success by Monsieur L. von Nagy. It comes under the category of layering.

Cuttings of the Flowering-tips.—Monsieur Henri Flémal invented a method which he declares to be excellent, as he has practised it for fifteen years. It is in every way a method which deserves to be mentioned here :—

The time having arrived for propagating the queen of flowers, I think that Rose-lovers will be glad that I should describe to them the method I have practised for fifteen years. All the books I have read on striking Roses assume the use of bell-glasses, frames, &c. My method is far more simple, and its success is always complete. It is as follows: I make the cuttings from the lower part of the stem of the Rose, leaving them of a length containing three or four eyes; I cut them horizontally about five millimetres under an eye. I remove the leaf from this eye, but leave the petiole. I make two longitudinal incisions, a centimetre long, in the bark on either side of the eye. I cut off half of the other leaves. I cut off the top of the cuttings obliquely, one centimetre above the top eye, and then put them in water, where they ought to remain for three or four days.

The plot in which the cuttings are to be planted should not be clayey, nor too sandy; it should be well rammed before planting, and situated where it gets most sun. Before planting the cuttings, which should be inserted into the ground about a centimetre, the border should be well watered. When the cuttings are put in place they should be watered again. During the eight or ten days following the planting it is necessary to keep the earth very moist, by watering it as often as necessary, until the callus is formed, from which the roots will soon break forth. It naturally follows that the watering is continued as necessary, and according to the growth of the plants. It is also well to give them a little liquid manure. I was brought to strike Roses in this way by pure chance. A Rose, 'Perle des Jardins,' remaining several days in a vase, formed a slight callus. This circumstance was a guide to me, and from that time I have put all my Rose cuttings into a basin of water in a greenhouse. In order to warn everyone, I think it as well to say that, generally, my cuttings are from plants cultivated under glass. I think it also useful to state that 'Maréchal Niel' strikes very readily, but that it is better to bud it upon a Brier stock.

Cuttings of Eyes.—I learnt the following method from the *Gardeners' Magazine*, and have proved that it often gives good results. It is little used; but it may nevertheless be of service in particular cases :—

In some shallow earthen pots place on a drainage of broken crocks a mixture of leaf mould and white sand, and on this compost spread a layer of pure sand two centimetres thick. Select some branches furnished with eyes, as if you were going to bud; and in the same way cut out well-formed eyes as if for budding, but do not remove the wood, and leave the leaf intact. Then plant your buds so that the eye is above ground, but the bark entirely covered; when the pan is quite full, with the leaves upwards and touching each other, lightly water them on the top and cover the whole with a bell-glass. Eyes treated in this manner root easily. As soon as the callus begins to send out small white roots, proceed to repot them singly, or if you like you can pot them as soon as the callus is well marked and firm. The young plants should not be disturbed as long as the sides of their small pots are not covered with roots. Winter them in a frame if the season is advanced, or plant them out in a border with a good position, where the little plants may be easily protected during severe cold.

This method of propagation is much to be recommended; it is not costly, and is one of the quickest.

Cuttings of Shiraz and Kasanlik Roses.—Monsieur J. F. Grossen at Simferopol in the Crimea has explained the method used in the East for propagating the Roses of Shiraz and Kasanlik, which are largely cultivated for the attar of Roses. The following is the way in which our Eastern friends proceed :—

The propagation of Roses in the East is very simple. In the autumn, after having worked the soil to a depth of 50 centimetres, small trenches are made 10 centimetres deep, and $1\frac{1}{2}$ metre apart; in these are laid Rose branches 40 to 50 centimetres long, which are entirely covered with earth. In the spring each eye or bud develops, and at the end of three or four years each line forms a hedge. During the summer they only require a small amount of attention in removing weeds; the Roses have no need whatever of pruning.

Cuttings in full Sunshine.—The following method is, in my opinion, of very little practical value, for such frequent waterings are necessary that it requires a workman to be always at work, and unless one has thousands of cuttings the game is not worth the candle :—

Cuttings prepared in the usual manner are made about August 15 in frames in the full sunshine. The frames are kept quite closely shut. Do not give them any air, and above all do not shade them, but water frequently, and more or less according to the strength of the sun heat. On hot and clear days the waterings should be repeated about every quarter of an hour or so. You may work without heat, but it is better to make a slight hotbed, about thirty centimetres deep, either of leaves or rotting manure. On top of this bed should be spread, for good drainage, fagots or, better still, rubble or leaf mould. The whole being evenly pressed down, so as only to leave a space of ·25 metre under the glass, the soil prepared for the cutting is laid on to the thickness of ·10 metre, and is composed of two-thirds fine river-sand and one-third leaf mould mixed with earth. The soil is trodden down and levelled, and then covered with ·05 metre of washed river-sand, in which the cuttings are planted.

Striking from Roots of Roses.—We know that the roots of certain kinds of trees and shrubs are capable of producing shoots which can be used for purposes of propagation: the Elm, Acacia, Ailantus, for instance. Sometimes Roses can be increased in the same way. I have obtained from the roots of old stocks of the Bourbon section very good cuttings by working in the following manner :—Choose stocks of three, four, or five years old (it must, of course, be understood that they must be on own-root stocks), and in the month of October cut them down level with the ground. From all the suitable wood you can make cuttings under bell-glasses in a north aspect. In the spring, about the first fortnight in March, carefully dig up the stumps of the cut-down Roses and cut their roots into lengths of five centimetres. Do not make use of any roots of less than four millimetres in diameter. When this operation is finished prepare against a north wall a frame into which put a bed about ten centimetres thick of fine river-sand: this bed should rest upon soil previously dug and well manured. Spread the lengths of root on the sand-bed, taking care to mingle the large with the small. When the roots are arranged they are covered with another layer of sand about four centimetres thick and watered freely for the first time; then a light is placed on the frame, so that heavy rains may not flood the roots thus prepared. About the first fortnight in May, as soon as young shoots appear, the lights may be taken off. New shoots will continue to develop until about the first fortnight in July. From 100 pieces of root I one year obtained sixty-five well-rooted plants, 50 centimetres high, and another year 70 per cent. grew. The object of mingling the pieces of root of different size is that, as all do not grow equally well, those making the most growth may not be unduly crowded. This method is a good one

FIG. 149.—'THE GARLAND' ROSE IN A COTTAGE GARDEN. (*The Garden.*)

whenever, having old stock plants, you wish to renew them, in which case you cannot do better than treat the roots as I have described.

Autumn and Winter Cuttings without Leaves.—Many Roses (notably Teas, Bourbons, Noisettes, and almost all Indian Roses, and such of their descendants as have retained their physiological characters) do not strike well from cuttings without leaves; but this is not the case with Hybrid Perpetuals, which are now so numerous in gardens. They can be struck successfully from September to March. The following is the way to set to work :—Good, well-ripened shoots of one year's growth are chosen and cut into lengths of about 15 centimetres, taking care not to use the tips of the shoots, which are usually too soft. The cut should be close under an eye. A border with a good aspect is prepared of earth well mixed with sand if the soil is too heavy, and the cuttings are placed ten centimetres apart, taking care only to leave two eyes of them above ground. The soil should be heaped up sufficiently to firmly hold the buried part. When it gets very cold the border should be covered with litter or dry leaves, which should be carefully removed when the temperature becomes more moderate. One year after striking, Roses thus treated are ready to be planted out. In clayey soils, instead of mixing sand with the earth of the border, small trenches are made with a trowel, about fifteen centimetres deep, and these are filled with sand.

Another excellent way of striking H.P.'s consists in making the cuttings in winter and keeping them in a cellar until February or March, when all that have formed a callus are potted (three in a pot of six centimetres diameter) and put in frames in a hotbed, giving them a temperature of 12 to 15 degrees centigrade. They generally root very well, and in April are planted out in a well-manured soil, where they grow vigorously.

By the first method I have obtained magnificent plants without having been obliged to transplant them.

Cuttings on a Hotbed.—Instead of working with a cold frame or in the open air, particularly in September and October, certain varieties strike much quicker, and sometimes much better, if one takes the trouble to plant them in a hotbed giving a bottom heat of 15 to 25 degrees centigrade. There is, moreover, no further trouble to take with them than when in a cold frame. For wintering they should be placed in pots with soil similar to that in which they will afterwards grow.

The Editor of the *Revue de l'Horticulture Belge* remarks that hotbeds made of manure give bad results from the emanations of the bed blackening the leaves of the cuttings. To avoid this defect he advises the following :—

> Instead of making the bed of manure I have used turves and grass, not too fresh cut, but mown about twenty-four hours and slightly dried. This bed gave a very strong bottom heat for a fortnight. The experiment was made in a two-light frame, filled exclusively with cuttings of 'La France.' The cuttings were made in August, as usual, of lengths bearing three leaves each, and preferably with heels. The bed was covered with two layers of earth, composed of lumps of rough peat laid upon crocks, and then a bed of ·06 metre of old soil mixed with coarse sand. In this compost the cuttings were planted, then sprinkled with water, the lights put on, and shaded with Russian matting. The shading remained until the cuttings were rooted; they were watered four times a day, air being given sparingly as long as the bed was in a state of active fermentation. Treated in this way for about three weeks, 90 per cent. of the cuttings when lifted from the bed were found to be furnished with a good tuft of roots. The others had a few roots, or simply a callus, but very few had blackened, as one knows so often happens with cuttings made in a bottom heat of dung. The method I have just described appears to be worthy of every consideration, since cuttings rooted in August or September can be planted out in the autumn, establish themselves in the winter, and make fine bushes in the following year.

The Bearing of Climate on the Question of Own-root versus *Budded Roses.*—We know that some varieties are as vigorous and floriferous from cuttings as they are when budded on Brier or other stock. It is at least so in some regions. To mention only one example, taken at Lyons (the country above all others for Roses); 'Souvenir de la Malmaison' grows very well on its own roots, and also equally well budded on the Brier. But if this be true of any particular variety cultivated in a particular climate,

Fig. 150.—China Roses in Vase.

it often ceases to be the case when the same variety is transported into another country. For example, having written in the *Lyon Horticole* that certain Tea Roses on their own roots did not make strong plants at Lyons, I drew upon myself the following answer from a Roumanian lawyer, Monsieur G. J. Béjan :—

I have read in the *Lyon Horticole* that Tea Roses on their own roots are not recommended because they do not grow strongly. I grow Roses largely, and can assure you that Teas from cuttings grow more quickly and are much stronger than when budded. There are very good reasons for this. The Brier is neither floriferous nor a perpetual bloomer, and only puts forth fresh shoots once a year; and to make it flower oftener it is necessary to induce it to shoot by inserting a bud of a better-bred race than itself, whilst, on the other hand, Tea Roses are by nature vigorous and floriferous.

Thus plants of 'Souvenir du Dr. Passot' have in my garden reached a height of one metre in two months, as also have other varieties of Teas, *grown always from cuttings*, and they are covered with flower-buds. I have been lucky enough to make the method of striking so perfect as to obtain 80 per cent. of plants from them for certain. The plan I have followed for three years has never failed: it gives regularly the same quantity. I use pots of three centimetres diameter, and for potting soil, leaf mould mixed with chopped-up sphagnum. The points to be aimed at are: a bottom heat of about 25° C., and to be kept quite close under glass; remove every day any signs of mouldiness or excess of damp, and at the end of twenty-five to thirty days all the cuttings will be rooted. I can guarantee this method as absolutely certain, and with it you can produce thousands of Teas in particular, but also of Polyanthas and Bengals.

With the object of rendering service to horticulture in general, I have thought it well to inform you of this my method of making cuttings. As you will see, I follow the ordinary plan, except as to the soil I use, and it gives astonishing results.

I wrote, in answer to Monsieur Béjan, that the climate and soil of Roumania, in which his Rose cuttings were planted, must be exceedingly favourable to their growth for them to attain so rapidly the sizes mentioned in his letter. In other countries things are not always so, and particularly in France. Tea Roses budded on the Brier or on *Rosa indica major* (this latter being generally used in the South) grow vigorously, whilst plants from cuttings remain weakly for several years, even in the most favourable soils. Indeed, some varieties never make good bushes unless they are budded. As for thinking that a bud on the Brier can be affected detrimentally as to the amount of its blossoming power by the stock it is on, this is an idea which experience contradicts. Tea Roses budded on *Rosa canina* flower almost throughout the whole year, from May to November. I fully recognise that the method pointed out by my correspondent is a very practical one. Except as regards the compost he uses—chopped-up sphagnum and leaf mould—I have struck Roses in the same manner with entire success. But I repeat—in France Tea Roses on their own roots do not make as good a growth as those which are budded on the root of the Brier or on *R. indica major*. It is well known that the different species of Roses do not all grow in a wild state in the same climates; some inhabit the colder parts of Europe; others Southern Europe; others Asia, Africa, or America. Nature has assigned to each one of them certain well-defined regions where they flourish vigorously, each with its own particular characteristics. When they are suddenly transported to other skies, their growth becomes weakly, and it is often only with great attention, skill, and care that they can be made to thrive at all. It is certain that when an Indian Rose is united by budding to a *Rosa canina* stock, it will grow very well in lands where *R. canina* is indigenous, but very badly if taken to India or similar climates, such as the South of Europe. In this country it was long ago noticed that this union between Briers and Tea Roses was not a happy one, so another stock was substituted for it, well known under the name of *Rosa indica major*.

For making cuttings of Roses like considerations must guide the cultivator. A Rose on its own roots which grows as well as if it had been budded is better than a budded one; but if it continues weakly, it is not so good, and cannot be recommended. It sometimes happens that a Rose from a cutting grows a little less vigorously than one of the same variety that has been budded, but flowers oftener. In this case one is free to choose which of the two is the more satisfactory. But it is only reasonable that in every country and district Rose-growers should satisfy themselves more or less of the fitness of the best varieties of Roses to grow well and to flower abundantly when on their own roots.

THE SENSITIVENESS OF CULTIVATED ROSES TO CHANGES OF WEATHER.

By Edward Mawley, Hon. Sec. N.R.S.

For the last twenty-five years I have contributed to the "Rosarian's Year Book" (ably edited throughout that period by my recent colleague of the National Rose Society, the Rev. H. Honywood D'ombrain) an article entitled the "Weather of the Past Rose Year." In that series of articles I have endeavoured to trace the influence of the various atmospheric changes which occurred in the different seasons of each year upon the Roses growing in my own garden. Had these Roses been grown for ordinary garden decoration, the effect of favourable and also of adverse weather conditions upon them might not have been so keenly noted; but as they were cultivated with much care for exhibition purposes, the influence of every change upon the size and form of the individual flowers and upon the growth of the plants themselves could not very well escape detection. The general conclusion at which I have arrived is that there is no plant largely grown in this country which is so greatly at the mercy of the weather as our "exhibition" Rose. So powerful and insidious are the attacks of the elements upon it that human skill can do but little to resist them when once the plants have started into growth. Such at least has been my experience. Indeed, the very measures taken to protect such delicately constituted outdoor plants as our cultivated Roses will sometimes increase the very ills they were intended to counteract, and even produce evils which they might have escaped altogether had no such measures been adopted.

Against all other enemies the skilled rosarian comes fully armed at every point of attack, but only let adverse weather conditions set in and he has to confess himself altogether powerless. "I only wish her majesty the queen of flowers were less at the mercy of seasons," wrote many years ago an ardent amateur rosarian, and I am afraid her majesty is still as much at the mercy of the seasons as she ever was.

There are, no doubt, several causes why the Rose should be so susceptible to weather changes, but most of these may be summed up in the consideration that our cultivated Roses are, after all, only half-hardy shrubs. Could we only obtain a race of really hardy varieties, our difficulties would in a great measure disappear, and doubtless, as well, our absorbing interest in Rose culture. As an example of a perfectly hardy Rose I may instance a large plant of 'Bennett's Seedling' which not only covers the porch of my house and a large wall space above it, but, turning the north angle of the building, has found its way round to the kitchen window and over the back door. This splendid plant, although it receives no attention whatever beyond fastening-in occasionally some of its most vigorous shoots, appears entirely uninfluenced by weather of any kind. It has passed through the most cruel winters altogether unharmed; spring frosts have no effect upon it at all, while it appears equally as unconscious of drought and heat as of floods and storms. For year after year, without fail, it produces many thousands of snow-white blooms, which, while they last, form the crowning beauty of my garden.

And yet it is stated that the blooms staged at our English Rose shows

FIG. 151. Rose 'Félicité Perpétue' over Garden Arch. (*The Garden.*)

gathered from the half-hardy shrubs I have mentioned, are unsurpassed in size, perfection of form or colour, by any Roses the world can produce elsewhere. If this be true, as I believe it to be, surely the greatest credit is undoubtedly due to our British rosarians, when we consider that we have here a somewhat delicate plant coming to perfection out of doors in a climate to all appearance only able to satisfy one of its requirements, which is the delight it takes during its growing period in a moderately cool and humid atmosphere.

Although there are few outdoor plants so quickly influenced for ill by unfavourable atmospheric changes, yet, on the other hand, it must be acknowledged that there are few plants which have such splendid recuperative powers, and which so quickly recover to a greater or less extent from the injuries inflicted on them as the Rose. So that although a really good Rose year is very rarely experienced, yet it very seldom happens but that at some time or other in the flowering season, though it may be only for a short period, a large number of fine and well-formed Roses can be gathered even during the most unpropitious of summers.

I will now touch briefly upon one of the atmospheric conditions affecting Roses, and that is temperature—the most potent factor of all. During the winter months moderate uniform cold is the best suited to the requirements of Rose plants, as it allows them a long period of rest, which is so desirable at that season without inflicting any serious injuries upon their shoots; whereas in a really severe winter much damage is often done, particularly if the frost attacks the plants suddenly and after a spell of unseasonably mild weather. On the other hand, great mildness is undesirable, as the plants are deprived of that complete repose which all deciduous shrubs require at some period or other of the year. It also renders them more susceptible to injury should any frosty weather set in at the end of the winter. In hot and dry climates this rest is obtained in the height of summer, but in our higher latitudes in the depth of winter. In my opinion all dwarf Roses are benefited by the surrounding soil being drawn over their crowns in the late autumn to the height of a few inches. When so treated, although the shoots may be destroyed to the level of the earthing-up, the rest of the plant will in nearly every case remain efficiently protected.

So far the cultivator can, with a little care, safeguard his favourites. But from the time they start into growth in the spring they must be regarded as practically at the mercy of the elements. Late spring frosts are greatly to be dreaded. Often in a single night many of the promising young growths are destroyed altogether, or the plants receive such a check from the cold that a large number of the shoots become blind, and the flowers which are spared are often ill-shaped, and consequently worth ess to the exhibitor.

The greatest trial of all, however—and it is not an unfrequent one—occurs when the plants have passed through the spring months uninjured only to fall victims to a spell of exceptionally cold and dry weather in June, when the buds are just formed. This is, indeed, a trying experience. It is like an angler who, having hooked and successfully played an unusually fine trout, has the keen disappointment of seeing it break away through some unforeseen circumstance at the very moment when the landing-net is about to be put under it.

The following particulars may prove of interest, as they clearly show the marked variability of seasons as well as their surprising uncertainty:—

In fifteen of the twenty-five years over which my records extend, the wood of the principal shoots of my Rose-plants had become well ripened before the winter frosts set in, whereas in the remaining ten years the shoots were but indifferently matured at the end of the autumn. It was, however, sometimes found, when a mild and dry winter followed, that the ripening of the wood had been completed before pruning time in the following spring.

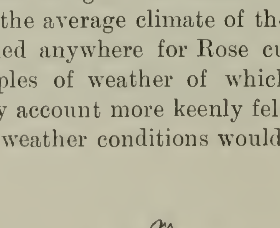
There occurred seven winters when the weather proved exceptionally severe, the remaining eighteen having been either variable in temperature, moderately cold, or more or less mild. In six winters the season was so exceptionally mild throughout as to allow the plants no real rest. The hardiness of most of our modern Hybrid Perpetuals and Hybrid Teas, under favourable conditions when dormant, is shown by the fact that on several occasions a large majority of the best shoots were found altogether uninjured after having been exposed to a zero temperature—32° of frost. By favourable conditions I mean that at the time when such a severe frost occurs the shoots must be well ripened and the atmosphere fairly dry and calm.

In only eight springs were there any destructive late frosts, but during several of these frosts the damage done was considerable.

It may appear surprising, but it is nevertheless true that during the twenty-five years now under review more Rose seasons were spoilt by adverse weather in June and the early part of July than by either winter or spring frosts taken separately. For instance, in nine years a spell of cold weather in June suddenly arrested the growth of the plants and the development of the flowers—from which they never afterwards entirely recovered during the rest of the summer. Then again in eight other summers the prospects of a fine flowering period were marred by dry, hot, and forcing weather hurrying the blooms prematurely into flower.

The distribution of early and late Rose seasons over the twenty-five years is rather remarkable. For in the first twelve years of that period there were as many as eight backward seasons, whereas in the last thirteen years there occurred only three. Then again in the first twelve years there was only one forward season, whereas in the last thirteen years there have occurred seven Rose seasons which were more or less early.

In conclusion, I am very sorry indeed, in these short notes, to have had to report so unfavourably upon my friend the weather and its spiteful treatment of our national flower—the Rose; and it is unfortunately difficult to find any extenuating circumstances for this apparently cruel conduct. The fact is, the average climate of the British Isles is, so far as I am aware, unequalled anywhere for Rose culture; but the effect of the unsatisfactory samples of weather of which that climate is often made up is on that very account more keenly felt by the ardent rosarian in Britain than similar weather conditions would be in any other quarter of the globe.



THE HYBRID TEA

(*Rosa indica odorata hybrida*).

By the Rev. Joseph H. Pemberton, Vice-President of the National Rose Society.

I. A Retrospect.

In introducing the Hybrid Tea for consideration by the Conference, bear with me if I allow some echoes of the last Rose Conference, held in 1889, to reach our ears.

> "The class of Hybrid Teas do not seem to have made real advance. After 'Cheshunt Hybrid' came in 'Reine Marie Henriette,' and then some double climbing Roses from Nabonnand, as 'Reine Olga de Wurtemberg' and 'Marie Lavallée.' 'Camoens' and Bennett's 'Grace Darling' are beautiful free-flowering additions likely to continue." (*Roses since* 1860, by Mr. G. Paul.)
>
> "The separation of these hybrids from the parent group has not been made too soon, although I think some varieties that have been placed here might have remained with the Tea-scented, and others have been placed with the Hybrid Perpetuals. They are hybrids between individuals of these groups, and are not always a distinct departure from one or the other parent. We gain something in constancy of flowering by this cross, but the offspring is often susceptible of injury by frost." (*Grouping of Garden Varieties*, by Mr. W. Paul.)

These echoes help us to realise the position. In 1889 Rose cultivation was on the eve of a new era, the era of the Hybrid Tea. The invasion of our gardens by a new race was imminent, quietly yet steadily advancing, aided in no small degree by a revival of a more refined appreciation of the beautiful in the Rose, a revival of what are appropriately termed "Decorative" Roses. Speaking generally, the decade of 1870–80 was the era of the exhibition Hybrid Perpetual as we know it now, since those of the sixties had for the most part given place to larger and more perfect flowers. In like manner the decade of 1880–90 may be termed the period of the Exhibition Teas. We are not surprised therefore to be told (I again quote from the last Rose Conference Report) that "Hybrid Perpetuals are virtually perfected." Those were days when the so-called Exhibition Roses were paramount; the demand was for them, and the supply corresponded. Our exhibition schedules bore witness to the fact that two groups, and groups by no means to be despised, were in power, the Hybrid Perpetual and the Tea. Nevertheless, as in politics, so in the Rose world, a third party was in process of formation which now is challenging the other two for supremacy—the Hybrid Tea. The time was propitious. Lovers of the Rose were yearning for something more suitable for the garden than purely exhibition Roses. The introduction of Mr. Bennett's 'Her Majesty' set us thinking. Magnificent as a specimen-flower when seen in the exhibition tent, as a garden Rose it lacked that something which can best be expressed in modern Italian as *simpatica*. Few and scentless were its flowers, which by being perched on the top of a stiff stem savoured of stubbornness and self-conceit. Was it for this that we had expelled from our collection 'Aimée Vibert,' 'Maiden's Blush,' 'Mrs. Bosanquet,' 'Félicité Perpetue,' and all our grandmothers' Roses, with their exquisite scent and masses of flowers? We resolved to have them back again, and with them anything that was as free in flowering and perpetual.

II. The Rise and Progress of the Hybrid Tea.

This was the psychological moment for the advent of the Hybrid Teas. By reference to a trade catalogue we can trace their advance. In the catalogue for 1890 we find six, and then two years later, and every two succeeding years to 1901, we find the number of Hybrid Teas to be twelve, thirty-one, forty-three, forty-nine, and sixty-five. These returns are taken from the catalogue of a grower who is most careful in his selection, so careful indeed that some varieties are omitted which, in my opinion, might well be included. But what do these figures show us? Just this, that during the last ten years Hybrid Teas have increased from six to sixty-five. In support of this evidence let us call upon the "Official Catalogue" of the National Rose Society. In 1882 this Society published its first catalogue, which, with the exception of the Bourbon 'Souvenir de la Malmaison,' contained nothing but Hybrid Perpetuals and Teas. In the second edition of 1884 three Hybrid Teas found a place, these being 'Cheshunt Hybrid,' 'Reine Marie Henriette,' and 'Longworth Rambler.' In the edition of 1893 there were twenty, and in the last edition, that of 1899, there are no less than forty, showing an increase of 100 per cent. in six years. What these statistics foreshadow I leave to the consideration of the Conference; but on one point we shall probably all agree, that since our last Conference the progress of the Hybrid Tea has been phenomenal.

III. What is a Hybrid Tea?

This is a question the Conference might well endeavour to determine. We greatly need a definition. It is difficult to reconcile the grouping together of 'Marquise de Salisbury' and 'Caroline Testout,' the former showing affinity with *R. spinosissima*, the latter, especially in its armature, with *R. canina*. It is more difficult still to discover the dividing line between 'Kaiserin Augusta Victoria,' Hybrid Tea, and 'Maman Cochet' Tea (fig. 153); and what prevents 'Gruss an Teplitz' from being classed as a China? Rabbits are excellent judges of Teas and of Roses possessing any strain of Tea, but whilst leaving untouched many so-called Hybrid Teas, they are most partial to 'Suzanne Marie Rodocanache,' Hybrid Perpetual. Why is this variety excluded from the Hybrid Tea group? Again, are we to conclude that the apparent diversity among Hybrid Teas is a result of heredity? It is stated that the first Hybrid Perpetual was obtained by crossing the Hybrid China with a Damask

Perpetual. If this is so, then we have in this class the intermingling of *R. damascena* with *R. gallica.* On the other hand there is considerable variation in Roses of the Tea-scented group, which appears to owe its origin to the blush Tea introduced from China in 1810, and the Yellow Tea received from the same country in 1834. Was not the Hybrid Tea originally a cross between the Hybrid Perpetual and the Tea-scented? Have we kept to this? Is there not rather a tendency in the present day to class all perpetual Roses of an indefinite character as Hybrid Teas, regardless of botanical characteristics? It seems that a raiser considers there are but three courses open to him. He obtains

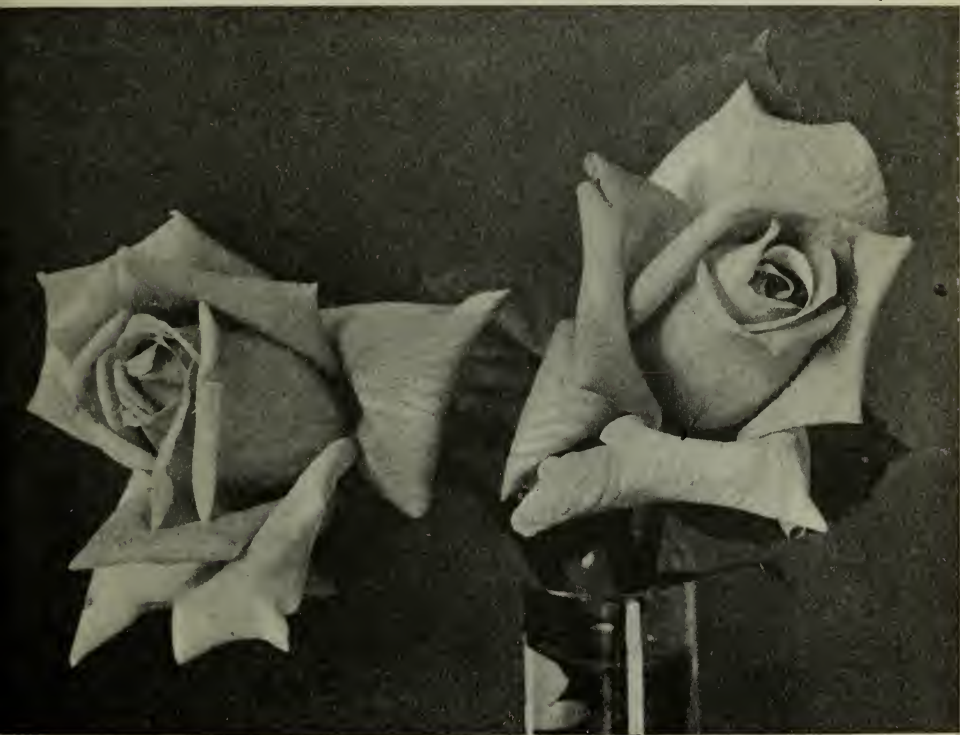


Fig. 152.—Hybrid Tea Rose 'Mme. Jules Grolez' (slightly reduced). (*The Garden.*)

a seedling, propagates it, and then, when on the point of distributing it, considers whether it is a Hybrid Perpetual or Tea. If he is unable to determine this point, he calls it a Hybrid Tea. Again, some it may be who approach the question from the more or less restricted view of an exhibitor, jealously protect the Tea-scented class from any intrusion of a red flower. A dark Rose in a stand of Teas, they say, spoils the stand. As an instance of this we may cite the case of 'Souvenir de Thérèse Levet,' introduced in 1882, which had to struggle hard to maintain its position as a Tea. If this Rose had been sent out some ten years later, I venture to say it would, solely on account of its colour, have been classed as a Hybrid Tea. And here I would put forth another possible reason for this extension of the group. The National Rose Society steadfastly refuses admission to any Hybrid Perpetual in the decorative Rose classes at its exhibitions, the result being that no new decorative Rose, if classed as a Hybrid Perpetual, unless it is single, has any chance of being seen at the National Rose Society exhibitions, and therefore to avoid the above restriction the decorative Hybrid Perpetual is sent out as a Hybrid Tea. Has not the time arrived when more care should be exercised in the classification of a new Rose, and if so I repeat the question, What is a Hybrid Tea ?

IV. Cultivation.

As we have already observed, this group is most comprehensive. It includes some first-rate exhibition varieties, such, for example, as 'Bessie

Fig. 153.—Rose 'Maman Cochet.' (*The Garden.*)

Brown,' 'Caroline Testout,' 'La France,' and 'Mrs. W. J. Grant'; excellent pillar Roses, as 'Reine Olga de Wurtemberg,' 'Longworth Rambler,' and 'Waltham Climber.' Above all, it is by far the best class for those who desire a profusion of flowers for the garden. They are, as a rule, very free-flowering, vigorous, and as hardy as any Hybrid Perpetual. But this comprehensiveness, excellent as it is, makes it impossible to lay down a definite rule for cultivation applicable to all alike. Especially is this the case with the method of pruning. Each variety has its own idiosyncrasies, and therefore what may be good for one may be death to the other. But speaking generally, Hybrid Teas, unlike Hybrid Perpetuals, are impatient of the knife. It is better not to prune than to prune too much. And then, with reference to the stock, it is by no means certain that the Brier is the best for all. For instance, 'Mrs. W. J. Grant,' I am inclined to think, prefers the Manetti, whilst 'Clara Watson,' with us, has on the much despised Polyantha given the finer flowers and stronger growth. Does not the question of cultivation therefore seem to rest on this basis—knowledge of each variety gained only by personal observation and experience?

V. Raisers of Hybrid Teas.

Hybrid Teas having become so prominent during the last ten years, it would be well at such a gathering of Rose-growers as this to place on record the names of some of the pioneers in this new departure, giving honour where honour is due. For the best Hybrid Teas we are principally indebted to H. Bennett, A. Dickson & Sons, Nabonnand, Pernet-Ducher, and W. Paul & Son, sharing between them forty-four varieties. Paul & Son, of Cheshunt, led the way with 'Cheshunt Hybrid,' sent out in 1873; for, although some Roses which have since been recognised as Hybrid Teas were already in cultivation but classed as Hybrid Perpetuals, Messrs. Paul & Son were the first to detect and establish the difference between Hybrid Teas and other Roses.

Of the varieties raised by Mr. H. Bennett the best, I think, is 'Viscountess Folkestone.' Messrs. A. Dickson & Sons have proved themselves his worthy successors, and are well to the front as successful hybridisers, some of the most valuable Hybrid Teas emanating from this firm. Among the best of those already tested are 'Mrs. W. J. Grant,' 'Bessie Brown,' 'Liberty,' 'Killarney,' 'Marjorie,' 'Countess of Caledon,' and the three beautiful singles, 'Irish Beauty,' 'Irish Modesty,' and 'Irish Glory.' Last year we received from this firm 'Mamie,' 'Duchess of Portland,' 'Mildred Grant,' Roses of considerable merit; and this year are promised 'Alice Lindsell' and possibly 'Florence Pemberton.' In M. Nabonnand's collection 'Bardou Job' takes the leading position, and M. Pernet-Ducher will long be remembered for some of the very finest productions, such as 'Caroline Testout,' 'Gustave Régis,' and 'Marquise Litta,' closely followed by 'Madame Abel Châtenay,' 'Madame Cadeau Ramey,' and 'Souvenir du Président Carnot.' A grand record. To William Paul & Son we owe, amongst others, 'Exquisite,' 'The Waltham Climbers,' and 'Tennyson.' Guinoisseau has given us 'Augustine Guinoisseau,' Geo. Prince contributes 'Clara Watson,' M. Geschwind has made our gardens gay with 'Gruss an Teplitz,' and Paul & Son our dinner tables in early spring with 'Lady Battersea.' There are many others one would like to mention, but time forbids. They shall be recorded in an appended list.

Concluding Remarks.

We are informed by Lindley, in his monograph of the Rose, that the name "Rose" is derived from the Celtic word *rhodd* and the Greek ῥόδον, signifying "red"; but why is it that the Hybrid Tea class, speaking generally, is so deficient in reds of a decided colour? Of Hybrid Perpetuals we possess magnificent reds, such as 'Horace Vernet,' 'Charles Lefebvre,' and 'Victor Hugo.' When shall we have a 'Horace Vernet' of the 'Caroline Testout' type, robust, constant, and free? Year by year we eagerly scan the lists of new Hybrid Teas, and inspect the stands of new Roses, but although in 'Bardou Job,' 'Marquise de Salisbury,' 'Liberty,' and 'Gruss an Teplitz' we have some good reds, yet for the most part the gold medal Roses are pasty, washed-out-looking things. We want something definite—a good red, dark and vivid, or a good pure white—and to the raiser who supplies these we shall accord a hearty greeting.

A Selection of Hybrid Teas suitable for Exhibition.

White.—'Bessie Brown,' 'Beauté Lyonnaise,' 'Kaiserin Augusta Victoria,' 'Mildred Grant,' 'Souvenir de Madame Eugène Verdier,' 'Tennyson,' 'White Lady.'

Cream.—'Madame Cadeau Ramey.'

Blush.—'Antoine Rivoire,' 'Killarney,' 'Lady Mary FitzWilliam,' 'Souvenir du Président Carnot.'

Pink.—'Countess of Caledon,' 'Caroline Testout,' 'Captain Christy,' 'Danmark,' 'Duchess of Albany,' 'Gladys Harkness,' 'La France,' 'Mamie.'

Red.—'Exquisite,' 'Mrs. W. J. Grant,' 'Marquise Litta.'

A Selection of Hybrid Teas suitable for Garden and Decoration.

White.—'Irish Beauty,' 'Kaiserin Augusta Victoria,' 'Marjorie.'

Cream.—'Madame Cadeau Ramey,' 'Viscountess Folkestone.'

Yellow.—'Gloire Lyonnaise,' 'Gustave Régis,' 'Madame Pernet-Ducher,' 'Madame Ravary.'

Blush.—'Antoine Rivoire,' 'Augustine Guinoisseau,' 'Clara Watson,' 'Grace Darling,' 'Irish Glory,' 'Killarney,' 'Madame Jules Grolez,' 'Souvenir du Président Carnot.'

Pink.—'Camoens,' 'Caroline Testout,' 'Irish Modesty,' 'La France,' 'Madame Abel Châtenay,' 'Rainbow.'

Red.—'Bardou Job,' 'Gruss an Teplitz,' 'Lady Battersea,' 'Marquise Litta,' 'Marquise de Salisbury,' 'Papa Gontier,' 'Princess Bonnie.'

Hybrid Teas suitable for Pillars.

'Cheshunt Hybrid,' 'Longworth Rambler,' 'Pink Rover,' 'Reine Marie Henriette,' Reine Olga de Wurtemberg,' 'Waltham Climbers,' 'Climbing Captain Christy,' 'Climbing Kaiserin Augusta Victoria,' 'Climbing La France,' 'Climbing Mrs. W. J. Grant.'

A List of some of the best Hybrid Teas and their Raisers.

Raiser	Year of Introduction	Names
Bennett . . .	1882	Lady Mary Fitzwilliam.
,, . . .	1884	Grace Darling.
,, . . .	1886	Viscountess Folkestone.
Bonnaire . .	1896	Rosette Légion d'Honneur.
A. Dickson & Sons .	1895	Mrs. W. J. Grant, Marjorie.
,, ,, .	1897	Countess of Caledon.
,, ,, .	1898	Killarney.
,, ,, .	1899	Bessie Brown.
,, .	1900	Liberty, Gladys Harkness, Irish Beauty, Irish Glory, Irish Modesty.
,, ,, .	1901	Mildred Grant, Mamie, Duchess of Portland.
,, ,, .	1902	Alice Lindsell.
,, ,, .	1903	Florence Pemberton.
Dingee & Conard .	1891	Rainbow.
,, ,, .	1895	Princess Bonnie.
Guillot . . .	1867	La France.
,, . . .	1884	Gloire Lyonnaise.
,, . . .	1895	Charlotte Gillemot.
,, . . .	1897	Madame Jules Grolez.
Guillot fils . .	1894	Madame Jules Finger.
Geschwind . .	1897	Gruss an Teplitz.
Guinoisseau . .	1889	Augustine Guinoisseau.
Lacharme . .	1873	Captain Christy.
Lambert & Reiter .	1891	Kaiserin Augusta Victoria.
D. Lambert . .	1897	Grand Duchess Victoria Melita.
,, . .	1899	Papa Lambert.
Levet . . .	1878	Reine Marie Henriette.
Liabaud . . .	1880	Longworth Rambler.
Nabonnand . .	1881	Reine Olga de Wurtemberg.
,, . .	1883	Papa Gontier.
,, . .	1887	Bardou Job.
,, . .	1898	Albert Stopford, Comtesse Vitali, Grand Duchesse, Anastasia, Lucy Carnegie.
Paul & Son . .	1873	Cheshunt Hybrid.
,, ,, . .	1901	Lady Battersea.
W. Paul & Son .	1886	Waltham Climbers.
,, ,, .	1888	Duchess of Albany.
,, ,, .	1890	White Lady.
,, ,, .	1899	Tennyson, Exquisite.
Pernet-Ducher .	1890	Caroline Testout, Gustave Régis.
,, .	1891	Madame Pernet-Ducher.
,, .	1893	Marquise Litta.
,, .	1895	Antoine Rivoire, Madame Abel Châtenay, Souvenir du Président Carnot, Souvenir de Madame Eugène Verdier.
,, .	1896	Beauté Lyonnaise, Ferdinand Batel, Madame Cadeau Ramey.
,, .	1897	L'Innocence, Madame Eugène Boullet.
,, .	1898	Souvenir de Madame Ernest Cauvin.
,, .	1899	Madame Ravary, Monsieur Bunel.
Pernet père . .	1890	Marquise de Salisbury.
Prince . . .	1894	Clara Watson.
Schwartz . .	1881	Camoens.
Soupert et Notting .	1889	Duc Engelbert d'Aremberg.
Zeiner & Co. . .	1890	Danmark.

EXHIBITION ROSES.

By George Paul, J.P., V.M.H.

By a curious irony of fate, owing to the lateness of the season, I have not been able, at this Conference, to show a solitary flower of any so-called Exhibition Roses. Taking the great London shows, this has happened to

Fig. 154.—Mr. George Paul, J.P., V.M.H. (*The Garden.*)

me only twice in the forty-two years during which I have exhibited in the chief class.

The Exhibition Rose is a modern product, although its introduction is not quite within the recollection of any living horticulturist. Its history covers the lives of three generations of Rose nurserymen, of whom I am in my own case the third, as Messrs. Rivers, Lane, and Wood, with my grandfather, Adam Paul, were among the first exhibitors of Roses.

Prior to the exhibitions of the R.H.S. in 1833, Roses were exhibited at shows in the Royal Surrey Gardens and in some smaller exhibitions in the London suburbs. At these early shows arose the taste for finely formed flowers and the desire to raise Roses that should have "a *florist's standard of excellence.*"

In 1840 there seem to have been "classes" at some shows, as, for instance, in that of the Herts Horticultural Society, and in 1849 "fifty varieties of cut Roses" seem to have been the competitive class. Possibly some lists of the varieties shown are extant in the journals of this society earlier than that given in vol. vi. of the R.H.S. JOURNAL in the year 1849.

In 1851, in the first edition of the "Rose Garden," Mr. W. Paul gives a list of Exhibition Roses, and in a small book, "The Tree Rose," published in 1845, a list of six finely-shaped Roses is furnished by Mr. Thomas Rivers, then one of the large trade exhibitors.

From the varieties given in these lists we can fairly judge what was the standard of excellence which, after twenty-five years' exhibiting, Roses had attained. My own experience dates only from 1860, twelve to fifteen years later, so that I have to accept these recorded lists, some flowers in which stayed till my time. Mr. Rivers' six may be noted: 'Coupe d'Hébé,' a cupped hybrid China; Gallica 'Boule de Nanteuil,' a large, flat, imbricated flower with short petals; 'Kean,' also a flat Gallica, with an occasional green eye. The others I do not remember.

The R.H.S. list includes mostly Hybrid Perpetuals, amongst others: 'Baronne Prévost' and 'Géant de Batailles,' flat flowers; 'Madame Laffay' and 'William Jesse,' somewhat globular; 'Baronne Hally' and 'Caroline de Sansal,' upright globular; 'Armosa' and 'Bourbon Queen,' semi-doubles, were good enough to be included, as were the Chinas 'Mrs. Bosanquet,' 'Fabvier,' and 'Abbé Miolan.' The only flowers an exhibitor would to-day admit to his stand would be Tea 'Niphetos,' 'Madame Bravy,' 'Devoniensis,' and, if he could get it, 'Cloth of Gold.'

The Rose Garden exhibition lists give 'Crested Provence,' 'Madame Hardy,' and others, 'Moss Laneii' and 'Bath White,' Gallicas *ad libitum*, with Persian yellow, hybrid Chinas such as 'Brennus' and 'Chenédollé,' and hybrid perpetuals such as those noted. Bourbons, including 'Souvenir de la Malmaison' and Noisette 'Lamarque,' in fact the best of them, are now included among the garden Roses given in the N.R.S. Catalogue, in contradistinction to the exhibition Roses.

And yet the standard must have been fairly high, for the points of merit accepted are thus laid down clearly in 1848:—

"The outline of show Roses should be circular, free from all raggedness; the flowers should be full and the petals arranged as regularly as possible; the larger the flowers the better, provided they are not coarse."

In 1879 the National Rose Society laid down the rules for judging:—

"A good Rose must have *form*, size, brightness, and substance.

"*Form* shall imply petals abundant and of good substance regularly and gracefully disposed within a circular outline.

"Brightness shall include freshness of colour, brilliancy, and purity."

A delightful perfection if it were adhered to; but vivid colour is now treated as a secondary consideration, and the blossoms of some of the Exhibition Teas are now said to be "developed in tissue paper"!—that is to say, wrapped up in tissue paper when quite buds and allowed to develop under this unnatural envelope, whereby all true brightness of colour is lost.

A slight but continuous improvement was made up to 1861.

From this time I speak from personal experience.

Lacharme and others at this time began to send us varieties of Hybrid Perpetuals, which were marked advances in all ways.

At the last Conference I was privileged to record the rise and coming to perfection of the Hybrid Perpetuals.

'Charles Lefebvre,' followed by 'Maurice Bernardin,' 'Prince Camille de Rohan,' 'Mdme. V. Verdier,' 'Pierre Notting,' 'Xavier Olibo,' and 'Alfred Colomb,' are magnificent flowers; gains in colour and form.

They changed the standard of excellence, and the types used for the figures in the N.R.S. Catalogue were selected from among them. They remain, and probably will remain, the standard shapes of H.P. Roses.

'Pierre Notting' is the "globular" *picture example*; 'Alfred Colomb' is the "globular with high centre" type, published in the Catalogue.

In 1867 another break occurred in 'Baroness Rothschild'—the picture type of the "cupped" Rose—and 'La France,' a type not figured, but which cannot, although it does not fit in with our accepted forms, be left out of the show boxes. It was the first of the pointed flowers with folded petals, of which 'Caroline Testout,' 'Killarney,' and 'Lady Mary Fitzwilliam' are the perfected forms.

In 1877 'A. K. Williams,' the typical "imbricated" Rose, appeared. As yet no Rose has approached it.

By 1880 the Hybrid Perpetuals as show Roses were perfected, and if a list were drawn up, gains since that date would be found to be few and of no serious importance as additions. Those which came, such as 'Merveille de Lyon' and 'Victor Hugo,' were but perfected forms of, or varieties of, existing types.

The new Hybrid Teas gradually added a new feature to the boxes. Only partially double, they had petals folded to a point in the centre, and if tied and the other petals dressed, that is, folded over, they added new forms "teeming with points" to the types of flowers.

Though only semi-double they lasted, after the centres were untied, long enough for the judges to deem each flower worthy of three points, and they soon began to take, and are still taking, a great share in prize-winning.

The French gains with stiff petals and more reflexed flowers, such as 'Antoine Rivoire,' 'Charlotte Gillemot,' 'Marquise Litta,' and the German 'Kaiserin Victoria' and 'Victoria Melita,' stay on to please the public at exhibitions later in the afternoon.

Of the types—'Killarney,' 'Mdme. Grolez' (fig. 152), and 'Mrs. Grant,' though quickly passing, are so beautiful that all like them.

The 'La France' type, with 'Châtenay,' 'Admiral Dewey,' and 'Viscountess Folkestone,' admirable as half-blown flowers, are wonderful show Roses: they supply the place of the old bolder H.P.'s, such as

'Marquise de Castellane.' The newer H.T.'s, 'Bessie Brown' and 'Mildred Grant,' seem intermediate between the two classes.

With the newer more refined taste 'Captain Christy' has almost ceased to be an exhibition variety.

The Bourbons have given us little in addition, but 'Mrs. Paul,' 'Mdme. Isaac Periere,' its seed-parent, and 'Mdme. Pierre Oger' are large back-row imbricated flowers, and the form should for its variety be extended as a foil to the thin-pointed petalled flower.

They require, like the beautiful H.P. 'Captain Hayward,' to be nicely timed—the N.R.S. should give a brief time-table—"for removing ties prior to the judges beginning."

In exhibition Teas the taste is changing. One does not see the large round flat flowers of which 'Souvenir d'un Ami' and 'Souvenir d'Élise' were the types.

The judges favour the pointed type of flower such as 'Contesse de Nadaillac,' 'Princess of Wales,' and the 'Mermet' family. I think they are right.

Of the cupped form with five petals 'Mdme. Hoste,' 'Anna Olivier,' and 'Rubens' may require perfecting. 'Mrs. Berkeley' moves in this direction.

I wonder if Moss Roses, Rugosas, and even perpetual Chinas may not take a place in the show boxes of the future. I should rather incline to a belief in Rugosas.

Exhibition Roses, all must allow, have played and are playing their part in leading on to comparative perfection in Roses. Taste changes, and though some of us who have borne the heat and burden of the Rose fights may not abruptly adopt new tastes, real improvements soon win over experienced exhibitors.

I have always fought against spoiling flowers by dressing. I once more protest against it: it spoils the unique character of a flower and leads to the adoption of one type (whereas the Rose should give us many), and the distinct character of each individual flower is lost. I deprecate tying, as too thin Roses that will not stand for the general public to look at, such as 'Captain Hayward,' are not Exhibition Roses. They do not last in the garden, and any methods of showing which lead the public to think a flower other than it is, recoil, at least, on the trade exhibitor. A flower should be double enough to last cut in a room or in a flower-box four or five hours.

Besides, we all love colour, and for people to throw away one of the great gifts God has given us in flowers is a *bêtise*.

A stand of flowers which have been tied up ready for the show two days beforehand is a dull and uninteresting exhibit.

The President of the Rose Society, the Very Rev. Dean of Rochester, said to me: "Where are the 'Charles Lefebvres' and the 'Horace Vernets' *we* used to see?" They are not, for they will not bear the artificial treatment to which flowers are now subjected.

A stand brilliant in its colouring used to be an enjoyable sight at a Rose show, now it is seldom seen.

Judges are responsible for this—or perhaps rather the attempt to tie down judges to "rules for judging" in which colour has not its proper number of points.

"Rules for judging" are useful for the man who is not quite up to his work, but the expert does not need many rules to enable him to arrive at a right decision.

I would plead in the interest of the Rose that colour should have more weight in making awards; that mere form should not be the sole criterion.

The *present definition* 6 of the National Rose Society's "rules for judging" says "brightness shall include freshness, brilliancy, and purity of colour," qualities now rarely seen in a stand of Roses at a Rose show.

This is not the place to talk of modes of exhibiting, but the Society should adopt a way of showing each flower, so that its habit, character, and strength of growth may be seen the better by everybody.

For a full list of Exhibition Roses, can I do better than refer you to the National Rose Society's list? Its list of Exhibition Roses is the consensus of the opinions, after debate, of the best exhibitors.

But I may give you the names of, say, twenty-four or a few more of what may be considered types of the six or eight classes we should like to see in *all exhibition boxes*.

Perfectly Imbricated:—
'A. K. Williams.'
'Horace Vernet.'
'Charles Lefebvre.'

Imbricated with a centre:—
'Beauty of Waltham.'
'Prince Camille de Rohan.'
'Comte Raimbaud.'
'Duchesse de Morny.'

Cupped:—
'Baroness Rothschild.'
'Merveille de Lyon.'
'Ulrich Brunner.'
'Madame Hoste.'

Globulars:—
'Auguste Rigotard.'
'Duke of Connaught.'
'Dupuy Jamain.'
'Éclair.'
'Helen Keller.'
'E. Y. Teas.'
'Souvenir d'un Ami.'

Globular, high centre:—
'Alfred Colomb.'
'Duc d'Orléans.'
'Marie Baumann.'

Globular, pointed centre:—
'Duchess of Bedford.'
'General Jacqueminot.'
'Gustave Piganeau.'
'Victor Hugo.'
'Catherine Mermet' and its sports.
'Maman Cochet' and its white variety.

'La France' type, or pointed globular with reflexed petals:—
'La France.'
'Caroline Testout.'
'Mrs. Mawley.'
'Marquise Litta.'

Roses beautiful in the buds, but of undefined shade:—
'Captain Hayward.'
'Duke of Edinburgh.'

Teas 'Marie Van Houtte':—
'Rubens.'
'Mrs. Grant.'
'White Lady.'
'Viscountess Folkestone.'

Egg-shaped, a new type:—
'Bessie Brown.'

The shapes might be more subdivided, *but* the above are the present favourites of judges *for Exhibition Roses*. No comparison should be instituted between them and the *Garden Roses*. May I add that I think the demand for *selected large* cut flowers of Roses for home decoration shows that size must not be neglected in our future aims? Other points to seek are clearer, more holding colours—pursuing the old aim of getting the pure crimson and eliminating the purple, but not neglecting the typical colour of the flower—Rose-colour in its varied shades.

So much has been said and written about Roses that I fear I have not been able to add anything new; but perhaps the suggestions made in this paper may not be unacceptable as coming from one who has spent his life in the cultivation and the improvement of the Queen of Flowers.

CULTURE OF ROSES UNDER GLASS.

By Geo. Mount, F.R.H.S.

There are two principal ways of growing Roses under glass, either by growing them in pots or planting them out in the soil; both are good (in their own way). I grow them both ways, but for early forcing, *i.e.* getting them to bloom in mid-winter (February), it is best and necessary to grow them in pots, as you cannot force them sufficiently to bloom so early if planted out; later on you can get good results with perhaps less trouble by having them planted out. One great advantage of growing them in pots is that when the plants have done flowering, and have made their growth for next year, you can take them outside and use the house for other purposes. I use mine for growing Tomatos in the summer and Chrysanthemums in the autumn; and when these are over it is time to put the first batch of Roses in again, so that the houses are never empty, and I am able to get three separate crops out of the same house in one year. Of course, if the house is planted up with Hybrid Perpetuals you only get the one crop; if planted with 'Teas' or 'Hybrid Teas' you are able to get more or less a succession of bloom, which will depend on how you manage the houses.

After this preface I will now tell you my own treatment in as few words as possible. First as to potting. About the end of October or beginning of November I take up young maiden plants from my outdoor beds, and put them into eight-inch pots. At one time I used ten-inch pots, but now I only use eight-inch, as I think they are quite large enough, and much easier to move about. The potting soil, which is carefully prepared, is composed of two parts turfy loam, one part well-rotted manure, one part sand and "denture" *i.e.* wood ashes &c., with a little bone or similar artificial manure, all well mixed together. The pots must be clean and well drained, *i.e.* a large piece of crock in the bottom of the pot, with finely broken crocks on that, with a few pieces of rough turf over them; put the Rose plant low enough to cover where budded if possible, and be sure to pot very firm and well ram the soil with a stick. After potting give the plants a good watering and put them in a cold frame or under a sheltered wall, so that they can be covered if necessary through bad weather, and leave them till the time for pruning, which will depend on when you want them in bloom. Of course they will want occasional watering when necessary, and if there is a lot of foliage on them when potted, syringing will do them good by keeping the foliage green, and so help the plants to make root action. I have spoken at some length on this part of the subject, as I think a great deal depends on starting on a good foundation, especially for early forcing.

Now for pruning. I begin to prune early in November for flowering in February. This first batch of Roses must be well established and good strong plants, or you will be courting failure. It is no good thinking you can bring the plants in for forcing that have just been potted as described; they must wait till next year. Each plant is carefully knocked out of its pot to see if the drainage is all right, and then some of the top soil is taken off and top-dressed with good rotted turf and manured with artificial bone manure, pruned, and afterwards every pot well scrubbed, and then taken into the house and put into their winter quarters for flowering. I prune very hard, cut them down as low as I can, or they soon get leggy and unsightly. After the first batc I continue to prune every fortnight for succession till February, when all the newly-potted Roses are done.

Culture after Pruning.—When the Roses are brought into the house in November the house is kept close, pipes just warm if it is cold weather, and the plants lightly syringed at times to help make them start, but no fire heat to force them in any way; let them start as naturally as possible. If you try to force them now you spoil them. After the shoots begin to show leaf I think my treatment is different from most people's. *I leave off syringing entirely.* My early Roses, from the time of the opening leaf till they are cut, never have any water on the foliage. I used to syringe my Roses every day when the weather was favourable, but now I never do so after the early stage; and this I think is the reason why my foliage is always clean, with no marks on it, and those who have seen my Roses as exhibited will testify to the truth of this. Of course the plants must be kept clean and free from green fly, which can be easily done by fumigating, but it is best to fumigate early enough. When you see the first green fly, that is the time to fumigate; do not wait until they get bad, or they will leave their mark behind. When the plants are in full growth and showing bud they want well feeding up with "brandy-and-water."—I mean liquid manure, which can be made of sheep droppings and soot, or any of the well-known artificial manures can be given alternately. Most people stake their Roses, which I think looks very unsightly and takes time. I never stake, but try to grow them strong enough to stand alone, and they certainly look better. Out of the many thousand pots of Roses I have grown this year I have not used a single stick for any one of them.

They must now be well disbudded and looked over for maggots (there is no way of killing this pest that I know of save by finger and thumb), and then in about ten days or a fortnight you may look forward to having some grand blooms.

After flowering many people make a great mistake by putting their Roses out-doors too soon, or under the shelf, or anywhere out of the way to make room for other things. Now I think this is the time to take the greatest care of them and try to get them to make all the growth they can for next season. After they have made good growth, take them out and put them in a cold frame or sheltered spot to harden off, and afterwards put them in their summer quarters and keep them well supplied with water when necessary, especially in hot dry weather.

There are three chief enemies or drawbacks to growing Roses under glass: mildew, green fly, and red spider. Mildew is the worst: it can be battled with and prevented better in the early forcing season than it can later on, because you can smear the hot-water pipes with sulphur and make the fumes steam into the house, which keeps the mildew under and is, I think, the best way of doing so. Later on, when you do not have the hot-water pipes in use so much, you can dust the plants with sulphur and keep it under ; but it disfigures the foliage, and is not, I think, so effectual as the former method. Green fly can be easily killed under glass by fumigating with X L All or a similar compound. Red spider does not trouble you much in winter, but it is very troublesome at times in the summer months, and then the remedy is well syringing every day till you get the pest under.

Perhaps you will like to know the varieties which I think do best, and which I grow in quantity for early forcing. H.-P.'s and H.-T.'s are: 'Mrs. John Laing,' 'La France,' 'Captain Hayward,' 'Mrs. S. Crawford,' 'Ulrich Brunner,' 'Baroness Rothschild,' 'General Jacqueminot, 'Mdme. Montet,' 'Caroline Testout,' 'Mrs. W. J. Grant.' Teas : 'C. Mermet,' 'Niphetos,' 'Anna Olivier,' 'The Bride,' 'Perle des Jardins,' 'Bridesmaid.'

Now I must say a few words about planted-out Roses, and the best kind of house to grow them in. I grow them in both lean-to and span-roof houses, but I like the span-roof house better. The houses I prefer are span-roofs twenty feet wide with a sunk path on each side, which leaves two side borders four feet wide, and a centre bed eight feet wide, and then you can plant such a house with Roses permanently, or if in pots you can use it for Tomatos and Chrysanthemums after the Roses are taken out. When planting I put the plants about eighteen inches or two feet apart, so as to cover the ground soon. When established, prune them about the first week in January, give them manure and a good soaking of water, shut the house up close to make them break well, and then cultivate them as described for pot Roses till the first blooms come ; as soon as they are over, the plants (being Teas or Hybrid Teas) soon make their second growth, and on some varieties you get finer blooms off the second growth than you do off the first, especially 'C. Mermet.' After the second blooms are over in June or July, and there are plenty of Roses out-doors, it is well to give them a little rest, which you can do by withholding water for a time, and then you can get some nice blooms in the autumn before the winter comes in.

ROSES IN AND ABOUT LONDON.

By James Hudson, V.M.H.

General Remarks.—It is with the object of encouraging the cultivation of this, the most popular of all flowers, when within the prejudicial influence exerted upon vegetation by dull leaden skies and a smoke-begrimed atmosphere, that I am induced to make the following remarks. At Gunnersbury we are fairly within what may be termed the London fog-radius, yet we have succeeded very well with the cultivation of the Rose. I have found that most reliance can be placed upon those Roses which possess a vigorous constitution, whether they be climbers or bushes. Those of tender or delicate growth are more susceptible to injury, hence it is not advisable to attempt their cultivation. For instance, that beautiful Rose 'Sunrise' is not with us a success out of doors, neither is 'Comtesse de Nadaillac.' By keeping to those of a robust or hardy character we can secure a good return, and but few deaths have to be recorded. When I first came to Gunnersbury in 1876 I found several standards of the then well-known and best Roses. For many years these were retained in good condition. Of climbing early-flowering Roses there were also a goodly number. Some of these had been planted, as I was informed by the man who planted them, as long before as 1850, and several of them are still in good condition. With these my practice has been to adopt the extension principle; by so doing they are more vigorous now than they were twenty-six years ago, when I first took charge. Since then I have planted other Climbing or Pillar Roses with the same satisfactory results; 'Charles Lawson,' for instance, planted about twenty years ago, has grown into a huge mass. In later years the 'Penzance Briers' have been added and the extension system adopted, the growth being as vigorous as could be desired. 'Crimson Rambler' was added when it was first sent out; this also succeeds well. This latter is a good example of what a London Rose should be, both in its constitution and in its shining glossy foliage, which is washed clean from smoke-deposit after rains have fallen. Some of our very oldest Roses here, still in robust health, are now comparatively unknown to present-day rosarians. They flower well in their season, viz. from the third week in June to the second week in July, after which there is with these a blank, save in their healthy leaf-growth.

With the introduction, however, of the improved race of Hybrid Teas, Hybrid Chinas, and better autumn-flowering climbers, we have received a great accession of strength. These continue the Rose season well on to the end of October. On October 25 last there were still a quantity of blooms in good condition, individually smaller, it is true, and not of such good colour, but none the less welcome. These Roses to us are simply invaluable for a late autumn display; they are good even after the early frosts have cut short the beauties of the Dahlia, the Heliotrope, the Salvia, and the Geranium. True, we have had 'La France,' which was the forerunner in this late-flowering race for about thirty-four years now, but its merits as a late Rose were not for some years fully appreciated. It is now surpassed by 'Caroline Testout' and other varieties, yet it ought not to be discarded; for its fragrance alone it is worth retaining. These Roses have been grown well and their worth clearly demonstrated at Kew. Their cultivation should be taken up more, and I am surprised that it has not been done more extensively in the London parks and gardens. Far better have some beds of Roses in lieu of so much tender bedding material, with its short season and great additional labour in

FIG. 155.—'WHITE PET' POMPON. (*The Garden.*)

maintenance. Lord Ilchester, at Holland House, has given an object lesson in what may be done with these free-flowering autumnal Roses. In this his lordship is to be congratulated for his enterprise, and Mr. Dixon, his gardener, for the way in which he has carried out the cultivation. We find at Gunnersbury that far greater success accrues since we have adopted the Continental system of liberal applications of farmyard and other special manures. This was done upon the suggestion of Mr. Leopold de Rothschild, who is himself a keen observer with respect to all cultural details, having noted the methods adopted abroad in order to obtain the desired ends. This manure we apply in the autumn as soon as the Rose-beds have been repaired, or freshly-planted ones completed.

Two courses are open in this treatment: one is to lightly fork over the ground and then apply the manure liberally as a top dressing, after which a light sprinkling of soil may be added to present a better appearance; another is to fork in the manure as it is applied, only adding fresh top soil to cover it where it is not so easy to fork it in.

Not sufficient importance is attached to the matter of watering during dry or hot weather. If this be duly attended to better results will assuredly follow, and it will tend to a prolonged season of bloom in the autumn. I am also disposed to think that the mildew is, in a measure, kept in abeyance by the liberal use of nitrogenous manures. As in the country, we find that a deep loamy soil suits the Rose better than a shallow soil resting upon gravel. The latter will have a tendency to become dry—too dry, in fact, for the Rose to thrive well; I would even prefer the opposite extreme of a soil somewhat waterlogged, but not to an excess of course. All Rose-growers know the harm done by the red spider to some varieties. At Gunnersbury we have a preponderance of Elm trees; these are attacked by the spider, and thus this insect will spread rapidly to other things, provided the conditions are favourable to its increase.

I have alluded to the extension of growth allowed to strong and robust varieties. We prune as a matter of course. In the case of climbers it is more a question of thinning than of actual pruning so understood. Dwarf-growing varieties we prune as others do, but on the whole I prefer to leave it a week later than I should do if further away from London.

Some dwarf varieties we do not prune at all, such, for instance, as 'White Pet' (fig. 155) and 'Perle d'Or' of the Polyantha section; these we allow to grow into shrubby bushes, merely thinning out the weakly wood.

Varieties.—The following (in addition to the old varieties, the names of which I cannot give, but which I have alluded to above) are of proved excellence:—Of Climbers, 'Gloire de Dijon' and its various forms, 'Alister Stella Gray,' 'Charles Lawson,' 'Crimson Rambler,' the 'Penzance Briers,' 'Zépherine Drouhin' (the thornless Rose), 'Madame Plantier,' 'Carmine Pillar,' 'Aimée Vibert,' 'Aglaia,' 'Thalia,' 'Euphrosyne,' and 'Rêve d'Or.'

Of Teas, Hybrid Teas and Hybrid Chinas—'Caroline Testout' (the finest of all), 'Mrs. Grant' (syn. 'Belle Siebrecht'), 'Viscountess Folkestone,' 'Marquise Litta,' 'Madame Abel Châtenay,' 'Hon. Edith Gifford,' 'White Maman Cochet,' 'Gruss an Teplitz,' 'Kaiserin Augusta Victoria,' 'Georges Nabonnand,' 'Laurette Messimy,' 'Eugène Résal,' 'Irene Watts,' 'Souvenir de Catherine Guillot,' 'Souvenir de J. B. Guillot,' 'Corallina,' 'La France,' and 'Marquise de Salisbury.' Of Hybrid Perpetuals the strongest growers, notably 'Duke of Edinburgh,' 'Dr. Andry,' 'Mrs. Rumsey' (the mildew-proof Rose, hence extremely valuable), and 'Mrs. Sharman Crawford.'

The 'Rugosa' section do well and are valuable for their berries in the autumn. 'Conrad Ferdinand Meyer,' pale pink, classed under this head, is a hybrid twice removed from 'Rugosa'; it is one of our very finest summer Roses, of wonderfully luxuriant growth, some shoots attaining a length of ten feet in one season. It flowers very early in the summer, earlier even

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than 'Gloire de Dijon,' for which property alone it would be extremely valuable, but in addition it is one of the sweetest scented of all Roses. It is essentially a shrubbery Rose.

The Wichuraiana Roses are proving themselves most useful for any position where their natural habit of growth can be followed. We have them planted upon old walls, where they are thriving well. Any of the Polyantha section we find to make useful bedding Roses, being far better in masses than in twos and threes.

In conclusion, I would add that we find the 'X L All Insecticide' most invaluable for summer dressing against aphis, as it is also for the destruction of the "worm in the bud" in the earlier growth.

HYBRID TEAS.

By Alexander Dickson, F.R.H.S.

I have chosen the subject of Hybrid Teas mainly on account of the deep personal interest I have felt in its advancement as a class. I formed an opinion in the early years of my efforts as a hybridist, based upon the actual results of my experiments, that before many years the class of which I am now speaking would take the first place in the estimation of rosarians, the place to which it is by merit entitled. Year after year, as each crop was sown, germinated, and blossomed, I watched the results with absorbing interest, and always with a deep-rooted conviction that what was at one time a speculation was rapidly becoming a certainty; until I can now say positively that my assertion is quite irrefutable, and that before many seasons the Hybrid Teas will ultimately supersede all other varieties on the show bench, in greenhouse and garden. Roses suitable for every purpose are now to be found in the Hybrid Tea section, and I will give examples of the varieties most adapted for the various purposes for which Roses are used. With this object in view I will make five subdivisions

1st. Roses with single flowers for garden and general decoration.
2nd. Bedding Roses with semi-double flowers.
3rd. Bedding Roses with double flowers.
4th. Pillar and Climbing Roses.
5th. Exhibition Roses.

Probably no section of the "Queen of Flowers" excited so much controversy at its initiation as that for Hybrid Teas. Many leading rosarians were of opinion that Roses were amply classified, and that further classifications were unnecessary and could only be confusing. Since its establishment in 1893 by the National Rose Society no other class has advanced with the same rapidity, and yet it is only in its infancy, as the field for the hybridist to work upon is almost without limit. Previous to Hybrid Teas being recognised as distinct from other sections, the earliest known variety, 'La France,' which was introduced by M. J. B. Guillot, of Lyons, in 1867, was classed as a Hybrid Perpetual. Some experienced Rose-growers consider it a hybrid of the Chinas, and with this opinion I agree. It was in 1879 that the late Mr. Henry Bennett, of Stapleford, exhibited a series of seedling Roses which were the progeny of such Teas as 'Alba Rosea,' 'Madame de St. Joseph,' and 'President,' crossed with smooth wooded Hybrid Perpetuals of the 'Victor Verdier' type. The varieties then distributed were 'Beauty of Stapleford,' 'Duke of Connaught,' 'Duchess of Westminster,' 'Jean Sisley,' 'Michael Saunders,' and 'Viscountess Falmouth.' Most of these have been allowed to fall out of cultivation here, but are to be found described in some Continental catalogues. For several years 'Duke of Connaught' was extensively used for winter forcing in the United States of America, where it was much esteemed. The initiation of this section was virtually due to the efforts of the late Mr. Bennett, who gave us, during the early eighties, some of the most noteworthy varieties, such as 'Viscountess Folkestone' and 'Grace Darling,' most popular Roses to-day for bedding; and 'Lady Mary Fitzwilliam,' which still ranks high as an exhibition variety, its one defect being want of vigour to make a good cut-back Rose.

By the creation of Hybrid Tea Roses a race has been brought into existence which is absolutely as free and continuous in bloom as either the Tea-scented or China classes, while the vigour and hardiness of the Hybrid Perpetual and others have, in most instances, been preserved. This is a vast gain, and must eventually obtain for Roses increased attention in all gardens, as no other flower can compare with it for decorative effect and delightful fragrance, whilst as a source of continuous supply for cut blooms, where such are in demand, it is unequalled either for out-door or in-door cultivation.

I will now proceed to illustrate by typical varieties the subdivisions which I have already mentioned above: (1) Roses with single flowers. The three Irish singles, 'Beauty,' 'Glory,' and 'Modesty,' are good examples. In their several phases they are extremely beautiful and distinct, and all three make splendid bushes; consequently they should receive little pruning. Grown in this manner they bloom profusely and continuously from June till cut off by frost. There are many other single varieties, shades of yellow and crimson, equally vigorous and free-flowering, but those named are the only ones yet in commerce. Until the advent of these varieties, single Roses, though charming, were very evanescent, the season of bloom being extremely short.

(2) Bedding Roses with semi-double flowers in bunches. Of this type the best representatives are 'Marquise de Salisbury,' a bright velvety red of excellent habit; 'Killarney,' a grand and unique variety, the colour of which is flesh, shaded white and suffused pink, every bud perfect and a marvel of beauty. This, if disbudded, is a show Rose, and if sparingly pruned forms a good-size bush, giving large quantities of flowers. 'Camoens,' rosy-colour shaded white, of good growth and very floriferous.

(3) Bedding Roses with double flowers and of free-growing habit. Under this head quite a number of varieties are available. Good examples are 'Mrs. W. J. Grant,' a grand Rose, than which a more perpetual bloomer does not exist. In the early season the plants are a mass of bloom and continue flowering almost without interruption till cut off by frost. Disbudded, the buds remaining develop into flowers of very large size, the colour of which is a new and pleasing shade of pink. This was the first seedling, and is, I believe, the only one emanating from 'La France.' My people first exhibited it at Hereford in 1891, the next occasion being at Chester in 1892, when it gained the Gold Medal of the N.R.S. Afterwards we sold our entire stock of it to Messrs. Siebrecht & Wadley, of New York, who sent it out under the name of 'Belle Siebrecht.' In 1895 'Souvenir du Président Carnot' was sent out by M. Pernet-Ducher, of Lyons (probably the most noted French raiser of the present day, and certainly one who has done much for this class): it is a most distinct and grand Rose, and, in my opinion, the best production of this

eminent raiser ; colour pale flesh, shaded white. In the year 1900 we sent out 'Liberty,' and thereby advanced the section in the Rose world, as until the introduction of this variety the absence of good bright crimson shades was decidedly prejudicial to the popularity of Hybrid Teas as a section. This variety, which is brilliant crimson, supplied the colour most desired. The shade of crimson is unique, and difficult if not impossible of description. The wealth of colour cannot be fully appreciated until one has seen a bloom in its typical character. It is possessed of a good constitution, flowering profusely and continuously; the blooms are of medium size and most perfect form. This Rose was forced for cut flowers in the winter and spring in the United States of America for two seasons previous to its distribution by Mr. Ernst Asmus, of West Hoboken, New Jersey, to whom the raisers, sold the entire right to grow for cut flowers, Mr. Asmus giving the owners a guarantee that flowers offered for sale would be disbudded so that no stock could be obtained in what might be termed a surreptitious manner. That it is an ideal forcing variety and the best crimson for that purpose is proved conclusively by the fact that in March 1900, when it was first offered for distribution in the United States of America, within one month upwards of 100,000 plants were sold. Unquestionably this Rose will in a very few years be found in every garden. 'Kaiserin Augusta Victoria,' pale primrose in colour, is a very charming and most distinct Rose, of perfect form and possessing great substance: the growth is robust and erect: it is alike valuable for bedding, exhibition, and forcing purposes. This variety was received from Germany, and will, I believe, prove the forerunner of a type giving us the yellow shades necessary to supersede similar colours amongst the Teas—passing from a yellow to a white colour. 'Marjorie' gives us a splendid bedder. It is always good in form, an excellent grower, of model habit, constant and free-blooming, and if a trifle undersized as a show Rose, is pretty and perfect in every other respect. As a pot Rose it would be difficult to excel: its distinct shades of white and salmon pink form a pleasing combination and one much required. This I named after my daughter, distributing it in 1895. 'Lady Battersea,' although only distributed by Messrs. Paul & Son in 1901, has attracted very considerable attention, and very justly so. Its free-growing and blooming habit stamps it as a first-rate bedding and pot Rose. The shape and general character of the flower somewhat resemble 'Mrs. W. J. Grant.' It is, however, quite distinct in colour, which is a charming cherry crimson. In addition to those already referred to in this subdivision I must mention the following valuable and popular varieties:—'Caroline Testout,' pink; 'L'Innocence,' white; 'Madame Ravary,' orange yellow; 'Madame Abel Châtenay,' rosy salmon (for all of these we must thank M. Pernet-Ducher); 'Countess of Caledon,' rose with yellow zone at base of petals; and 'La France' and its sports.

(4) Pillar and Climbing Roses. In this subdivision I will mention 'Chestnut Hybrid,' introduced in 1879 by Messrs. Paul & Son, Cheshunt, which was the first climbing or pillar Rose of this class. It is a variety of great vigour, flowering freely, and succeeding admirably on northern exposures; the colour is cherry carmine. Five years later M. Levet sent out 'Reine Marie Henriette,' popularly known as 'Red Gloire de

Dijon'; its colour is deep cherry red. These were followed in 1893, 1897, and 1899 by the climbing sports of 'La France,' 'Kaiserin Augusta Victoria,' and 'Mrs. W. J. Grant.' Singular to relate, all three originated in the United States of America. From Germany, in 1897, we received 'Gruss an Teplitz': this is a splendid free-blooming pillar variety of the brightest scarlet-crimson colour. The latest additions are 'Ard's Pillar,'

FIG. 156.—CLUSTER ROSES ON A PERGOLA. (*The Garden.*)

a variety raised by my firm, an absolutely distinct and unique pillar Rose of richest velvety-crimson colour, and 'England's Glory,' by I. Wood & Son, a seedling from 'Gloire de Dijon' × 'Mrs. W. J. Grant,' possessing the colour of the male and substance of the female parent; both are valuable acquisitions.

(5) Exhibition Roses. The past four years have witnessed the

evolution of the Hybrid Teas in a most extraordinarily marked degree. I may say without egotism or fear of contradiction that no Rose ever elicited the same unstinted admiration and praise as the variety 'Mildred Grant.' It is a veritable giantess, possessing the most perfect form; the flowers are of immense size and substance, with high-pointed centres and massive petals, the colour white, with a delicate tint of pink or peach on the edge of the petals. In 1900 it was unanimously awarded the Gold Medal, that much coveted hall-mark of the National Rose Society, and was distributed in 1901. In the history of Roses it must stand conspicuously as the most phenomenal Rose of the century. I feel proud as a British subject that through the efforts of my brother and myself we have been able to give to the world a Rose that must stand pre-eminent amongst the many good Roses of British origin disseminated through that long and glorious period, the Victorian era. 'Lady Maura Beauclerk' is a representative of another type: the colour is bright madder-rose, with silvery reflexes; although not of such enormous dimensions as the preceding, yet the flowers are very large, perfectly formed, with high-pointed centre, from which the petals reflex as in 'La France.' Moderately pruned and not disbudded it is also a grand garden Rose, being possessed of a splendid habit and free-flowering propensity. 'Duchess of Portland' is another Gold Medal Rose, pale yellow in colour, with large perfectly-shaped flowers, which always open well. 'Robert Scott,' raised by Mr. A. B. Scott, and named after his father, the founder of the Penrose Nurseries, Philadelphia, is the result of a cross between 'Merveille de Lyon' and 'Mrs. W. J. Grant.' It is the most striking instance that has yet come under my notice of a seedling bearing distinct traces of both parents. The growth and substance are indicative of the female, and the colour and freedom of bloom of the male parent. In the country of its birth it is called an ever-blooming Rose, and it is worthy of the term, especially when grown under glass. I have had blooms of it rivalling 'Her Majesty' in size. 'Bessie Brown' is another of our Gold Medal Roses of sterling merit. In the Rose analysis of the past year this variety, though only distributed in 1899, occupied the proud position of being only just second to that grand Rose, 'Mrs. John Laing,' which has so long stood first. I anticipate that another year will see these positions reversed. In appearance and general character it differs from any in the class. The blooms are massive, elegantly formed, with large smooth and shell-shaped petals. Altogether a truly magnificent free-flowering and sweetly perfumed Rose. In addition to those described the following are good exhibition Roses:— 'La France,' 'Caroline Testout,' 'Madame Cadeau Ramey,' 'Madame Jules Grolez,' 'Kaiserin Augusta Victoria,' 'Mrs. W. J. Grant,' and 'White Lady.'

It was originally suggested that I should read a paper upon the subject of hybridisation, but I felt that to do so would be almost useless, as I should be utterly unable to lay down even approximate rules for the production of any desired result.

Few people have any real conception of the difficulties under which a hybridist works. I have been often asked why I did not introduce a Rose of particular form or colour. The answer is simple—because I could not raise it. I have hybridised for almost twenty-five years, and the seedlings developed during that time now number over fifty thousand, whilst those which have, in our opinion, been good enough to take their place in your shows and gardens scarcely amount to one hundred. My firm have always held it a duty to send out only those which they believe to be worthy of cultivation, and which in their opinion will advance the species.

You will gather from what I have said the enormous waste of time, money, and energy incidental and consequent upon the introduction by raisers of any new Rose into commerce.

I have studied the question of hybridisation in its many aspects, and practically applied and tested every theory which a long experience could suggest, and yet I have to confess, as the result of almost a life's work, that I have failed to reduce to a certainty a single theory for the certain production either in form, fragrance, or colour of a seedling containing even one characteristic which the hybridist desires it should contain. Nature retains locked up in her as yet inaccessible depths the secret which will enable the hybridist to produce the type of Rose his desire may suggest. Until this is yielded up he must be content to sacrifice time and money for the sake of his calling, and trust that in the vastness of his sowings fickle Nature may from time to time deal kindly with him, and enable him to delight the world with still finer examples of God's marvellous creation which man has fittingly called the Queen of Flowers.

In conclusion I can only say, if there are any to whom the subject of hybridisation holds an interest, that I shall be happy, if they will pay a visit to the Emerald Isle, to show them some of the results of the labours of my brother and myself as hybridists in the form of many thousands of seedlings; a wonderful example of Nature's inexhaustible resources of powers of variation, from which I think the visitor will draw a fuller and better appreciation of the darkness still clinging to this interesting branch of floriculture.

DECORATIVE TEA ROSES AND HOW TO GROW THEM.

By Frank Cant, F.R.H.S.

My subject under the above heading is open to the question, "Are not all Tea Roses decorative?" They are! but with some it is a matter of degree, very infinitesimal. For instance, while the lordly 'Souvenir d'Élise,' 'Comtesse de Nadaillac,' 'Cleopatra,' and a few others, which are so frequently in evidence in the winning boxes of Roses at shows may be termed decorative in a way, they can in no way compare with 'Maman Cochet,' 'White Maman Cochet,' 'Madame Lambard,' 'Marie Van Houtte,' and many others for garden decoration. I draw this comparison for the purpose of conveying to the minds of my hearers an idea of what the chief characteristics of a true Decorative Tea Rose must consist. In the first place, I take it, those who grow or wish to grow decorative Tea Roses do so with some object in view—either for the ornamentation of their gardens, or for cutting for embellishing their houses; and naturally for either purpose none would desire to plant any varieties of Roses which produced few flowers (however magnificent the individual blossoms) or puny growth. Therefore it is all-important, keeping the above objects in view, that a Decorative Tea Rose should have the following qualifications in order to rank as such:—Freedom of growth; strong constitution; early, continuous, and late blooming; practically, as far as possible, indifferent to wet, with great power of reproduction! This would appear exacting, but it can easily be realised, even amongst what were termed in the earliest days of my Rose-growing experiences "delicate Tea Roses," which are now discovered to be as hardy as, if not more so than, many of the so-called Hybrid Perpetuals.

I have never liked the term which has been given to these beautiful Tea Roses. To describe them as mere "Decorative Tea Roses" inadequately describes them, or the place they should occupy. I think, if they were described as "Roses for the garden," the description would convey to the uninitiated some idea of the purpose for which they are most suited. The "Exhibition Roses" and the "Roses for the garden," or, putting it another way, "A garden for a Rose" and "Roses for the garden," reminds me of the "men who ride to hunt" and the "men who hunt to ride." There is just the difference, and each should be used for their most fitting positions; the one to be protected from rain and dirt for show, the other—just to grow as it pleases. For one the soil and treatment must be rich and liberal (no gates or double ditches); for the other soil matters little, and the situation and district less. Tastes differ, and of that there can be no doubt; it is only right and proper they should; but a taste has developed to a most remarkable extent for the free and continuous blooming "Roses for the garden," be they Teas, Hybrid Teas, Chinas, Rugosas, or any other varieties answering that description, so much so that I almost tremble when I think of the Hybrid Perpetuals ceasing to find a place in many gardens, excepting a very limited number of varieties. It is to this free-blooming type of Roses we owe the beauty of our gardens, be they large or small, and the possessor of the latter, by selecting suitable varieties, may enjoy the pleasure his Roses afford him not only during June, which has been called "the month of Roses" (perhaps a misnomer this year), but from May to November or even December. Indeed, I have more than once gathered most beautiful buds and blossoms of Roses from the open ground on Christmas morning. It has been said over and over again by some people that the reason they do not grow Roses in their gardens is because the soil is unsuitable, or the district

FIG. 157.—ROSE ARCHES.

in which they live is too cold, but such a statement cannot be substantiated. I venture to say there is no garden in which Roses of some kind or another cannot be grown, and successfully too, if the Roses are selected for the garden.

This statement is borne out by Mr. H. E. Molyneux, of Balham, who says in the "Garden" of June 14:—"I undertake to say that there is no garden, however small, so long as sun and fresh air reach it, outside the four-mile radius from Charing Cross, that will not grow Roses of some sort or another, and grow them well."

This should prove a ray of sunshine to many despairing lovers of the Queen of Flowers.

Failure has more than once been brought about by visits to Rose shows, where may have been seen a grand bloom of 'Souvenir d'Élise' or 'Comtesse de Nadaillac.' Perhaps either may have been awarded a silver medal for the best Tea Rose in the show, and thus made doubly attractive. One can readily imagine a youthful enthusiast making notes of both, never dreaming of becoming an exhibitor, but hoping to grow these Roses in his own garden, and he orders perhaps six plants of each *for a start.* Is not this courting failure, and likely to end in disgust—fifteen shillings clean gone, and no result! Another enthusiast visits a show and makes notes of 'Georges Nabonnand,' 'Madame Falcot,' 'Madame Lambard,' and several others, and, like No. 1, orders a few plants of each, with the result that, having purchased "Roses for the garden," the result is most enchanting, and he discovers that Roses *will* grow in his garden, although perhaps he had been told over and over again they would *never* "*do.*"

Now the purposes for which "Tea Roses for the garden" may be used are so varied that it is almost impossible to enumerate them here, and, as may be readily understood, much must depend on the space which can be allotted to them; but a garden of ordinary dimensions must provide space for some Roses, and where practicable beds of Roses, in which may be planted in groups of one variety such charming and continuous bloomers as 'Souvenir de Catherine Guillot,' 'Anna Olivier,' 'Georges Nabonnand,' 'Madame Chedane Guinoisseau,' and others of similar habit of growth, bearing in mind always that the colours harmonise.

If planted in borders, the taller-growing ones should be placed at the back; if in beds, the taller-growing must be placed in the middle.

Oval beds of Roses may be much improved in appearance by planting a climber on each side of the bed near the turf, and training it to an iron rod bent over the bed in the shape of a half-moon, eventually forming the handle to what appears in the distance "a basket of Roses."

Soil and situation play a less important part in the life of these Roses, preference being given to good mixed, moderately gritty soil, rather than stiff clay or loam; and the object being to produce abundance of bloom rather than large individual flowers, the manure is not of so much consequence.

Perhaps the next most important point is the pruning of "Tea Roses for the garden." Nature here provides its own lesson! As the object aimed at is to provide an abundance of bloom, it is necessary the plants should be allowed freedom of growth to expand, and therefore the old proverb of "to spare the rod is to spoil the child" must be reversed: "Spare the knife and improve your 'child.'"

The stronger-growing climbing Tea Roses, such as 'Rêve d'Or,' 'Bouquet d'Or,' 'Gloire de Dijon,' climbing 'Perle des Jardins,' 'Billard et Barré,' and many others may be most usefully employed in making Rose-pillars by training them round three stakes driven into the ground Gipsy-tent fashion; in a couple of years they will completely hide the stakes and look like pyramids of Roses rising out of the earth.

TEA-ROSE TRIFLES.

By Osmond G. Orpen, F.R.H.S.

"*Trifles make perfection, but perfection is no trifle.*"

It is not my intention in these short notes to go fully into the cultivation of Tea-roses, but simply to mention a few of those trifles which, in my opinion, tend to success or failure; and I am confident that success depends more on a common-sense observance of trifling details than on the adoption of a system of culture differing materially from the practice that generally obtains.

Every phase in Rose cultivation has been so fully discussed that I feel that much I shall say will savour of repetition, and to many it will not prove particularly interesting or instructive because of their intimate acquaintance with the subject. I am fully aware, also, that to many rosarians my remarks will seem too obvious and elementary; my remarks, however, are not specially intended for the skilled rosarian, and I hope that those who are not far advanced in our art may gain some hints that may be useful in themselves and tend to promote a desire for further information. I also hope that what I shall say will induce those who have not already done so to commence the culture of the Tea-scented varieties, which, in my opinion, are the most charming of all our Roses.

Many rosarians say that they cannot grow Teas, as their soil or situation, or both, are not suitable; but I believe in many instances they have come to this conclusion without having given them a fair trial. I have not found them more difficult to grow or less hardy than many varieties usually looked upon as easy of cultivation, and able to bear without injury our average winters.

I do not propose to give what are my ideals as to position and soil, as I prefer to speak of the details from actual experience rather than to theorise, and I shall endeavour to show some of the conditions under which I have grown the Roses I have exhibited. It is my firm belief that anyone with a true love for Roses may grow Teas successfully in nearly any position, though, of course, some positions are much more desirable than others.

My garden is on the side of a hill—130 ft. above sea-level—and faces S.E. It is well protected on the N.E. and N.W. by a high fence and by fruit-trees. I consider the position and aspect as good as can be found for the purpose, and am of the opinion that the side of a hill is a better position than on a flat plain, as the frosts are less severe, the air as it cools rolling down into the valley below.

The question of height above sea-level I do not consider of any importance; but high ground relatively to that near it I consider a great advantage. I am convinced that the pure dry air of East Anglia plays a more important part in the cultivation of Roses, and especially of Teas, than anything else.

While many rosarians would probably approve of the position of my garden, I am sure not one would select the soil as suitable to Roses of any kind. Resting on a subsoil of gravel, the greater part is very light and stony, and totally different from that in which the Roses in this district are mostly grown. I think that for Teas this light, open soil has its advantages over those of a heavier texture, as there is no necessity to raise the beds above the ordinary level to ensure perfect drainage and warmth to the roots, and in it the plants do not make coarse growth late in the autumn which has no chance to ripen sufficiently to stand even an ordinary winter. The soil has been deeply cultivated, but I have not added to it any other soil of a heavier or more retentive character. It is very necessary, when preparing ground for Roses, that the trenching should be done as early in the autumn as possible, to give time for it to settle before planting in October or November. Many advise, where part of an old meadow is to be prepared for Roses, that the turf should be put in the bottom of the trench, and I think that this practice has much to recommend it; but great care must be taken that the sods are well broken up, and, if dry, they should be trodden somewhat solid before the trench is filled in. If this is not done, when the grass rots, the ground under the plants becomes hollow and does not provide a firm root-run. I prefer to plant as early in the autumn as possible; but if this is done before the plants have lost their leaves, and while the sun has still considerable power, much withering of the shoots will be the result. This can be prevented by cutting off all the leaves, and so checking evaporation. This takes rather a long time, but I have proved the plants to benefit so greatly from the defoliation as to fully repay the time devoted to it. I have examined plants a month or so after planting, and have found that they had started rooting at once. Many failures in the cultivation of Tea Roses, I am sure, are due to a want of care in planting. The roots are not spread out sufficiently, and unsuitable soil is frequently put into direct contact with them. Some leaf-mould, containing plenty of grit, should be put under and over the roots before the ordinary soil is filled in.

With reference to the stocks on which Tea Roses should be worked, I will at once state that I prefer the standard Brier budded two to three feet from the ground, but for some of the stronger varieties the Brier-cutting stock gives good results. I know the seedling Brier finds favour with many rosarians, but the tendency this stock has to throw up suckers is, I consider, a disadvantage. In no class of Roses is the influence of stock upon scion more marked than in Teas; and my experience is that the majority of varieties must be grown as standards if grand specimen blooms be the end in view. I know of no variety which cannot be grown in that form, but I have found many which have failed to produce flowers of appreciable size when grown as dwarfs. Standards can easily be protected against frost by bracken tied into the centres of the heads. This will keep the union dry, and consequently this vital part will be less liable to be frozen.

The plants here are too large to be thatched as recommended by some authorities. Should some plants be killed, as was the case during the frosts in February this year, I think the loss is more imaginary than real, only the weakest, or those with bad unions, being seriously damaged.

With many it has been the practice to use the hoe only when there were weeds to be destroyed, and I believe some of the older men employed in gardens still look upon this as sufficient. I am certain it is as neces-

FIG. 158.—ROSE COMING OVER A WALL. (*The Garden.*)

sary for Tea Roses to have plenty of pure air to their roots as it is to their foliage, and this can only be secured by the frequent use of the Dutch hoe, or some other suitable tool. Many authorities deprecate the use of the spade among Roses, but I consider it absolutely necessary for turning in manure, and deeply moving the soil between the rows. Roses grown for exhibition blooms require so much attention that the ground is frequently trampled on, and often when it is very wet, with the result that it becomes almost impervious to air and moisture ; therefore mere surface cultivation with a hoe or a pricking over with a fork is wholly insufficient to loosen the soil to a proper depth to give free access of air to the roots. I know that many will think that great risk is run of damage to the roots if the spade is used, and I readily admit that in the hands of a man who does not understand what he is doing some harm would no doubt be done, but not so much as many would anticipate. The spaces between my Teas are dug over early each winter, when they receive a good coating of manure. The soil is only stirred to the depth of not more than two inches near the plants, where the roots are close to the surface and where there has been no traffic to consolidate it; but in the middle of the space between the rows, where there are no roots near the surface and where the summer traffic has been, I like to see the spade pushed down into the soil to nearly its full length. This treatment ensures the soil being sweetened and so well pulverised by frost as to render surface cultivation in the year following much more easy and efficient. For moving the surface of the soil where it has become too consolidated for the Dutch hoe to be readily used, I have a "crome" with two prongs five inches long and three inches apart. There is another and equally important reason for good surface cultivation : that is the cutting off of capillary attraction, so that the moisture in the soil, though attracted up to the roots, may not be lost by evaporation from the surface.

To prevent this loss, the top two or three inches of soil must be kept broken down very finely, so that the air between the small lumps may act as a non-conductor. With regard to mulching, except as a protection to newly-planted Roses and against the splashing of dwarfs by heavy rains, I do not use any. I have never had any standard Teas mulched. I consider a thin coating of fresh stable litter the best mulch ; but sodden, half-rotten manure should not be used. A thick coating of wet manure prevents free access of air to the roots, and I believe that the vapour arising from it after rain assists the growth of mildew. I am not in favour of watering save in a few exceptional cases, and then, of course, sufficient must be applied to thoroughly moisten the soil. Last year, with a total rainfall of between fifteen and sixteen inches only, my Roses had no water given to them. As opinions differ so greatly on the question of how much or how little Teas should be pruned, I will close my remarks with a brief reference to it. If the frosts leave any choice I am distinctly in favour of letting some strong shoots—if well placed and thoroughly ripened—remain at nearly their full lengths. I consider this absolutely necessary in the case of the stronger-growing varieties. If at the time of pruning the young new growths are very advanced, I like to leave one or two of the stronger of them, as I believe that they prevent such a great check being given to root action as would be the case if all were removed. These can be taken off later or shortened back if it is found that they are not likely to carry perfect blooms.

There is one item of plant revision or pruning I must refer to, and that is late summer pruning. I think all plants should be looked over not later than the end of September, and all useless wood removed. This enables the sun and air to reach all parts of the heads, and good, hard, ripened wood is the result. Careful summer pruning rids the plants of a lot of useless growth, to their great benefit, and it greatly lessens the work in the spring when pruning proper has to be carried out. Nothing has then to be done in the spring but to shorten the shoots, and it is astonishing how much more easily this can be effected when there has been a careful revision of the plants the previous year.

I have always found that strong natural healthy growth, brought about by good cultivation, is much more likely to carry fine blooms than that coarse sappy growth caused by too much manure.

ARGOTTI BOTANICAL GARDENS AND THE FLORA OF MALTA.

By Professor Dr. T. Debono, Director, and Rev. Professor G. Henslow, M.A., V.M.H., &c.

Historical Sketch.*—The first botanic garden in Malta was founded in the ditch of St. Elmo,† in 1676,† under the Order of St. John of Jerusalem, through the energy of Dr. Josephus Zammit, a Maltese physician and Abbot to the Order (fig. 159). Dr. Zammit, to whom is also due the establishment of a medical faculty in the Malta University, occupied the

Fig. 159.—Dr. J. Zammit.

chair of Botany. Joannes Franciscus Bonamicus and Ph. Cavallinus in the seventeenth century, and Petrus Forskalius in the eighteenth century, testify in their writings to the existence of a botanic garden in Malta.

In the early part of the nineteenth century, under the British Government, the botanic garden was transferred to Floriana, situate between the inner and outer fortifications, on the south side of Valetta. In 1804 the Pr fessorship of B tany was offered to, and accepted by P. F. Carolus Hyacinthus, Carmelita Excalceatus, who planted the Maglio † and had a c llection of plants f rmed in a garden adjoining his residence at Floriana. A small marble tablet in Italian † still records the event.

* By Dr. T. Debono. † See Appendix, 1, 2, 3, and 4.

In 1827 Dr. Stephanus Zerapha was appointed Professor of Natural History and Medical Jurisprudence at the University, and director of the Botanic Garden. About 1855 the Botanic Garden proper was transferred to another place in Floriana, where the old palace and grounds of Bailiff Argotti stood. During the governorship of Sir William Reid, some £800 were expended towards the improving and laying-out of beds in these grounds. A very limited space, one-third of an acre, was, however, allotted to the Botanic Garden, and the rest, together with the Maglio, withdrawn from the control of the Professor of Botany. During the Professorship of Dr. G. C. Grech Delicata, 1859–70, things were left unchanged; and no new start was given to the Botanic Garden before 1879, when Professor G. Gulia was appointed Professor of Natural History and Medical Jurisprudence at the University, as well as Director of the Botanic Garden.

In 1880 a step in the right direction was taken by the Government, on the recommendation of Professor Gulia, to put the Botanic Garden on a sound footing, by allowing a vote of expenditure of £200 for the purpose of importing plants and constructing a greenhouse. In 1882 the Botanic Garden received a yearly grant of £50 whereby to meet all requirements. In 1885 the staff of the Botanic Garden, consisting of one keeper, two gardeners, and one labourer, was transferred from the Public Works to the Education Department.

On April 22, 1890, I assumed direction of the Botanic Garden, and on my repeated requests it was (on February 1, 1892) extended to the whole of the Argotti Gardens, and styled "Argotti Botanical Gardens." Since then they have only been a teaching place for students of medicine. The public in general did not derive any benefit from them, and Government was therefore very little inclined, not only to increase the grant, but even to pay for its maintenance, so much so that I had to undertake the cultivation of the extended grounds on the self-supporting system, out of the proceeds of sale of plants, bulbs, flowers, &c. On January 1, 1894, at the suggestion of the Auditor-General, and contrary to my views, the income, which was then £156, was appropriated by the Treasury and an increase of £60 was carried to the vote of expenditure.

In 1897 the wooden roof structure of the greenhouse, being nearly worn out, was renewed and heightened. Not a year later, on October 18, 1898, Malta was visited by a very severe hailstorm which caused all the panes of glass to be broken into many pieces. The collection of plants suffered a great deal; many, among which was a fine collection of Selaginellas, were killed outright, while the rest had to be massed under cover for fully three winter months before glass could be available at a reasonable price.

Some of the plants cultivated under glass have now made a rapid growth, especially *Pandanus utilis*, the top of which reached the glass and has necessitated the construction of a large greenhouse, the north wing of which is nearly ready for use.

Appendix.*

1. The ditch of St. Elmo lies to the north-east extremity of Valetta, quite close to the Hospital of the Order of St. John, now the Station Hospital for the garrison.

* By the Rev. Professor Henslow, V.M.H.

2. With the exception of the Oxford Botanic Garden founded in 1632, and that of Edinburgh founded in 1670, the Botanic Garden of Malta is the oldest in the British Empire.

3. The Maglio stands at the south-west end of Valetta, in the intervening open space between this town and the suburb of Floriana. It is a long tract of ground, protected by walls on either side, where the members of the Order of St. John used to enjoy the game of the "maglio," whence the name.

4. "Questo Orto Botanico fu incominciato e ridotto a termine, sotto l'amministrazione del Cav. e Baronetto Alessandro Giovanni Ball, per Giorgio Terzo, Re della Gran Brettagna, governante le Isole di Malta e Gozo. Il luogo è a pubblico divertimento consecrato."

The Botanic Gardens of To-day.*—No one familiar with English botanic gardens, with their turf, shrubs, trees, and a generally more or less park-like character, with ornamental water, &c., must suppose such can possibly exist in Malta. The Argotti Garden is about the oldest in existence, is by no means large, and reminds one somewhat of the old Botanic Garden at Cambridge in the "forties." It is railed off on one side from the main road, but walled in on the others. Dr. Debono has certainly made the most of it. There is a long trellised walk on entering, covered with Creepers, Roses, &c., leading to the Fern-house. (Fig. 160.) There are eight native Ferns, six of which are also British, including the little *Gymnogramme leptophylla*, which reaches Jersey with other Mediterranean plants. Maidenhair Fern is abundant in wet places and is used for "bombli." These are porous water-bottles, on the outside of which the rhizomes are fixed in clay, so that by keeping the bottle constantly filled with water a dense mass of delicate foliage is formed over the bottle, which is of course suspended. (Fig. 165, p. 575.)

A shady walk runs along the side of the garden by the road, where several foreign trees are planted, such as the Date-palm which bears no fruit, *Chamærops humilis*, *Ailanthus glandulosa*, *Datura arborea* with its long white trumpets, *Adhatoda Vasica*, Oleanders, *Melia Azedarach*, and Lantanas. These latter are common roadside trees in Malta. Oaks are represented by *Q. Suber* and *Q. Ilex*; and Firs by *Pinus halepensis*. Of Figs, there is *Ficus indica*, the Banyan, *F. Carica*, var. *caprificus*, or the wild Fig, which always grows out of rocks or walls; the fruit of which is inedible, as it always contains the wasp (*Blastophaga grossorum*) which is used for fertilising the cultivated Figs. There is also *Cratægus Azarolus*, which occurs in some of the "wieds" or river valleys, and Castor-oil trees, growing to a height of fifteen feet at least.

There is a good collection of several of the more important native wild plants, such as *Acanthus mollis*, *Tulipa sylvestris*, *Iris germanica* and *fœtidissima*, both of which I found wild in the island; *Hypericum ægyptiacum*, with dimorphic flowers; *Urginea Scilla*, the Medicinal Squill, and *Scilla sicula*; *Sempervivum arboreum*, forming large plants with massive corymbs of yellow heads; *Phlomis fruticosa* with orange labiate flowers, and magnificent *Euphorbiæ*, such as *E. dendroides*, *E. meloformis*, &c.

* By the Rev. Professor Henslow, V.M.H.

Fig. 160.—Trellised Way in the Botanic Gardens, Malta. *(Gardeners' Chronicle.)*

(To face p. 566)

Fig. 161.—View in the Botanic Gardens, Malta. *(Gardeners' Chronicle.)*

(To face p. 567)

The only plant peculiar to Malta is *Centaurea crassifolia.* Fine specimens are growing in the Botanic Gardens, for one of which I had to thank Dr. Debono, and it is now in the Botanic Gardens, Cambridge.

Several of the native Orchids are grown in the gardens, among which are nine species of *Ophrys*, seven of *Orchis*, three *Serapiæ*, and *Spiranthes autumnalis*. The "Bee" *Ophrys*, curiously, only grows in wet grass by a rivulet, in one spot only, just as *Ranunculus ophioglossifolius* does; it formerly grew, but is now extinct, in Jersey.

A curious crucifer, *Enarthrocarpus pterocarpus*, introduced itself about twenty-five years ago from Northern Africa.

The water-tank, very limited in dimensions, contains a few aquatics, while Bamboos and *Arundo Donax*, a native, form clumps around it.

Numerous plants are grown for their flowers only, and need not be enumerated, as the Botanical Gardens have to be mainly self-supporting.

The view (fig. 161) is taken from the corner near the entrance and from the outside. The dome-shaped structure is one of the numerous churches. It is dedicated to the Conception of the Blessed Virgin Mary, called "Sarria." The Gothic building is the Wesleyan church. The whole stands within the inner and outer fortifications, called "Floriana." The cathedral of the ancient capital, Città Vecchia, is just visible on the horizon, on the extreme right of the view.

It is from those distant hills that water is brought by a closed aqueduct to Valetta. The Floriana water-tower is on the left of the view.

Object of the Gardens.—Hitherto the Botanical Garden was only used to furnish living specimens and materials to the Professor of Botany for his lectures and demonstrations. It now includes within its object the following:—

1. Practical teaching of botany to students in the Faculty of Literature and Science, and of medical botany to students in the Faculty of Medicine and Pharmacy.
2. The formation of collections of plants, classified according to their natural affinities.
3. The systematic introduction of new plants to suit the soil and climate of the Maltese islands.
4. The distribution, by sale or exchange, of plants, seeds, bulbs, &c.
5. The spread of information, by correspondence or otherwise, on various branches of botany, including economic botany and agriculture.
6. The training of apprentices in the art of gardening.
7. The taking of earth temperatures at various depths.
8. The formation of a Herbarium and Botanical Library.

Financial Condition of the Gardens.—The staff of the Botanical Gardens includes: the Director, who is *ex-officio* Professor of Natural History, Public Health and Hygiene, and Medical Jurisprudence at the University, and has to lecture on medical botany in the course of pharmacy and medical jurisprudence in the Faculty of Law. Salary £120, and £20 personal, after ten years' service. There is no salary in connection with the Botanical Gardens.

The Keeper, who acts also as clerk, has a salary of £36 a year, with free lodgings.

There are three gardeners, one at £35, and two at £30 a year, with no extras or lodgings.

There are four apprenticeships, three of which are now occupied; one is vacant. The present apprentices receive the following salaries respectively: £12, £10, £8 a year.

Extra workmen to the extent of £19 a year are employed.

Expenditure.—Besides £180 total personal emoluments, the Gardens are endowed with a vote of £110 to meet all ordinary expenses in keeping the gardens, in purchasing plants, bulbs, seeds, &c., as well as materials and instruments for lectures and demonstrations in botany, and for the students' practical work. Transport expenses, cost of books and publications, are also defrayed from the same vote.

Income.—All income is appropriated to the Treasury. It is derived from the sale of plants, bulbs, seeds, and flowers. Visitors to the reserved portion of the gardens are admitted free of charge, and every information is given gratuitously.

Table showing Income in each year from 1893 *to* 1900.

	£	s.	d.
1893 . .	123	2	0½
1894 . .	132	14	7
1895 . .	155	10	11
1896 . .	133	11	4
1897 . .	129	18	3
1898 . .	99	2	8
1899 . .	115	4	11
1900 . .	121	15	7
Total, eight years .	£1,011	0	3½

Average yearly income . . . . . £126. 7*s*. 6½*d*.

Works and repairs are carried out by the Public Works Department from vote, "Head 20—Annual Recurrent Expenditure."

Catalogues.—With regard to the plants cultivated in the Botanical Gardens none is at present published; but Dr. Debono has issued a catalogue of the plants grown in the gardens of the San Antonio Palace, the country residence of the Governor. With very few exceptions all the plants therein mentioned are to be found in the Argotti Botanical Gardens as well.

This admirable catalogue is arranged alphabetically, with the English names following the Latin, as well as the native countries and the natural orders. It contains eighty-two pages, with an average of twenty-six names to each, so that the total number of plants is about 2,150. Some of the largest genera grown—*i.e.* those having the greatest number of species in cultivation—are: *Acacia*, 23 (of this genus there are seventeen additional species in the Botanical Gardens); *Achimenes*, 10; *Adiantum*, 10; *Aloe*, 14; *Begonia*, 11; *Bignonia*, 10; *Casuarina*, 4; *Cereus*, 16; *Citrus*, with vars., 20; *Datura*, 7; *Eucalyptus*, 12; *Ficus*, 7; *Gladiolus*, 7, and one hybrid; *Gymnogramme*, 5; *Iris*, 8; *Jasminum*, 9; *Mesembryanthemum*, 13; *Narcissus*, 6; *Opuntia*, 14; *Pelargonium*, 14; *Palmæ*, 38.

Few, if any, of the innumerable hybrids grown in English gardens and conservatories have found their way to Malta; the species mentioned above, as of *Pelargonium,* are mostly the original wild ones from the Cape.

A seed catalogue is published every year; that for 1899 contains the names of 525 plants.

In an additional list of plants not yet catalogued, sent by Dr. Debono in manuscript, there are about 270 additional names. It contains eight other species of *Ficus,* five of *Opuntia,* eleven Conifers, and eighty-three Ferns.

The following enumeration of seeds received and despatched in 1900 will give some idea of the usefulness of the Garden under the present Director, Dr. T. Debono.

EXCHANGE OF SEEDS WITH THE ARGOTTI BOTANICAL GARDENS DURING 1900.

Seeds received from		Botanical Institutions	Seeds despatched to	
1889–1900	1901		1889–1900	1901
28	20	Royal Gardens, Kew	19	22
—	12	University Botanic Garden, Cambridge .	27	49
17	—	,, ,, ,, Oxford . .	35	51
16	10	Royal Botanic Gardens, Edinburgh . .	4	2
66	—	,, ,, ,, Calcutta	—	—
137	—	Botanic Gardens, Sydney	—	—
12	—	,, ,, Berlin	—	—
—	18	,, ,, St. Petersburg . . .	99	100
22	19	,, ,, Brunswick	—	12
7	—	,, ,, Görlitz	36	43
13	—	,, ,, Munich	7	61
6	26	,, ,, Bucharest	152	32
—	—	,, ,, Kalozvar	40	27
24	16	,, ,, Belgrade	31	8
13	—	,, ,, Tiflis	23	—
20	7	University Botanic Garden, California . .	55	7
7	24	Jardin Botanique, Paris	43	6
25	—	,, ,, Lyons	24	—
26	—	,, ,, Marseilles	11	—
17	14	,, ,, Nantes	11	—
—	21	,, ,, Bordeaux	25	22
1	14	Regio Orto Botanico, Rome	21	6
27	27	,, ,, Palermo . . .	20	12
20	17	,, ,, Pisa	62	17
17	—	,, ,, Parma . . .	—	—
—	—	,, ,, Siena	81	—
—	—	,, ,, Catania . . .	14	—
—	—	Giardino Botanico, La Martola . . .	15	—
—	20	Jardin Alpin d'Acclimatation . . .	—	15
—	—	Mr. Casimir Arduin, Turin	—	2
—	17	Botanic Garden, Zurich	—	31
—	15	,, ,, Cracovia	—	33
—	13	,, ,, Prague	—	10
—	11	Dr. Franceschi, California	—	14
—	4	Mr. Elia S. Pace, Malta	—	—
—	13	Regio Orto Botanico, Naples	—	—
—	16	,, ,, Florence . . .	—	—
—	7	Jardin Botanique, Lille	—	—
521	361		855	582

CATALOGUE OF 1806.—As an historical curiosity, Dr. Debono has sent for inspection a very rare copy of an *Index Plantarum Horti Botanici*, 1806. This was drawn up by P. F. Carolus Hyacinthus, and printed in that year. It contains many of the common wild flowers of Malta, such as *Bellis annua* and *B. sylvestris*, *Arundo Donax*, *Anagallis arvensis*, *flor. cæruleo* and *flor. phœniceo*, *Anemone coronaria*, which is always blue in Malta, several species of *Calendula*, &c.

Of exotic plants the following are mentioned: *Amaryllis equestris*, *A. formosissima*, *A. Reginæ*, and *A. vittata*: these were the original parents of our modern hybrids; numerous species of *Euphorbia*, abundant in Malta, many forming large shrubs; *Geranium* and *Pelargonium*. *Narcissus* was only represented by the Jonquil, Daffodil, and varieties of the indigenous *N. Tazetta*. *Oxalis cernua* * appears in this catalogue for the first time, being the earliest known record of its existence in Malta. We have it on the authority of Zerapha, a contemporary of Father Giacinto (Hyacinthus), that the latter brought the first individual plant from the Cape of Good Hope, and it is spoken of as having been cultivated in Malta in the Botanic Gardens in 1806, for the information of his pupils. Maltese botanists of a later date attribute the spread of it over the island to this source. Thus, Dr. Grech Delicata says of *Oxalis cernua* (the 'Haxixa ta l'Englisi,' or the 'English Weed,' as the Maltese now call it), in his 'Flora Melitensis,' p. 8, 1853: 'In campis et agris ubique. Indigena facta ab anno 1811' from the bulbs received from the Cape and grown in the Botanic Gardens in 1806. It has now spread all over Malta and Gozo, and occurs at intervals from Egypt to Morocco, and from Gibraltar to the Greek islands, having been diffused through traffic with the Maltese islands. It has never been known to set seed in the northern hemisphere, but multiplies itself exclusively by little bulbs.

This catalogue of 1806 contains so many native plants, as Plantains and Grasses, that it might be regarded as a mixture of wild flowers of the island and exotics introduced, as it is difficult to see how they could all have been grown in the "ditch." This ditch within the high wall of the fortifications still contains several Castor-oil trees, some fifteen feet in height, as well as variegated stocks growing out of the walls, probably descendants from those grown at the beginning of the century, as well as a few other introduced plants; but all else is a rank growth of weeds, &c., as no one is ordinarily allowed within it, since it contains Government army stores, &c.

Phœnix dactylifera and *Chamærops humilis* were the only Palms growing then, whereas thirty-eight species are now cultivated in the Argotti Gardens. On the other hand, while thirteen species of *Malva* were grown in 1806, only one, *M. rotundifolia*, is in the Antonio Gardens. Similarly *Plantago* was represented by nine species; now only *P. major* is grown. In 1806 seven roses were grown; now there are twenty-two. In 1806 there were twenty-four Salvias; the present gardens contain nine. *Silene* is represented by three species now, but in 1806 there were fourteen.

It is not easy to suggest a reason for Father Giacinto's having col-

* For a full description of the history, structure, and diffusion of this plant, the reader is referred to my paper, 'On the Northern Distribution of *Oxalis cernua* Thunb.' (*Proc. Linn. Soc.* 1890–91, p. 31).

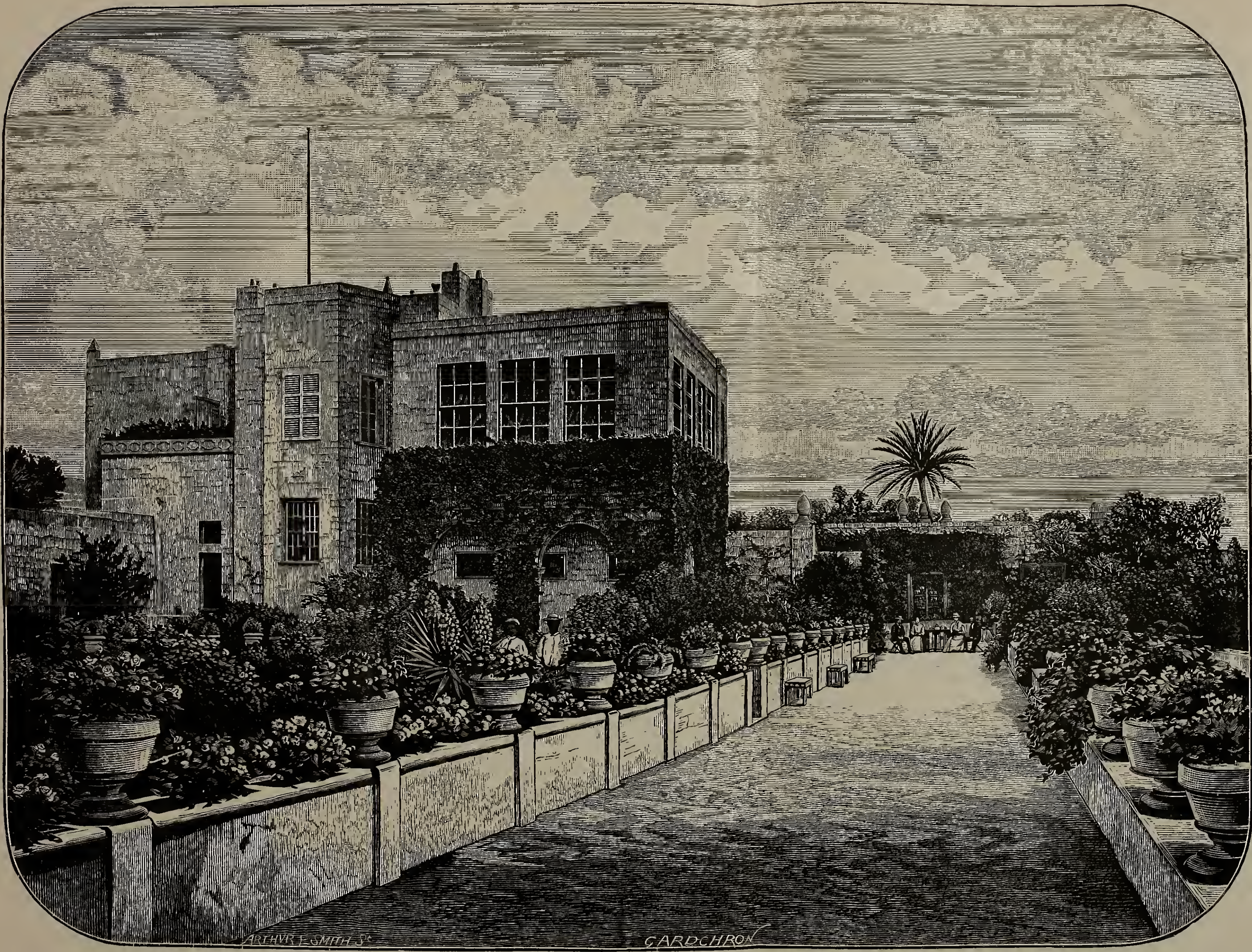


Fig. 162.—The late Mr. Harry's Garden at St. Julian's, Malta. (*Gardeners' Chronicle.*)

(*To face p.* 571)

lected together so many species of certain wild plants. We must, however, remember that the object of the garden in 1806 was *entirely medical.* This will presumably account for the cultivation of the Sow Thistle and the Groundsel, just as these were in "herb" gardens in England in the 15th century.

Some Orders are at present quite unrepresented, as the *Umbelliferæ*, but in 1806 Father Giacinto names the Goutweed, *Ammi*, Dill, Celery, Hemlock, Cummin, Carrot, *Eryngium*, Dropwort, Parsnip, *Sium*, *Tordylium*, &c., but omits *Smyrnium* (lAexanders), commonly wild at the present time at Malta.

Of important trees &c. introduced since 1806, there are *Adhatoda Vasica*, the Malabar Nut tree, the Horse Chestnut, *Vitex Agnus-Castus*, Araucarias and other Conifers, *Aucuba japonica*, *Buddleia Lindleyana*, species of *Cæsalpinia* and of *Callistemon*, Camellias, *Casuarina*, *Catalpa bignonioides*, *Diervilla*, *Erica speciosa* (the only sp.), Escallonias, 11. sp. of *Eucalyptus*, *Eugenia Pimenta*, *Euonymus japonicus* and *E. latifolius*, *Gardenia*, *Ginkgo*, *Kadsura japonica*, *Kerria japonica*, *Cytisus Laburnum*, *Liriodendron tulipifera*, *Acer Negundo*, *Phillyrea* sp., *Phormium tenax*, *Pimenta officinalis*, *Rhododendron arboreum*, *Azalea indica*, *Sarracenia* sp., *Sequoia gigantea* and *S. sempervirens*, *Styrax officinale*, *Taxus baccata*, *Tamarindus indica*, six species of *Tecoma*, *Wistaria chinensis*, and *Viburnum Opulus*.

The above will indicate the wide area abroad which contributed to supply the gardens in the energetic professor's time.

Of course, in addition to the above-named trees, numerous herbs have been introduced while a few of the above, as the two species of *Sequoia*, have disappeared ; but by far the greater number of modern introductions is due to Dr. Debono since 1890.

Private Gardens.—Besides the Argotti Botanical Gardens there are several private gardens in Malta, in which many plants are grown. Perhaps that of the late Mr. Harry may be taken as one of the best types. The following is a description of it :—

Maltese gardens, like Maltese fields, are all walled in, and mostly very small. Earth is a scarcity, for little of the virgin soil of Malta and Gozo, when these islands formed part of the continent, has escaped denudation. All that can be extracted from crevices and caves is utilised, some small quantity only having been brought from Sicily and elsewhere during the reign of the Knights as ballast ; the rest consists of the decomposition of the limestone rock itself, of which the islands are entirely composed. There is an interesting example of one of the caves alluded to in a garden now belonging to Captain Price (formerly of H.M.S. *Carysfort*), which was constructed by the previous owner, Mr. Frere. When he had excavated the earth from what appeared at first to be a superficial fissure, he discovered that it was a "swallow-hole," as such a fissure is called in Derbyshire ; and when all the earth was cleared out it was found to lead to an ancient subterranean watercourse, 63 feet deep. That being now the level of the sea, it could not be traced further, as the water came through the fissures in the limestone. The sides are waterworn, and show clearly that it was a place where in former days a river plunged headlong down and then ran underground, just as often occurs in limestone countries, such as Derbyshire. Ferns and other plants now clothe its sides, affording a curious and interesting feature in the garden.

The late Mr. Harry's garden, at St. Julian's, and Captain Price's, at Pietà, are, I believe, the largest gardens in the island, excepting, perhaps that of the Governor's summer residence at San Antonio; but for picturesqueness they are unsurpassed. Mr. Harry's consisted of at least fifteen separate portions at different elevations, divided off by walls or terraces, the largest of which is shown in fig. 162. The Rose garden is, perhaps, the largest, being about sixty by forty feet. One or more of the "gardenettes," to coin a convenient term, as also in Captain Price's, are devoted to the cultivation of mandarin, blood, egg, and other kinds of oranges, lemons, white nectarines, loquats, and almonds. All the walls, ranging from some three to fifteen or more feet in height, are covered with purple-flowering Bougainvillæas, Tritomas, Passion-flowers, the blue Plumbago, Pelargoniums, *Ficus repens*, and Ivy.

There are many interesting trees and shrubs in both gardens; as, for example, in Mr. Harry's there is a very old India-rubber, *Ficus elastica*, its many branches growing to a great height. It is situated at the end of the long terrace, which terminates in a little paved court. An ancient well stands on the opposite side, at a distance of thirty feet. (Fig. 163.) The roots of the *Ficus* have, nevertheless, discovered it, for they have spread under the paving seen in the foreground, and thrust themselves through the sides of the well, down which they have then descended.

In another of the gardenettes is a large Acacia from Australia, and a Casuarina, which was planted in 1872 as a seedling. It is now about thirty feet high, the circumference of the base of the trunk being thirty inches, and at four and a half feet twenty-one inches; a fair growth for some twenty years. (Fig. 164.)

In another part of the garden is a "blue Hibiscus" (*H. Patersonii*) at least thirty feet high, and a handsome Wigandia, which, like the *Ficus*, is diving under the walks and walls, and sending up young trees in unexpected places.

One does not expect to see much bloom in the depth of winter, but the reader would be surprised to see the dense masses of blossom upon yellow Cassias, scarlet *Bignonia radicans*, and its yellow ally *B. stans*, as well as on the 'Trompe de Jugement,' the large white double *Datura*. Lastly, Bougainvillæas exhibit dense masses or sheets of purple on the walls. The Rose garden is bordered on one side by a row of great variegated Agaves, the low wall being covered with masses of *Sempervivum arboreum*, which now grows almost spontaneously in Malta, having been introduced probably more than sixty years ago. It bears trusses of golden-yellow flowers, nearly as large as that of the Horse Chestnut; the foliage is in terminal rosettes. Poinsettias grow twelve feet high, with a profusion of scarlet leaves, and fine varieties of Crotons and Bilbergias, *B. Leopoldi* being in blossom, brighten up the stone corridors and passages, where freely-growing Adiantums, Aspleniums, and other Ferns form a perfect bower for the visitor to walk through. One corridor, the entrance to Mr. Harry's house, is at least 100 feet long, with Ferns to the right, Ferns to

FIG. 163.—ANCIENT WELL IN THE LATE MR. HARRY'S GARDEN. (*Gardeners' Chronicle.*)

the left, and Ferns suspended overhead, as well as Palms and other plants. The method of growing Adiantums outside earthen vessels is a favourite one in Malta. The globular vessel is very porous, and kept full

Fig. 164.—Casuarina in the late Mr. Harry's Garden. (*Gardeners' Chronicle.*)

of water. On the outside are fixed lumps of clay, upon which the Fern roots are fastened; they soon clothe the whole with a luxuriant mass of foliage. I have figured one of these "bombli," as they are called, as an example. (Fig. 165.) At each end of the long passage mentioned stands a fine plant of *Philodendron pertusum*, with its curiously perforated and slashed leaves. Apropos of this, on an occasion when the corridor was illuminated, and lamps were placed behind the Philodendrons, a guest naïvely remarked to Mr. Harry, "What trouble it must have been to cut out all the holes in the leaves to let the light through!"

Another remarkable plant is a brick-red coloured *Bougainvillæa*, the only specimen in the island, which Mr. Harry received from Madagascar. A fine Cycad, with its spreading foliage, around which *Myrsiphyllum asparagoides* (a great favourite in Malta, and used in decorations of the dinner-table) had grown, formed a pleasing combination. The borders were bright with scarlet Salvias, *Lavandula Spica*, *Polygala Chamæbuxus* just coming out; while several large trees of white and rose-coloured Almonds were in full bloom in January.

On the limestone rocks are Cacti and Mesembryanthemums covering

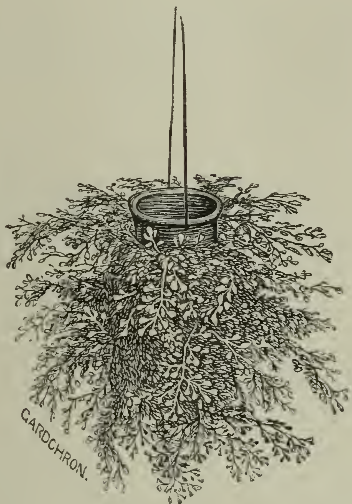


FIG. 165.—FERN 'BOMBLU.'

many square yards, including the indigenous "Ice-plant," *M. crystallinum*. In one "wild" corner is a cluster of the tall stems of the native *Arundo Donax*, a mass of *Arum italicum*, and the so-called English weed *Oxalis cernua*, with its bright yellow flowers, the trifoliolate leaves carpeting the ground, while cultivated varieties of the native *Narcissus Tazetta*, now in full bloom, were abundant. Palms are not abundant in Malta, though the dwarf Fan Palm, *Chamærops humilis*, is pretty frequent in gardens; while two lofty Dates furnished the name to Mr. Harry's house as "The Palms." The Date is not generally cultivated, as it will not furnish edible fruit on the island.

One remarkable tree known as Zinzilla (*Zizyphus*) bears curiously gouty twigs to its branches, and, although it bears plenty of fruit, Mr. Harry said that it invariably falls prematurely if stones be not wedged in at the forks of the branches; when this is done the fruit ripens. He frequently tested this curious fact, and vouched for its truth. The only interpretation which seems feasible is that the stones in some way impede the circulation, but it is not clear how this is effected.

Mr. Harry was not without his Fig-trees, so common in Malta, but to see tall branching trees devoid of leaves, as in midwinter, some fifteen feet high, clothed below to some eight feet with scarlet Pelargoniums in full vigour, presents a curious contrast.

I must not conclude without a tribute to the owner's great liberality, for though he delighted in his flowers without, and, I may add, his extensive and valuable collection of curios within his house, his friends, and the writer included, well know how often are their own drawing-rooms brightened by a floral display, which at once betray their source at St. Julian's, such as large sprays of white and pink Almonds, Irises, Pelargoniums, Tea and other Roses, bunches of yellow Cassia and scarlet Bignonia. Accompanying them are the following wild flowers, which I gathered from the rocky valleys on the south side of the island :—Bunches of *Erica multiflora*, *Narcissus Tazetta*, Rosemary, *Asphodelus ramosus*, *Orchis fusca* and *saccata* ; while the fields, &c., have furnished the scarlet *Adonis Cupaniana* and purple *Anemone coronaria*, the pink *Silene sericea*, and the yellow *Chrysanthemum coronarium.*

COMMERCIAL WILD FLOWERS.—As there are no professional florists in Malta, the peasants collect great quantities of wild flowers, which they sell in Valetta for decorative purposes. The following are the most important from the point of view under consideration :—

Acanthus mollis and *A. spinosus.*—These occur in many of the rocky valleys. The form of the leaf is familiar to the reader, as it is carved on the Corinthian capitals. It is often grown in wild parts of gardens, where its handsome leaves are very effective.

Adiantum Capillus-Veneris.—This is the only Fern which is really common in caves and elsewhere in Malta.

Adonis autumnalis.—Many fields are sometimes almost scarlet in places where this plant grows ; great quantities are sold in the streets. There is a variety called *citrina*, which has generally golden-yellow petals. It is a degraded form, and appears to be a reversion. Orange-coloured flowers are occasionally met with.

Amygdalus communis.—The Bitter and Sweet Almonds are much grown, and bear profusely. Though not truly wild in Malta, the flowers, pink and white are often cut for decorative purposes.

Anemone coronaria.—The purple flowers of this species are dotted about the fields in many places ; a large bunch can soon be collected by jumping over the wall of a field, which has no gates, only loose stones piled up where the gate ought to be. There is no variation in the wild species, but it gives rise to many different colours under cultivation. It is grown in several gardens.

Antirrhinum majus and *A. siculum.*—The two species are plentiful in certain places ; the former abounds on the walls and rocks round the orange groves of Boschetto, on the south side of the island. It is the ordinary purple form of our English gardens. *A. siculum* has a rather smaller flower, nearly white, with a little yellow and purple about it. It is common in the forts of Valetta, and in some of the valleys.

Arundo Donax.—This handsome Bamboo-like grass is indigenous, but also cultivated. The inflorescence is often cut for halls and passages, and is employed in conjunction with Pampas grass. The split stems are used for making market baskets.

Asphodelus ramosus.—This is very abundant all over the island wherever rocks are exposed, so as to prevent cultivation. The stems grow to three or four feet high, and have much-branching panicles of star-like white flowers, each petal being streaked down the middle with brown.

Aurantiaceæ.—Oranges, Lemons, and their kind being a staple commodity, the profusion of orange blossoms at certain seasons, one need hardly say, does not fail to supply some for decorative purposes.

Calendula maritima and *C. fulgida.*—The commonest species of this genus is *C. arvensis*, which grows profusely by roadsides, but the flowers are not larger than that of a Daisy; those of the two mentioned are much larger, but, as they are not so common, they are not much used.

C. officinalis is more generally grown, and mostly has a somewhat deeper orange tint than in England.

Ceratonia Siliqua.—The Carob, or St. John's Bread, is the only tree of any abundance in Malta; being much exposed, the trees grow low and assume a scrubby form. The leaves are used for strewing the floors of churches at the time of festas.

Chrysanthemum coronarium.—This is most abundant about the ditches of the forts of Valetta and elsewhere. In some inaccessible enclosures it forms a perfect sheet of yellow, and is much gathered for sale. There is a variety with about half the corolla white, going a pale rose on the circumference.

Cratægus Azarolus.—Several trees of small size occur in the valleys; the foliage is tomentose, but the bunches of flowers are very like our 'May'; the fruit is very large, and eaten by the peasants. Being rare, it is seldom seen. I have gathered it in quantities from one valley.

Diplotaxis erucoides.—This white crucifer is one of the most abundant of plants, the slopes outside the forts being a sheet of white in December. It is also very abundant in the fields. Bunches are occasionally brought for decorative purposes in the winter.

Erica peduncularis.—This is the only Heath in Malta, and is abundant in the rocky parts. It varies in tint from pale pink to cerise. Men and boys collect it in sacks, and bring it to Valetta, where it is sold in the streets.

Fedia Cornucopiæ.—This herb has bright crimson flowers; it occurs in waste places, barren rocky ground, and in fields. It is collected and sold.

Ferula communis.—This plant is common, and bears large decomposed leaves like Fennel (which also grows wild in many places), though the ultimate divisions are not so fine; the foliage is used for decorating the "carrozze," or "cabs," during the carnival.

Gladiolus segetum.—This species is very abundant as a "cornfield" weed. Large quantities are sold. *G. communis* is also in the island, but is less common.

Hedysarum coronarium.—This is called 'Sulla,' or Maltese Clover, and is cultivated for making "hay"; when in full flower little else than a crimson sheet is seen in the fields.

Hyacinthus (Muscari) comosus.—This is very abundant in fields; the terminal barren blue corymb—the origin of the feathery process in the cultivated form—is not ineffective with the dark purple bells below.

Iris germanica.—Though not usually recognised as a wild flower of Malta, I found it far away from the haunts of man in a deep rocky valley. In Mr. Harry's garden it changed from purple to white, and then much resembled *I. florentina.*

Matthiola incana.—The Brompton Stock is abundant in the rocks, fortifications, and elsewhere near the sea. It is usually purple, but a variegated variety, striped with purple and white, grows on the rocks of the fort just outside Valetta. Both varieties, as well as the white and the double forms, are cultivated for sale.

Narcissus Tazetta.—This is extremely abundant on all rocky ground. Great quantities are collected by boys and brought to be sold in Valetta. The usual form has a thick short stem and numerous flowers; another form has slender and long stems and fewer flowers.

Nigella damascena.—Our old-fashioned garden flower, 'Love-in-a-Mist,' grows wild in the fields.

Ophrys and *Orchis.*—There are four or five common species of each of these genera. I have personally gathered many bunches of *Ophrys fusca* and *O. bombyliflora*, as well as *Orchis saccata*, *O. tridentata*, *O. pyramidalis*, and *O. undulatifolia.* They are not collected, however, for sale.

Oxalis cernua.—This so-called 'English weed,' introduced from the Cape of Good Hope by Prof. Giacinto in 1806 as stated above, has become the greatest pest in Malta, though its golden-yellow flowers brighten up every field, wayside, tops of walls, crannies, &c., where it vies with the ubiquitous Pellitory. It is disappointing, for though a nosegay looks well for half an hour, the petals then roll themselves up, and they never open again. There is a double form as well.

Pancratium maritimum.—This handsome plant produces long leaves, sometimes nearly a yard in length and broad in proportion, and is grown in large pots in passages, halls, &c., for decoration.

Phlomis fruticosa.—This shrub, with whorls of orange-coloured flowers, would doubtless be more sought for if it were commoner. It only grows abundantly in one valley. It is called 'Jerusalem Sage.'

Phœnix dactylifera.—The Date will not ripen in Malta, so that it is not cultivated. Here and there one sees a tall, solitary tree, a relic of a bygone time. The foliage is sometimes used at festas.

Reseda alba.—This Mignonette is most abundant in fields, and is often gathered with the *Adonis.* It has a slight perfume, the corolla being white, and larger than in *R. odorata*, making the flowers more conspicuous.

Rosmarinus officinalis.—Large bushes of Rosemary grow in several rocky places; in one I found a pure white variety.

Salvia officinalis.—This accompanies the Rosemary in some valleys. Neither plant, however, is much collected.

Scilla sicula.—This has several varieties of colour, from white to deep blue. The latter form is cultivated, and the size of the umbels has enlarged. Mr. Harry had splendid specimens in his garden.

Sempervivum arboreum.—Though a true Sicilian plant, like almost all the Maltese plants, it is regarded as not having been introduced. It produces large golden trusses, which are often used.

Silene sericea.—This closely resembles in general appearance our cultivated *S. pendula*, which is also a native, but is not common. The former is as abundant as Daisies, waste ground being perfectly red with it. It is not collected for sale, but is often gathered for rooms.

Tordylium apulum.—This common umbellifer has large white flowers on the circumference of the umbel, like the wild Guelder Rose. It is collected somewhat largely for sale.

Triticum sativum.—Wheat grown in saucers, &c., till the germinating plants are several inches in length, is much used as decoration at Christmas.

Tulipa sylvestris.—This is abundant in two particular valleys, but nowhere else at the present time. It resembles our English form. Cultivated, it gives rise to several varieties.

Urginea Scilla.—The Medicinal Squill is extremely abundant on all rocky parts of the island. It is exported to England and elsewhere; and is often dug up, the bulb stripped of a few outer scales, and then put in vessels of water for temporary decorations as on hotel dinner-tables.

The Flora of the Maltese Islands.—As the reader might like to know something more of the flora of the Maltese islands, I add the following details:—

The last geological upheaval seems to have left the Maltese islands as perfectly denuded limestone rocks, connected by a low-lying land with Sicily. A large fault on the south side appears to imply a more decided severance from Africa. This is now indicated by the fact that the soundings between Malta and Sicily do not exceed 75 fathoms; while on the south side they reach to upwards of 400 fathoms.

Evidence of a considerable amount of fresh-water action—such as of old continental rivers—is seen in the "wieds," or deep and narrow ravines with steep rocky sides, in the occasional "swallow-holes," like those so common in Derbyshire, and in the presence of caves. The last two are no longer in connection with running water. They often contain the last remains of the old land surface, and, together with some fissures, have yielded the well-known fossil fauna.

The wieds mainly run, at least ultimately, northwards; small brooklets now occupying them finally find the way into the sea, with one or two exceptions, on that side.

The south coast is composed of lofty and precipitous rocks.

The flora corresponds with the geologically historical features, in that it is almost entirely Sicilian, a few truly African plants being in a decided minority.

With regard to the relative proportions of Maltese plants, of the 700 and odd species there are about 400 genera, so that the flora agrees with Sir J. D. Hooker's observations of tropical and other islands, in that the genera are numerous in proportion to the number of species. Some of the largest genera are to be found in the *Leguminosæ*. Thus *Trifolium* has nineteen species; *Medicago*, fourteen; *Vicia* and *Lotus* each have nine; *Ononis*, eight. Of other genera and orders *Euphorbia* has sixteen; *Allium*, ten; *Ophrys*, nine; and *Orchis*, eight. The dry soil is particularly favourable to leguminous plants, because they do not require a rich one, being capable of obtaining their nitrogen from the air. Conversely a wet soil is very injurious, but few being ever found in our English water-meadows. Monocotyledons, such as Orchids and Liliaceous plants, are well represented, because bulbs can resist a period of excessive drought, which occurs annually in Malta; while plants characteristic of damp soil, as our English Buttercups and Primroses or Violets, can rarely find the conditions favourable for their maintenance, excepting at the bottom of the wieds. If the peasants were more particular in weeding their fields they might soon exterminate many bulbous and tuberous-rooted plants, as *Gladiolus*, species of *Allium*, *Hyacinthus comosus*, and *Anemone*, which are only too abundant in them.

Cryptogams are represented by eight Ferns, three *Equiseta*, one *Isoetes*, one *Selaginella*, two *Charæ*, and one *Nitella*.

Of introduced plants, *Oxalis cernua* is the most remarkable for its rapid multiplication. It is propagated solely by numerous small bulbs; for being "trimorphic," and only one form, the "short-styled," being present, it is never known to set seed in the northern hemisphere. From the year 1806 to the present time it has not only spread nearly all over the islands of Malta and Gozo (it is wanting in Salmonetta), but it has established itself at various places on both shores of the Mediterranean.

Another plant, a crucifer, *Enarthrocarpus pterocarpus*, arrived about fifteen years ago from the Cyrenaican coast, and has established itself within the fortifications of Valetta, in the Florian ditch, and at Fort Manoel on the opposite side of the harbour. *Fagonia cretica* is a third African plant. It occurs in one spot only in Malta, near the sea on the south side, and is now a truly indigenous plant. It is only known in one locality in Sicily, but it is characteristic of the deserts of Egypt.

In the present condition of the islands five floral areas may be more or less distinguished, as follows, though, of course, several plants are found in more than one of them:—

1. Roadsides and waste places. 2. Uncultivated bottoms and sides of the wieds. 3. Uncultivated exposed rocky surfaces. 4. Sea-coasts, rocky and sandy sea-shores, called "Marsas." 5. Cultivated fields and gardens. There are also aquatic plants.

With regard to the flora generally, it is represented by upwards of 700 species and varieties, of which all are herbs excepting about eight trees,* and about fifteen shrubs or shrubby plants.†

* *Cratægus Azarolus*, *C. Oxyacantha*, *Prunus spinosa*, *Pyrus communis*, *Fraxinus Ornus*, *Populus alba*, and *S. pedicellata*.

† *Capparis spinosa*, *Tamarix africana*, *Lavatera arborea*, *Rhamnus oleoides*, *Pistacia Lentiscus*, *Anagyris fœtida*, *Rubus discolor*, *Rosa dumetorum*, *Myrtus communis*, *Inula crithmoides*, *Erica multiflora*, *Periploca lævigata*, *Olea europæa*, *Vitex Agnus-castus*, *Rosmarinus officinalis*, *Euphorbia dendroides*, *Juniperus phœnicea*, *Smilax aspera*.

The few indigenous trees are mostly located in the wieds or old river ravines, being of small size and passing into shrubs. Thus, the common Sloe, Hawthorn, and Pear are more inclined to be bushy than tree-like. There are a few tall specimens of *Fraxinus Ornus*, the 'Flowering Ash,' which yields the manna of commerce, in one valley (Boschetto). There are two species of Willow (*Salix alba* and *S. pedicellata*), of which males only occur, and *Populus alba*.

Of cultivated trees, the Carob is conspicuous everywhere, but it is always stunted when exposed. In the Kirda and Encita valleys, however, it grows to a good-sized and symmetrical tree. A solitary and forlorn-looking Date is occasionally conspicuous; Figs and Prickly Pears are often grown by the walls in the open fields. Oranges, Lemons, &c., are mostly within more enclosed areas.

Of shrubs, the following are examples: The Caper is common on the walls of Valetta and on the rocks. *Pistacia Lentiscus* (allied to *P. vera*, which supplies Pistachio nuts) is not uncommon; and a leguminous shrub, *Anagyris fœtida*, occurs in one place. *Rubus fruticosus*, var. *discolor*, is a form of Blackberry with scarcely edible fruits. The Myrtle was thought to be extinct, but I met with a bush in the Wirda valley, where the rare *Ephedra fragilis* was once found, but appears to be now extinct. The only species of Heath, *Erica multiflora*, of which large bunches of flowers are brought to market, is common over the rocky parts of the island. Rosemary occurs as large bushes on the south side; and a very handsome *Euphorbia*, *E. dendroides*, six to eight feet high, is somewhat local. The scrambling *Smilax aspera* (allied to Sarsaparilla), and the Prickly Asparagus, *A. acutifolius*, are common. The dwarf and common Elders are occasionally to be met with.

The following plants are a selected few, taken as illustrating each of these areas respectively:

1. Roadsides and Waste Places.—There is often a stretch of green between the road and the low stone walls which take the place of hedges in Malta, with or without a small ditch or gully by the side of them. A great variety of plants occur here. Thistles, white and red, are abundant, including the handsome Milk Thistle, and *Cynara spinosissima*, with very large leaves. Yellow species of *Centaurea*, as *C. melitensis*, and the blue Borage are common; while the ground is carpeted with Daisies (*Bellis annua*), the crimson *Silene sericea*, and the orange 'Marigold,' *Calendula arvensis*. There are various Grasses, interspersed occasionally with the Buttercup, *Ranunculus chærophyllos*. The common Mallow, *Malva sylvestris*, abounds, but is always prostrate on the ground, as well as *M. parviflora*, cultivated as a pot-herb in Egypt.

The deep blue *Anchusa italica* and the white *Echium italicum* are common, the *Boragineæ* being well represented in Malta; *E. violaceum*, a Jersey plant, occurs in one spot only. Euphorbias abound, one species, *E. pinea*, being ubiquitous. *Mentha Pulegium*, or Pennyroyal, occurs in very dry places, with small hairy foliage, and also as a sub-aquatic plant with smoother and larger leaves. The ubiquitous *Oxalis cernua* replaces turf of Grass, borders the gullies, climbs up the walls between the loose stones, comes out at the surface, appearing like a fringe around them, and caps the tops, flowering profusely from November to May, with umbels of large golden-yellow flowers. *Arum italicum*, with large arrow-shaped leaves and pale green spathes with yellowish spadices, forms clumps by sides of walls or in waste places, as old quarries, associated with the three kinds of Nettles, one being our English *Urtica pilulifera*. Here may also be seen large masses of our commonly cultivated species, the yellow *Chrysanthemum coronarium*; and of *Smyrnium Olusatrum*, the umbelliferous 'Alexanders.'

2. The Wieds.—These supply some of the choicest plants. Besides shrubs, one meets with the evergreen Honeysuckle. *Ferula communis*, with large, much dissected leaves, sometimes cultivated in English gardens, under the name of Giant Fennel, as well as two varieties of the true Fennel, one with short spiny leaf-segments, are common; as also the handsome *Acanthus mollis*, the leaf of which suggested the ornamentation of the Corinthian capital. Large masses of red Snapdragon grow out of the rocks, as well as a yellow and white flowering species. Several species of *Euphorbia* abound (Malta has about twenty in all); while in two valleys yellow Tulips, *Tulipa sylvestris*, are abundant. The rocky sides of the wieds abound with clumps of white-flowered Asphodel, *A. racemosus*, *Narcissus Tazetta*, and numerous species of Orchids.

The fleshy-leaved *Centaurea crassifolia*, the only species of any plant peculiar to the Maltese islands, occurs in the rocky sides of Wied Babu. Of climbing plants, Ivy is ubiquitous. *Smilax aspera* and evergreen Honeysuckle are common, as well as the wild Madder, *Rubia peregrina*; several species of Convolvulus, as the large-flowered, rose-coloured *C. althæoides*. In one valley I found *Iris germanica*, the purple species of Flag, familiar to Londoners, and the English *I. fœtidissima*. *Psoralea bituminosa*, a strong-smelling leguminous plant with purple flowers, forms low scrambling masses. On the rocky sides where earth accumulates, as well as on the more open uncultivated areas, numerous Orchids are to be found, *Ophrys fusca*, *bombyliflora*, and *aranifera* being the commonest of this genus, and *Orchis pyramidalis*, *saccata*, and *fragrans* of the latter. Lastly, of Ferns, *Adiantum Capillus-Veneris* and *Gymnogramme leptophylla* occur in moist and shady crevices in the rocks and walls. This last is found in Jersey, but not in England.

3. Uncultivated Rocky Surfaces.—Trees and shrubs are here entirely wanting, the rocks being partly flat and smooth, partly weather-worn into a hummocky surface. Here are to be seen abundantly the Medicinal Squill, *Urginea Scilla*, their large bulbs nestling in holes in the rock. Clumps of Asphodel and *Narcissus Tazetta* abound where earth has accumulated. In certain places, as near the end of St. Paul's Bay, a strong-smelling Rue, *Ruta chalepensis*, is abundant. Numerous leguminous plants, many remarkable for their curiously-shaped pods, as species of *Medicago*, *Astragalus*, *Hippocrepis*, *Scorpiurus*, as well as of *Trifolium*, *Melilotus*, and *Lotus*, occur. *Sedum cæruleum* with azure-coloured flowers, forms masses between the rocks. A yellow flax, *Linum strictum*, a sweet-scented Orchis, *O. fragrans*, a tiny composite about an inch in height, *Evax pygmæa*, are very common. On the exposed slopes of the fortifications there are a small Buttercup (*Ranunculus bullatus*), the

honey-scented *Königa maritima*, dwarf forms of *Salvia clandestina*, and a small Dandelion (*Taraxacum minimum*). In one part the tall labiate *Phlomis fruticosa*, with its large yellow flowers, is common. A Dodder, *Cuscuta globularis*, attacks everything, sometimes completely destroying large plants of Asphodel. The blue *Iris Sisyrinchium*, a small purple-flowered *Romulea*, and *Allium Chamæmoly*, as well as *Aloe vulgaris* occurring in one place, are also characteristic of exposed areas.

4. Maritime Rocks and Sandy Shores.—The south side of the island is mostly composed of high precipitous cliffs. The coast is also rocky on the east and north-east parts. The small rivulets nearly all enter the sea on the north side, where are the principal "Marsas" or sandy beaches, such as St. Paul's and Mellaha Bay.

Maritime plants are represented by the Horn Poppy, *Glaucium luteum*; Sea-Kale, *Crambe maritima*; three kinds of Stock, *Matthiola*; the Caper, *Capparis spinosa*; and a curious shrubby little St. John's Wort, *Hypericum ægyptiacum*, with dimorphic flowers, which is abundant on the rocks on the south side; *Fagonia cretica*, a North African desert plant, but found in one locality in Sicily; the Samphire, *Crithmum maritimum*; a form of Chamomile, viz. *Anthemis maritima*; the bushy *Inula crithmoides*, a composite with fleshy leaves and yellow flowers suggestive of Furze bushes at a distance. It is upon the roots of this plant that the peculiar flowering but fungoid parasite *Cynomorium coccineum* grows. The Beetroot, *Beta maritima*, and the usual Saltworts, &c., of the order *Chenopodiaceæ* are common. *Pancratium maritimum* grows in the sands of Mellaha Bay, while the *Posidonia Caulini* (*Caulinia oceanica*) grows at some little distance from the shore, remarkable for its fibres being rolled by the waves into felted balls on the beach.

5. Fields and Cultivated Areas.—Of field weeds the most prominent are the following: The scarlet Pheasant's Eye (*Adonis microcarpa*) and the var. *citrina*, with yellow flowers; the purple *Anemone coronaria*; Love-in-a-Mist (*Nigella damascena*); our English Poppies as well as the purple *Papaver setigerum*, supposed to be the origin of the Opium Poppy (*P. somniferum*), which is not known wild; a white but nearly scentless Mignonette (*Reseda alba*.) The somewhat local plant in England, *Lathyrus Aphaca*, is very common, as well as other leguminous plants, *e.g.* *Lathyrus arvensis*, the wild form of the Field Pea, the crimson *Lotus Tetragonolobus*, the white umbellifer *Tordylium apulum*, and the crimson Corn-Salad *Fedia Cornucopiæ*. The Corn-Marigold, *Chrysanthemum segetum*, is rather local, while the enormous Broom-Rape, *Orobanche speciosa*, with white, lavender, or yellow flowers, and growing three feet in height, is too common in beanfields, as it is also at Cairo. Both the blue and the scarlet Pimpernel abound, though the former is somewhat earlier of the two. The purple *Gladiolus segetum* and *Allium nigrum*, together with two Ornithogalums, *O. narbonense* and *O. arabicum*, appear late in the season together. The white *Diplotaxis erucoides* occurs everywhere in waste places as well as fields.

Aquatic Plants.—In most of the wieds there runs a small streamlet in which aquatic and sub-aquatic plants occur. Thus *Ranunculus hetero-*

phyllus is represented by a small-leaved form nearly like *Baudotii* and a *trichophyllus*. The following are characteristic plants:—Watercress, Celery, *Œnanthe globularis*, *Veronica Anagallis* (*V. Beccabunga* is wanting), a sub-aquatic form of *Mentha Pulegium*, *M. rotundifolia*, a large-leaved and large-flowered form of *Ranunculus Ficaria* known as *calthæfolius*, and *R. ophioglossifolius*, found in South Hants and formerly in Jersey. *Colocasia antiquorum* occurs abundantly in one rivulet. The giant Grass, *Arundo Donax*, used for basket-making, and its ally *A. Pliniana*, as well as the Water-Reed *Phragmites communis*, Common Docks, half-a-dozen species of *Carex* and *Cyperus*, *Equisetum*, *Isoetes*, *Chara*, and the minute *Elatine*, *Callitriche*, and *Lemna* are represented. Two kinds of Willow, *Samolus Valerandi*, *Lythrum Græfferi*, and *Ophrys apifera* are all found in wet grassy borders of streams.

SMALL FRUITS FROM A PRIVATE-GARDEN POINT OF VIEW.

By James Smith, V.M.H.

[August 5, 1902.]

The object in growing small fruits in private gardens should be to aim at keeping up a regular supply of each variety of fruit for as long a period as possible.

This can be done by planting early and late varieties side by side, and also by planting in different aspects. For instance, Gooseberries grown on a south border will be ripe ten days earlier, or perhaps more, than the same variety planted on a north border. Hence it is very important to have walls, in order to be able to keep up a long succession of each kind of fruit in its season.

The following is a list of the small fruits which I propose dealing with in this paper :—Currants, Gooseberries, Raspberries, Strawberries, Logan Berry, and the Strawberry-Raspberry.

Red Currants with Strawberries form an excellent plantation, as the shade of the Currant bushes will, in a measure, help to prolong the bearing qualities of the Strawberries. In making a bed of these fruits, the Currants may be planted six feet from row to row, and four feet apart in the rows. This would afford ample space for one row of Strawberries between the rows of Currants. The latter should be bushy plants, with about a foot of clear stem, as it is not desirable to allow them to become tall, or there would be a difficulty in placing nets over them to keep the birds from the fruit. The Currants should consist of both early and late varieties, so as to prolong the season as much as possible. The Strawberries may be planted one foot apart, and the second year every alternate plant removed, as by adopting this plan a good crop is secured the first year after planting. Late varieties only should be used, and those selected should be of decidedly sterling merit, such as :—

'Laxton's Trafalgar,' which is an unexceptionably fine variety for late use ; in fact, every garden should have a plentiful supply.

'Climax' is another of excellent stamp, which, with 'Sir Joseph Paxton,' will be found exceedingly useful as mid-season varieties.

'Eleanor' is another late variety well adapted for yielding late in the season.

When birds are much in evidence they must be kept off by means of netting. The plan adopted at Mentmore is to place wire netting first all round the beds, four feet high, of one inch mesh. Over the top of this must be placed ordinary garden netting, and a few laths must be fixed over the top to keep this netting in its place. The soil for Strawberries should be made very good before planting, both by deep trenching and adding a good supply of dung in the process. This is very important, for every care should be taken to secure a good crop, or it would not pay for all this extra labour and expense. Before placing the nets on the beds, the ground all round the Currant bushes and Strawberry plants should be heavily mulched with rotten manure, and then, on the surface, a good layer of clean straw. If this plan is adopted very little watering will be needed, for the Currants will, in a great measure, help to keep the ground shaded and moist for the Strawberries. The ground selected for this purpose is best if situated in an open position, where it has the full benefit of the sun, but so placed as to be protected from high winds, for these often dry the ground up and spoil the crop sooner than hot sunshine, for then the nets help to protect the plants.

In order to have very fine fruit from Strawberry beds, no plan is more successful than that of making a quite new plantation every year, and treating the plants as if they were intended for forcing. By planting out strong healthy runners from pots, a good crop can be secured the first season. They should be planted two feet between the rows, and one foot in the rows. Then, as soon as the fruit is gathered, cut out every alternate plant, thus leaving the plants two feet apart each way.

Gooseberries.—These, as a rule, do best in the coolest part of the garden, and may be grown in various forms, such as upright cordons, pyramidal bushes, or in the ordinary form. If trained on a north wall, they ripen much later, and so prolong the season. When placed in such position, it is a good plan to plant bush trees in front of the north walls, as then a net can be placed on the wall so as to cover the border at the same time, and thus have an ample supply till late in the season. In cultivating small fruits in the garden, a certain number of young plants should be propagated every year, for old plants are never satisfactory, they occupy valuable ground, and never produce such good fruit as young healthy plants. This remark applies to every variety of small fruit grown in the garden. Old worn-out bushes are like old horses: they consume valuable food, but are of no ornament or use. Nothing to my mind looks more wretched than a lot of old worn-out small-fruit bushes, either Gooseberries or Currants. Young trees are cheap, and they can be purchased far cheaper than grown from cuttings; then, I ask, "Why keep old and useless stock in a garden?"

Raspberries require few remarks. They are universally grown, and always appreciated for preserving or cooking purposes. Good soil and generous treatment will produce gratifying results.

Strawberry-Raspberry.—This has been introduced from Japan into this country, and was at first said to be a hybrid between a Strawberry and a Raspberry. It may almost be classed as an ornamental plant, for apart from its use it has a distinct value for its beauty, both when in flower and when covered with its fine handsome fruit.

The Logan Berry is a true hybrid between a red Raspberry and a Blackberry. It produces freely, and lasts a long time either gathered or on the bush.

HARDY FRUITS IN YORKSHIRE.

By A. Gaut, F.R.H.S., Yorkshire College, Leeds.

From Reports collected from sixty-seven fruit centres in all parts of the County.

[September 2, 1902.]

Special Reasons for collecting these Reports.—When I first began to give lectures on hardy fruit culture, the greatest difficulty in my experience was in recommending the most suitable varieties of the various species of hardy fruits to plant. Special lists suitable to certain counties or districts were found to be very misleading. Varieties which may succeed admirably in some places often give unsatisfactory results in others, and this sometimes within very small areas. This is particularly noticeable in the northern counties of England, where there is so much variation in the character and depth of soils and subsoils, position, shelter, altitude, and other influences. It is therefore absolutely necessary, in order to gain the confidence of the people with whom the lecturer comes in contact and to be able to give sound advice, that he should make himself thoroughly acquainted with the hardy fruits in his district and the conditions under which they are growing.

For the past three years I have been engaged in this work amongst the hardy fruits in Yorkshire, and up to the present time have personally visited and collected reports from sixty-seven of the best hardy fruit centres in the county. It has been a most pleasant task, as head gardeners, market-fruit growers, and others with whom I have come in contact, have in the most kind and courteous manner placed the results of their experience at my disposal, and a mass of most valuable information has been collected, as you may judge from statistics following. These represent the aggregate experience of sixty-seven hardy-fruit growers in Yorkshire.

I propose to give what must necessarily be only a very condensed summary of these reports, as time will not allow of anything more, and under four heads, viz. :—

(1) Climatic conditions and the main physical features of the county.

(2) Surface soils and subsoils in the chief fruit-growing districts.

(3) Short lists of varieties of some of the principal hardy fruits (mainly consisting of extracts from the reports).

(4) Future possibilities for hardy-fruit culture in Yorkshire.

(1) Yorkshire, taken as a whole, is subjected to much variation in climate and temperature. The physical configuration of the county has a great bearing upon its hardy-fruit culture. High, barren mountains and hills with their sides facing to all points of the compass, numerous sheltered vales, flat open country, in places nearly at sea-level, and a long stretch of sea-coast, are its main features. It is bounded on the east and north-east by the German Ocean, and on this side is much subjected to cold winds and fogs coming off the sea. During spring and early summer, especially when the trees are in flower, the fruit crops suffer very much from these causes alone. In some parts the coast is low and bleak, and these influences are felt for some distance inland, while in the more

sheltered vales bordering on the sea, as in the hilly Cleveland district, especially where it is well wooded, they do not suffer quite so much. On the west the Pennine chain runs the whole length of the county; the westerly winds sweeping down from these high altitudes are rather cold, and this has naturally a retarding influence upon the hardy fruits in the vales. Towards the north the country is open and exposed, and the cold north winds sweep down the Vale of York, which occupies a large area in the centre of the county; this shows what an important factor good shelter is to successful fruit cultivation in Yorkshire. High hills extend over a great part of the county, and it is particularly noticeable, where plantations and large trees abound, what a beneficial influence this shelter has upon farm and garden produce in their immediate localities. It would be well if landowners would turn their attention a little more in this direction. About Malton, York, and Selby vegetation is much earlier than in other parts of Yorkshire, and it is curious to note that Malton is considered to be fully a week earlier than Pickering, although the latter is situated on the sunny side of the moorland hills in the north-east of the county. Numerous cold springs burst from the rocks on the north side of the Pickering Valley, and this is considered to be the cause.

(2) The geological character of the soils and subsoils of Yorkshire is as strongly marked as its main physical features. I often make the remark that it is a "soil of patches." All through the county there is a great diversity of soils, and often within very small areas. Some of my notes are most interesting in respect to these conditions, not only as it affects the different species of fruits, but their varieties also. I once heard a fruit-grower of the good old school remark, "If you want to know what varieties of fruits to plant, look over into your neighbour's garden and see what are doing well there." This is generally sound advice, although it does not always stand good in Yorkshire. My notes show that in many places varieties of hardy fruits may succeed well in certain gardens, while in the districts round them the same varieties are most unsatisfactory, and *vice versa*. One head gardener told me he always planted the same varieties in different positions, and then some of them were sure to do well.

It is easy for anyone acquainted with Yorkshire to be able to picture in his mind its principal hardy-fruit districts. Following the line of the Great Central Vale of York, which lies between the two groups of hills on the eastern side and the two groups on the western side, from which ramifications sweep round and run between the hilly districts of the east, including the Plain of Cleveland, the Vale of Pickering, and following the Ouse Valley to the mouth of the Humber, then taking a course southward, over the flat alluvial plains by Thorne and Doncaster, much of the hardy fruit grown in the county is included within these boundaries. It has been said that "the rivers of Yorkshire are emphatically its own, born among its mountains, giving life and beauty to its numerous dales." In following up these dales along the main courses of the rivers some good hardy fruits are to be seen.

The Plain of Cleveland is mainly composed of strong, tenacious clay. Towards the rise of the hills the soil is very variable, being composed of boulder clay, lias shale, and oolite sandstone. Very little hardy fruit is grown in the Cleveland district, except in private places. In Eskdale, in the more sheltered parts, on towards Whitby, many Apples were at one time grown for the Whitby market, but the orchards are fast disappearing, and those trees which remain are mostly in a neglected condition, and very few young ones are planted. From the Tees on towards Richmond, round Bedale and Northallerton, there is a great diversity of soils, being composed of alternate beds of heavy and light loams, and gravel of varying depths. Here and there on the better class of soils quantities of fruit, especially Apples, Plums, Gooseberries, and Strawberries, are produced. Near Richmond Strawberries are largely grown by cottagers in allotments ranging from two acres downwards, a ready sale being found for them at Bishop's Auckland, Darlington, Barnard Castle, and Richmond. On the limestone soils, towards the hills by Richmond, some large Walnut-trees often crop heavily. In a garden at Middleton Tyas, near Richmond, a curious feature is particularly noticeable. Some of the Apple-trees and Raspberry canes annually produce leaves of a bright golden colour, while those of others are green. Copper is found in the district, sometimes traces of it occur close to the surface of the ground, and it has been suggested that this is possibly the cause. Some good standard Cherries and quantities of Plums are noted near Bedale. In the Thirsk district the soil is more clayey, forming cool strong lands, which, when well drained, are especially suitable for Apple culture. Thirsk is one of the most important wholesale fruit markets of the north, and much fruit is brought into it from the surrounding districts. Westward and beyond Ripon the soil becomes thinner, with alternate beds of sand, clay, and gravel. Taking a course from Thirsk eastward and south of the Hambleton hills, through a broad stretch of country by Coxwold, Gilling, and Helmsley, there is a great difference in the character of the soil, much of which is suitable for fruit culture, and many Apples, Pears, Plums, and Gooseberries are grown for the Thirsk market. The orchard Pear-trees in these parts are quite a feature; one which was measured, and that not the largest, being forty-six feet high, and large in proportion; there are many of these which generally produce heavy crops of fruit. In some portions of the Vale of Pickering the soil is very rich. This large valley, which is scooped out of the Kimmeridge clay, varies much in the character of its surface soils at different portions of the Vale. A great thickness of glacial beds and alluvium covers its eastern portion. Towards the west the Kimmeridge clay crops out in places through the alluvium, and forms, when not covered with gravel, a heavy clay soil. At the foot of the hills beds of rich sandy loam are found, especially adapted to the culture of Pears and Plums. On the southern side of the Vale alternate beds of sand, clay, and rich loams, with quantities of calcareous grit, are found. There are many rather populous parishes in and about this Vale, where, on the better classes of soils, much hardy fruit is grown. From Pickering eastward, for several miles along the Forge Valley line, many Apples, Plums, Raspberries, and Strawberries are sent into the Scarborough market. Over the eastern half of the East Riding very little good hardy fruit is grown, except in private places. It is worth notice, particularly on the calcareous soils, where they are then upon the chalk, what an influence this soil has upon the stock upon which Apples are grafted. My attention has been drawn to the fact that, while large Apple-trees are often seen fruiting freely, many which are newly planted die after a few years. I attribute this to the use of the Paradise stock. It must be understood I am not referring to those places where head gardeners are kept, as under skilful management this stock can be made to answer, even upon these thin light soils. At Sutton-on-Hull there is a large Strawberry farm of about fifty acres ; this is in the Holderness district. Mr. C. F. Thompson, the grower, says : " There are no large fruit-growers in this immediate neighbourhood. A good deep soil with a clay subsoil, well drained, and sheltered from the north and east winds, if possible in a sunny valley, are the best conditions for successful Strawberry-growing."

Between Malton and York, in places, according to the character of the soil, some good fruit is produced mostly by private growers, and round Malton and York in market gardens also. The Burr-Knot Apple is quite a favourite amongst cottagers near Castle Howard, as it rarely fails to produce good crops. From York to Selby and following the River Ouse on its eastern side, the soil is very variable, breaking up into small patches of heavy land, loam, sand, and gravel, and here it is particularly noticeable what a remarkable influence this has upon the different varieties of fruits grown. To mention one case, Mr. James Hornby, head gardener at Heslington Hall, says : " 'Ne Plus Ultra' (syn. 'Sir Joseph Paxton') does not succeed in these gardens, while in this same parish it is the principal market Strawberry. Some of the finest Apples in Yorkshire are to be found about here, whilst quantities of other fruits are grown for market. At one time many good standard Cherries were to be found about York, but from time to time these have been destroyed, the land being required for building purposes. Selby is a good fruit market. The rich warp lands on each side of the Ouse, between Selby and the Humber, and the rich alluvial soils about Thorne and Doncaster, form some of the best fruit-producing land in Yorkshire. Many of the farmers about Thorne and some parishes westward of it have considerable orchards, and on the cool soils Apples succeed well. At a hamlet called 'New Zealand,' close by Thorne, some fine Cherries are produced. Some of the land between Thorne and Doncaster is very light, so that even in this part of Yorkshire great care should be exercised in choosing suitable positions for planting fruit-trees. Much of the fruit grown about here is taken to Doncaster."

Crossing the narrow line of magnesian limestone, in this part of the county, along which in certain parts some of the fruit grown will compare very favourably with that from some of the more favoured fruit-growing counties of the South, the great coal formation is reached, and passing over this to the west we get into the factory districts. These extend all over the south, middle, and west of the West Riding of Yorkshire. The smoke which pours forth in volumes from the thousands of chimneys, from the collieries and factories, joined with that from the houses of the numerous workers, one would naturally think, would not be conducive to the culture of good hardy fruits. Yet near Barnsley I have seen some very fine Apples, but this is only exceptional. It is only here and there, and in private places, that hardy fruits are grown to any great extent. The soil of a great portion of the western side of Yorkshire is largely composed of the millstone grit. Gooseberries are largely grown, and Gooseberry shows are still held annually in several places, at which enormous berries are shown. In many portions of that tract of country lying between Leeds, Selby, York, Boroughbridge, and Harrogate, where again there is a great difference in the character of the soils, quantities of hardy fruit are grown in places. To the east, a few miles from Leeds, Raspberry-growing is rather an important industry, upwards of 100 acres being under cultivation. About South Milford some rather large orchards are seen. Near here quantities of the celebrated Yorkshire 'Winesour' Plum are still largely grown. Ribston Park is the home of the noted 'Ribston Pippin' Apple, which still holds its own as one of the best-flavoured Apples grown. The old original tree has passed away; a portion of its trunk is still preserved, and shown to visitors to the gardens. A sucker from the roots of the original stock is rapidly growing into a large tree, which is fenced round and carefully protected. Whixley, a small hamlet near Cattal, on the York and Harrogate line, is noted for its Cherries; the people call it the 'Whixley Cherry,' and say it has no other name. An old Cherry-picker told me it was the 'Whixley Cherry,' and nothing else; it had been called by that name ever since the world was created, and he could tell by its flavour whether a Cherry had been grown at Whixley or not. A Cherry fair is held annually, which, although not so important an event as formerly, is still looked forward to every year by the inhabitants and visitors.

(3) I now take some extracts from the "General Report" of the Yorkshire Hardy Fruits. Apples and Strawberries are arranged in tables, giving—satisfactory and unsatisfactory results, the different characters of soils, and the number of centres where each is grown. These show clearly how misleading special lists for planting are:—

Kitchen Apples. 20 Varieties.

Names of Varieties	No. of places where each variety is grown	Satisfactory				Unsatisfactory			
		General Character of Soils				General Character of Soils			
		Heavy	Medium	Light	Total	Heavy	Medium	Light	Total
Blenheim Orange Pippin	41	9	7	7	23	11	3	4	18
Bramley's Seedling	25	9	7	5	21	2	2	—	4
Cellini Pippin	25	9	7	5	21	1	1	2	4
Cockpit	8	7	4	4	15	1	1	1	3
Cockpit improved	16	4	8	4	16	—	—	—	—
Cox's Pomona	22	7	10	3	20	—	1	1	2
Dumelow's Seedling	17	2	5	5	12	2	2	1	5
Ecklinville Seedling	47	19	14	9	42	1	2	2	5
Hawthornden	25	5	7	9	21	2	—	2	4
Hawthornden, New	10	2	6	1	9	—	1	—	1
Lane's Prince Albert	29	9	15	5	29	—	—	—	—
Lord Derby	18	3	10	3	16	2	—	—	2
Lord Grosvenor	20	5	7	4	16	3	1	—	4
Lord Suffield	60	15	10	16	41	6	8	5	19
Keswick Codlin	47	14	14	14	42	4	1	—	5
Peasgood's Nonesuch	41	14	19	5	38	—	2	1	3
Stirling Castle	28	8	12	6	26	—	1	1	2
Tower of Glamis	23	8	9	4	21	1	1	—	2
Warner's King	43	14	12	10	36	3	3	1	7
Yorkshire Greening	15	3	6	5	14	—	—	1	1

Blenheim Orange is a very uncertain variety in Yorkshire, as the report shows, where it is eighteen times noted as unsatisfactory. The chief complaints are: (1) it cankers badly; (2) it does not bear well; (3) as the tree flowers early, its blossoms are liable to be cut off by frost.

Bramley's Seedling.—Where this is unsatisfactory it is as a shy bearer but a strong grower. These are chiefly young trees; as they get older they will probably bear better. Grafts on old Apple stocks are generally satisfactory.

Cellini is a good Apple generally, but in some places it cankers badly.

Cox's Pomona.—A very hardy variety, and a favourite in places.

Cockpit, Old
Cockpit, New } The Cockpits are largely grown in Yorkshire for market. They are very hardy; crop well. Some are discarding these for better varieties. Useful varieties in exposed positions.

Dumelow's Seedling.—A good Apple, but cankers badly in places.

Ecklinville Seedling.—A grand Apple in most parts.

Hawthornden
Hawthornden, New } Good hardy varieties for the hilly districts canker in some soils.

Lane's Prince Albert.—A grand Apple for Yorkshire.

Lord Derby.—Also one of the best; reports unsatisfactory in two places.

Lord Grosvenor is well spoken of where it succeeds.

Lord Suffield.—A most uncertain Apple, although good where it does well. It cankers very badly in many places; even in some noted as satisfactory it is liable to canker. Some gardeners, as soon as the disease begins to get bad, cut off the branches, and the fresh breaks will do well for a time.

Keswick Codlin.—One of the hardiest varieties, and a favourite in Yorkshire.

Peasgood's Nonesuch.—Generally very good; sometimes a shy bearer.

Stirling Castle.—A most useful and generally a reliable Apple.

Tower of Glamis is still a favourite.

Warner's King.—Cankers in places, in others very good.

Yorkshire Greening.—A good hardy Apple.

DESSERT APPLES. 12 Varieties.

Names of Varieties	No. of places where each variety is grown	Satisfactory				Unsatisfactory			
		General Character of Soils				General Character of Soils			
		Heavy	Medium	Light	Total	Heavy	Medium	Light	Total
Court Pendu Plat	13	4	3	2	9	2	1	1	4
Cox's Orange	44	11	9	11	31	7	2	4	13
Devonshire Quarrenden .	12	5	1	5	11	—	1	—	1
Duchess of Oldenburg . .	18	6	9	1	16	1	1	—	2
Golden Pippin	10	2	4	1	7	—	1	2	3
Irish Peach	31	11	10	10	31	—	—	—	—
Kerry Pippin . . .	12	4	6	2	12	—	—	—	—
King of the Pippins . .	36	12	8	5	25	4	4	3	11
Lady Sudeley	14	4	8	1	13	1	—	—	1
Red Astrachan	14	5	3	3	11	1	2	—	3
Ribston Pippin	37	9	8	5	22	7	4	4	15
Worcester Pearmain . .	25	12	9	4	25	—	—	—	—

Court Pendu Plat.—Good in places; in others it cankers badly.

Cox's Orange is generally a shy bearer where unsatisfactory; also cankers sometimes.

Devonshire Quarrenden.—A useful Apple.

Duchess of Oldenburg.—Grown for market; being a handsome Apple, it sells well. In Yorkshire it is of inferior flavour.

Golden Pippin.—Good in places; cankers badly in others.

Irish Peach.—A favourite early Apple in Yorkshire.

Kerry Pippin.—Good in Yorkshire, for cropping and for flavour.

King of the Pippins.—Good in some gardens; where reported as unsatisfactory it is of inferior flavour; requires a very warm position.

Lady Sudeley bears well; good reports.

Red Astrachan.—Grown largely for market.

Ribston Pippin.—Most uncertain Apple, as it cankers so badly in many places.

Worcester Pearmain.—Grown largely both in private gardens and for market.

Strawberries. 13 Varieties.

Names of Varieties	No. of places where each variety is grown	Satisfactory				Unsatisfactory			
		General Character of Soils				General Character of Soils			
		Heavy	Medium	Light	Total	Heavy	Medium	Light	Total
British Queen	18	3	3	—	6	4	3	5	12
Dr. Hogg	17	3	2	2	7	3	2	5	10
Empress Eugénie	9	2	2	5	9	—	—	—	—
James Veitch	11	4	4	2	10	—	1	—	1
Keen's Seedling	7	2	1	1	4	—	1	2	3
Latest of All	11	2	4	2	8	—	3	—	3
Laxton's Noble	10	1	2	3	6	1	—	3	4
Monarch	8	3	2	—	5	—	1	2	3
President	39	10	10	6	26	5	4	4	13
Royal Sovereign	54	19	14	17	50	4	—	—	4
Sir Joseph Paxton	27	8	5	4	17	2	4	4	10
Vicomtesse Héricart de Thury	31	12	8	8	28	1	2	—	3
Waterloo	9	3	3	3	9	—	—	—	—

The following other fruits are fairly proportionally representative for Yorkshire; the number of places where each is grown is shown by the figures. These are extracts from the "General Report." Sixty-seven centres in all:—

Pears trained. Walls, Bush, &c.

Beurré d'Amanlis	22	Easter Beurré	11	Marie Louise	40
Beurré Diel	20	Glou Morceau	17	Pitmaston Duchess	27
Clapp's Favourite	12	Louise bonne of Jersey	40	Souvenir du Congrès	14
Doyenné du Comice	27	Jargonelle	23	Williams' Bon Chrétien	38
Duchess d'Angoulême	14	Joséphine de Malines	13	Winter Nelis	14

Orchard Pears.

Hessle	23	Louise bonne of Jersey	11
Jargonelle	12	Williams' Bon Chrétien	10

Plums trained. Walls, Bushes, &c.

White Magnum Bonum	13	Victoria	40	Coe's Golden Drop	31
Orleans	11	Jefferson	27	Greengage	19
Pond's Seedling	12	Kirke's	33	Transparent Gage	10

Plums, Orchard.

Orleans	9	Pond's Seedling	14	Rivers' Prolific	11	Victoria	31

Cherries trained. Walls, Bushes, &c.

Black Eagle	7	Early Rivers	5	May Duke	23
Black Tartarian	9	Governor Wood	7	Morello	39
Black Bigarreau	10	Late Duke	6	White Heart	6

Apricots. Walls.

Breda	7	Hemskerk	10	Moorpark	31	St. Ambroise	7

Peaches, on Walls, outside.

Diamond	7	Hale's Early	8	Royal George	16

Very few Nectarines are grown outside, and they are mostly unsatisfactory.

Raspberries.

Superlative	21	Carter's Prolific	8
Northumberland Fillbasket	13	Semper Fidelis	7
Baumforth's Seedling	10	Fastolf	5

Red Currants.

Red Dutch	12	Raby Castle	10	La Versaillaise	4

White Currants

Are not largely grown in Yorkshire. White Dutch is the only name received from ten out of forty places.

Black Currants.

The Black Currant Mite (*Phytoptus ribis*) is very prevalent in Yorkshire, as the following table shows:—

—	Character of Soils			Total
	Heavy	Medium	Light	
Number of centres which are comparatively free from mite	11	8	5	24
Number of centres which are badly infested	9	1	9	19
Do. on which several infested buds are found	—	2	2	4
Total number of centres from which reports are received	20	11	16	47

Gooseberries.

The varieties mostly grown are Warrington, Whinham's Industry, Whitesmith, Crown Bob, Lancashire Lad, Keepsake, Yellow Champagne, Early Sulphur, Red Champagne, Ironmonger, and Leader.

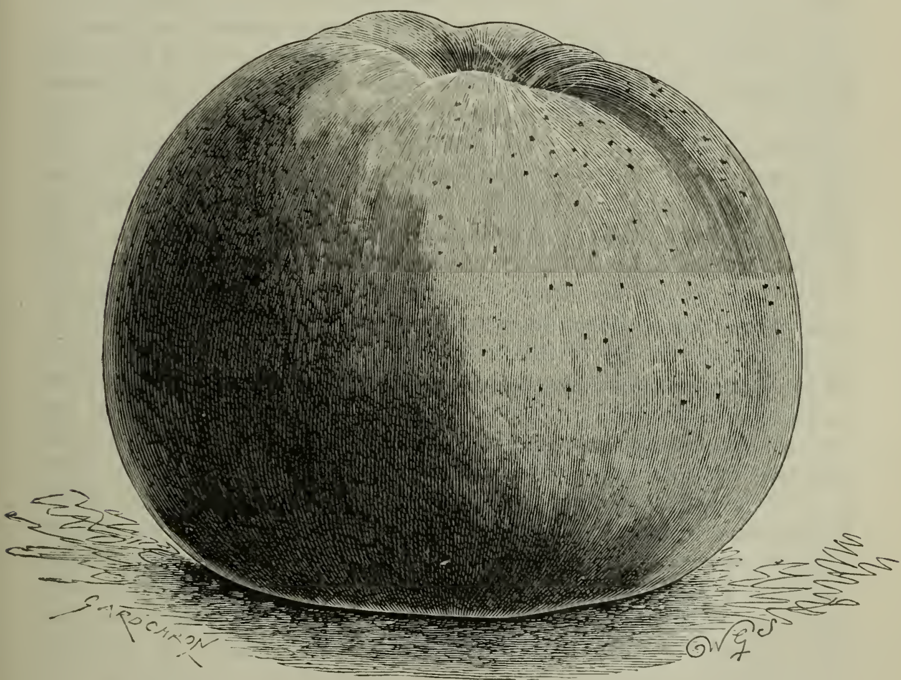
Prize Gooseberries.

The following are those varieties which have taken the prizes for the heaviest berry (one only being shown) during the past fifty years at the shows of the Gooseberry Growers' Association, held annually in this county, with the number of times each variety has gained the prize (from *The Gooseberry Growers' Register*) :—

London .	. 19	Ringer .	. 4	Antagonist .	. 3	Dr. Woolley .	. 2
Bobby .	. 7	Garibaldi	. 3	Rover .	. 2	Leveller .	. 2

And the following once each :—Paris, Seedling, Macaroni, Transparent, Ploughboy, Lord Derby, Stockwell, and Blücher.

(4) Much of the soil in the hardy-fruit districts of Yorkshire is well adapted to the culture of Apples, Pears, and Plums. In private places good fruit is often grown under the most difficult conditions, but only under exceptional cultivation, the cost of labour and material being only secondary considerations. When planting fruit trees in a county like Yorkshire for market purposes, special attention must be paid to choosing suitable soils and sheltered positions, and to the selection of varieties suitable to these conditions, as mistakes are easily made ; in fact such is frequently the case, with the result that the profit and loss account afterwards would possibly be represented on the wrong side of the balance-sheet. Following up carefully these conditions and under a system of good cultivation, hardy-fruit growing in parts of Yorkshire might be made a more profitable industry than it is at the present time.



ON THE INCREASE IN EUROPE OF THE AMERICAN GOOSEBERRY-MILDEW (*Sphærotheca mors-uvæ* (Schwein.), Berk. & Curt.).

By Ernest S. Salmon, F.L.S., F.R.H.S.

When giving an account, at p. 139 of vol. xxv. of this Journal, of the occurrence in 1900 of the American Gooseberry-mildew in a garden at Ballymena, Ireland—the first appearance in Europe of the disease—the opinion was expressed that in all probability the disease would invade other parts of Europe. In 1901 (see p. 778 of vol. xxvi. of this Journal) the disease recurred with increased severity in the original locality in Ireland, but was not reported from elsewhere. In the present year, 1902, not only has the disease occurred in several fresh localities in Ireland, but it has been reported from two widely-separated districts in Russia, where it caused wholesale destruction to the Gooseberry crop.

First, as to the spread of the disease in Ireland. Mr. Nixon has sent me the following notes on the occurrence of the disease during the present year in the original station at Ballymena:—"I had the Gooseberry bushes sprayed once this year, but now (June 11) I find the fungus is abundant both on the berries and on the young wood. I notice that the disease is far worse —that is, it spreads far more quickly—in damp or rainy weather. We have had a great deal of rain here this last April and May, and the temperature during May was lower at night than I have ever known it in all my experience of gardening. We are seriously thinking of burning all our trees—over three hundred—this season. We are greatly sheltered by very tall trees on the south side. I should think most of them are eighty feet high. I never saw many, if any, gardens so shaded on the south side. Possibly this may have something to do with the disease spreading so quickly, but its origin is as yet entirely a mystery to me." In August Mr. Nixon wrote:—"I have destroyed a great many trees by fire just on the plot where they grew. We have a Large Green Rough or Hairy variety of Gooseberry which seems to resist the disease." At the same time Mr. Nixon informed me that the disease had appeared in a garden at Knocktarna, Coleraine, Londonderry. On writing to the owner of the garden I received the following information on this fresh outbreak of the disease:—"The mildew, which appeared for the first time in our bushes this year, was first observed about the middle of July, when the berries were ripening. I feel confident that there was no occurrence of the disease last year. It began upon a plantation of young bushes bought four years ago from Portadown. It spread rapidly, until the fruit upon every bush was attacked in two gardens, quite separate from each other; yet our neighbour's gardens, only on the other side of the road, were quite free from it. None of the Gooseberry bushes appeared to remain unattacked by the disease. This is a heavy clay soil, and in former years was famous for Gooseberries. I have heard of the disease appearing in a garden at Aghadowey, but only a few bushes were attacked there; in our gardens there are more than one hundred attacked. We have had no communication with the gardens at Whitehall, Ballymena, nor with America." Specimens (now in the Kew Herbarium) of the fungus were also sent, and proved to belong to *S. mors-uvæ*. Another closely-allied mildew, *Microsphæra Grossulariæ* (Wallr.) Lév., occurred side by side on the same shoots with the *Sphærotheca*.

In August last, also, I received further specimens from Mr. F. W. Moore, A.L.S., of the Royal Botanic Gardens, Glasnevin, Dublin, of the American Gooseberry-mildew, which had been sent to him from a garden near Antrim, with the following report:—"I send a few Gooseberries showing a blight which has appeared this season both on my own crop and on that of others. The disease in my case began on one tree and has rapidly spread to several. I have not before noticed it, although I have been growing a considerable area for some years past. There was a report last year of a disease having appeared on Gooseberries at Broghahan, Co. Antrim, and probably this is the same." The owner of the garden supplied me with the following additional information:—"It was not until I began to pick this season that I noticed that the berries on some three or four trees were still small and green, with the blight showing on some of the branches. The variety affected was 'Crown Bob,' and these with 'Whinham's Industry' are the only kinds grown. The disease appears to be pretty general now, both in Co. Antrim and Co. Derry, but so far as I can learn has not appeared in Co. Armagh, which is the chief fruit-growing centre in Ireland."

In April of the present year Dr. Hennings, in a communication to *Gartenflora* [Bibl. (1)], stated that *S. mors-uvæ* had appeared in Russia during the season of 1901. The examples were sent to Dr. Hennings by Mr. N. A. Mossolow, from some private gardens at Michailowskoje, district of Moscow, where it occurred, causing an epidemic, on the cultivated Gooseberries. The berries were completely covered over with the rusty-brown mycelium of the fungus, which by July 8, 1901, showed perithecia containing ripe spores. Dr. Hennings states it as his opinion that the fungus is without doubt to be considered as a true native of Russia.

Mr. N. A. Mossolow has kindly supplied me with the following additional information on the subject of this outbreak of the disease in Russia:—"The Gooseberries which became infected were planted several years ago, and were originally bought in St. Petersburg and in Riga. Several different varieties of Gooseberries were attacked. The summer of 1901, when the fungus first appeared here, was very hot and dry. We found the fungus, in very great quantity, only on the fruit of the Gooseberries and not on the branches. The fruit-garden is surrounded by the park and woods on one side; on the other there is a hedge of *Cratægus*. The fruit-garden consists of Apple-trees, Cherries, Raspberries, Strawberries, Currants, and a few hardy plants, *Rubus cæsius*, &c."

Prof. A. de Jaczewsky (Inspector of Vegetable Pathology to the Russian Minister of Agriculture), to whom I applied for information as to whether *S. mors-uvæ* had been reported from other districts of Russia, wrote as follows:—"I do not know of any other place than Michailowskoje where the fungus has been found in Russia; in all other cases the fungus sent to me on Gooseberries has proved to be *Microsphæra Grossulariæ.* I do not consider that there is any reason for thinking that the fungus has been introduced into Russia from America. We have a great many American fungi on wild and cultivated plants that could not have been introduced in any way (e.g. *Plasmopara cubensis, Phytophthora Phaseoli, Exobasidium platydiscus*). It is very probable that the fungus is to be found in many localities here, but we have so few mycologists in Russia that there are few investigations on the subject, and our knowledge of the geographical distribution of fungi in Russia is very incomplete." Prof. A. de Jaczewsky kindly sent me beautiful specimens (now in the Kew Herbarium) of the Russian examples of *S. mors-uvæ.*

In August last a further communication was made to *Gartenflora* by Dr. Hennings (2), who reported as follows :—" On July 15, 1902, Mr. N. A. Mossolow wrote to me that the mildew had again appeared on all the Gooseberry bushes in the private gardens at Michailowskoje, Podolsk, district of Moscow ; and that not only was all the fruit completely destroyed, but the fungus occurred also on the young shoots. On the 17th of the same month I heard from Prof. Buchholtz, at Riga, that he had received a few days previously examples of the American Gooseberry-mildew on diseased Gooseberry-branches from Port Kunda in Esthonia, where the fungus had destroyed the whole crop of Gooseberries. In Prof. Buchholtz's opinion the disease appears to be spreading more and more from East to West." Dr. Hennings concluded by pointing out that it would seem from the existing evidence that the fungus is spreading from the interior of Russia, and that there are no grounds for assuming, as Prof. Magnus has done (3), that it has been imported on diseased Gooseberry bushes from America. Dr. Hennings also points out that it is very probable that the disease will appear in Germany, and remarks that should this happen it is expedient that all the affected bushes should be at once destroyed by fire on the spot, while all the non-infected bushes should be well sprayed with Bordeaux mixture. It may be mentioned here, however, that undoubtedly the best fungicide for combating the present disease is potassium sulphide, as has been proved by numerous careful experiments in the United States. (See vol. xxv. p. 141, and vol. xxvi. p. 779, of this JOURNAL.)

De Wildeman, in the *Prodrome de la Flore belge* (Thallophytes, fasc. 2, p. 219 ; 1898), has enumerated, on the authority of Prof. Em. Marchal, *S. mors-uvæ* among the *Erysiphaceæ* of Belgium. Prof. Marchal writes to me, however, that this record is erroneous and must be expunged.

We see, therefore, that the present disease has, since its original outbreak in Europe in 1900, appeared in numerous fresh localities in Ireland, and in two widely-separated districts in Russia. In every case where the disease has appeared it has assumed a serious character, and tends to recur annually in increasing severity ; and there is no doubt that Gooseberry-growers in Europe are now face to face with a dangerous enemy.

There is reason also to fear that another fruit than the Gooseberry is threatened by the present fungus. In a recent 'Bulletin' of the New York Agric. Exper. Station (4) the following statements occur :—" The powdery mildew of the Gooseberry (*S. mors-uvæ*) sometimes attacks Currants. At Ripley, Chautauqua County, we saw this mildew in two plantations of Currants. In one case the plants were unusually thrifty and growing in a Plum orchard. On many plants the mildew attacked the leaves at the ends of the canes, and on a few plants it also attacked the berries, covering them with a brown felt-like growth." The following additional information has been supplied to me by Prof. F. C. Stewart, of the New York Agric. Exper. Station:—"In the instance referred to in my Bulletin, *S. mors-uvæ* was on cultivated Red Currant, *Ribes rubrum*. I have never seen it on *R. nigrum*, and I think not on the White Currant. In New York it occurs quite frequently on *R. rubrum* in small quantity, and occasionally it is sufficiently abundant to be destructive. In my notes I have a record of an instance in which this fungus was destructive to Red Currants at Highland (in the Hudson River Valley) in 1897. The variety of Currant was 'May's Victoria.' In the case mentioned in my Bulletin the damage was slight, but the owner informed me that in former seasons it had sometimes been destructive. I am confident that there are other published references to its occurrence on Currants in the United States, but am sorry to say that in a hasty examination of the literature I have failed to find any." Specimens of *S. mors-uvæ* attacking the Red Currant were kindly communicated by Prof. Stewart, and are now deposited in the Kew Herbarium. In these the fungus is abundant in its conidial (*Oidium*) stage on the leaves of the young shoots, and in the perithecial stage completely invests the young berries with a thick dark-brown felted covering of mycelium.

On June 13 of the present year Mr. Nixon sent me from Ballymena some Gooseberries thickly covered over with a growth of *S. mors-uvæ* in its conidial condition. In this stage the fungus is wholly white, and is composed of delicate creeping mycelial threads, from which suckers are sent into the epidermal cells of the leaves and berries. This mycelium bears at short intervals a great number of closely-crowded, erect, simple branches, the conidiophores, and at the apex of each conidiophore the conidia are produced in a long bead-like chain by abstriction in basipetal succession. The conidia are broadly elliptic in shape, and measure 27–31 $\times$ 18–20 μ; they are colourless and hyaline, and filled with vacuolated protoplasm, in which minute fibrosin bodies occur. The conidia are produced in great number, so that the affected parts quickly become covered with a powdery mass of glistening white conidia. A representation of *S. mors-uvæ* in its conidial stage is given on p. 600.

Using the material sent by Mr. Nixon, I was successful in infecting another species of *Ribes*, viz., *R. Cynosbati*, with the conidia of *S. mors-uvæ* growing on *R. Grossulariæ*. The plant of *R. Cynosbati* that was thus infected was kept in a moist atmosphere under a bell-jar. Two young leaves and several old leaves were inoculated on the upper and under surface, also a portion of a young stem. On the tenth day after inoculation both the young leaves bore—on the under surface only—small patches of mycelium with numerous small groups of well-grown conidiophores with chains of ripe spores. No infection occurred on the old leaves or on the stem. The above experiment is of interest as showing that in the case of the form of *S. mors-uvæ* on *Ribes Grossulariæ* the conidia will directly infect another species of host-plant. In the case of some mildews, as Neger (5) has lately shown, the conidia have not this power.

Fig. 166.

Explanation of Figures.— Conidial stage of *Sphaerotheca mors-uvae* (Schwein.) Berk. & Curt., the American Gooseberry-mildew (drawn from material sent from Ballymena, Ireland). In centre, a single ripe conidiophore, bearing its chain of conidia, × 255; to right, above, uppermost portion of a nearly ripe chain, showing the fibrosin bodies in the cell-contents of the conidia, × 400; to right, below, a germinating conidium, from the surface of a Gooseberry, × 400; to left, a number of ripe conidia, × 400.

S. mors-uvae has been recorded in the United States on the following species of *Ribes*: *R. cereum*, *R. Cynosbati*, *R. divaricatum* var. *irriguum*, *R. floridanum*, *R. gracile*, *R. Grossulariae*, *R. Hudsonianum*, *R. lacustre*, *R. missouriense*, *R. prostratum*, *R. rotundifolium*, and *R. rubrum*. A full account of the fungus is to be found in the papers mentioned below (6), (7).

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ROOTS AND THEIR USES.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

[Lecture to the Students at the Society's Gardens, June 18, 1902.]

Germination.—When a Mustard-seed germinates, the first visible result is the protrusion of the *radicle*. This is not the root, but forms the primary stem, called the "hypocotyl,"* carrying the two green, edible *cotyledons* at the top. The undeveloped bud, or *plumule*, lies between them. These three parts constitute the entire *embryo*.

The root is formed by the "growing point" at the extremity of the radicle, just below the actual tip, and (with rare exceptions) grows downwards, penetrating the soil, vertically. This latter direction is regarded as being due to the influence of gravity; for if a germinating seed be supported horizontally, the root soon begins to turn downwards again. It also "circumnutates," or "bows around." This possibly aids the tip in finding a line of least resistance to penetration.

Primary Root.—The primary or axial root may elongate very considerably, as of the long-rooted Radish, Carrot, Parsnip, &c. If the plant be an annual, this root does not acquire any great size; but in a biennial the leaves have had a longer period of activity, so that there is more starch, &c., made by them than can be utilized, and the root has to be enlarged in order to store up this increased amount of reserve food-materials.

Garden Carrots were thus made, by sowing the seed of the wild annual Carrot (*Daucus Carota*) *late in the season*. This prevented the plants from flowering the same year. They thus had a season and a half for vegetative growth. Then, by selecting the *latest flowering* for a few years, the existing biennial races were established.

A converse effect was made with Beetroot (*Beta vulgaris*, var. *maritima*), for this is a common perennial on our sea-coast cliffs. By treating the seeds in the same way, the perennial habit was lost and the biennial races of Beets and Mangolds were obtained.

Root Forms.—Since the garden root-crops have been raised from wild plants the forms have changed considerably. Thus, while the root of the wild Carrot, Parsnip, Turnip, and Radish is long and wiry, we have in cultivation all sorts of "longs and shorts," cylindrical and globe forms, &c.; and the question arises—how did they come about?

Pliny, writing in the first century, says that the Greeks in his day had discovered a way of converting the female † "rape into a male"—that is, the long-rooted into the short form—by sowing the seed in a cloggy soil.

M. Carrière experimented with the wild Radish (*Raphanus Raphanistrum*) and found that he got a larger percentage of long roots in a loose

* *I.e.* "under the cotyledons."

† The terms "male" and "female" were often used then, as also in the Middle Ages, but only in a fanciful way.

soil, and a majority of short, Turnip-like forms in a stiff one. A similar result followed in experimenting with Carrots.

Hence, by the careful selection of seed from any form required, it becomes fixed as a race, and the selected root is established by heredity.

Root-Fibres and Fibrils.—Secondary and subsequent rootlets issue out of the primary root ; but they do not run vertically downwards, being less influenced by gravity ; so that in a plant with a large number of rootlets they are spread out and acquire a considerable volume. If the primary root be cut away, then one or more of the secondary roots grow downwards, just as, when a primary shoot of a tree is broken off, some other bough rises up and becomes a leader instead of it.

It should be borne in mind that it is only a very small portion—not much more than one-twelfth of an inch—by which the root-fibre is elongated. All behind that portion ceases to grow except in thickness. Moreover, the absorbing power of a root-fibril is confined to the delicate epidermal cells, whether they elongate into "root-hairs" or not, and is equally transient, as the superficial cortical tissues are soon formed and the surface consequently becomes non-absorbent.

The cultivator will thus clearly perceive the immense importance of never breaking any of the finer root-fibrils when transplanting herbs, as by so doing delay occurs in the plant having to form new ones, and that delay may prove fatal.

Adventitious Roots.—As the axial root may swell into various forms, as in Radishes, so may the secondary as well as "adventitious" roots, which issue out of stems, as in our terrestrial Orchids and the lesser Celandine (*Ranunculus Ficaria*), Pæonies, Dahlias, &c. Such are reservoirs of nutriment ; but they become storage reservoirs of water in very dry places, in order to sustain the plant during the intense heat of the summer, as in deserts, &c. Some species of Heron's-bill, for example (*Erodium*), do this near Cairo : and our own Dropwort is probably another instance, growing as it does in the very dry chalk hills.

Contractile Roots.—As the underground stems of plants, such as the root-stock of Primulas, the tubers of Arum, the corms of Crocuses, and the bulbs of many monocotyledonous genera, require to be at certain depths below the soil, according to the peculiarities of each kind of plant, certain roots—and indeed the primary root itself of the Carrot &c.—have "contractile" powers, whereby they pull the organ in question downwards. It is done by a shortening of the superficial cells ; the result is seen in the horizontal wrinklings on the surface.*

Endophytic Fungi.—A curious fact has been lately investigated with Orchids. It is that their seeds on germination, as well as their roots and rhizomes, are infested with the mycelium of fungi, species of *Fusisporium*.

Although it would seem that the fungus is a parasite and not living symbiotically with the host—that is, for their mutual benefit—yet, as the embryo of the seed of Orchids is always arrested in the pro-embryo stage,

* For fuller details the reader is referred to a paper by Prof. Oliver, *Journ. R. Hort. Soc.* vol. xxi. p. 486.

it seems that it now cannot start into growth without the stimulus excited by the endophyte.

This appears to account for the difficulty florists experience, and the right course to pursue is to sow the seed on soil taken from the pot in which the same species had been grown for some time, as the soil will have become thoroughly impregnated with the particular species of *Fusisporium* required.

So important is it believed to be that tubers cannot be formed unless the plant has been entered by the fungus through the roots beforehand. This not only applies to Orchids, but the Lesser Celandine and even Potatos. Experiments appear to show that if the fungus is withheld the underground shoots of the Potato are merely prolonged without their forming tubers at all.*

Parasitic and Saprophytic Roots.—Many flowering plants have acquired the property of attaching themselves to the roots of others and thereby extracting nourishment from them. They thus become parasitic. There is every degree between a perfect parasite which has lost all power of making starch, by having no green leaves or chlorophyll, and a plant with green leaves capable of supporting itself, yet having the power to become a parasite. Thus, while Broom-Rapes (*Orobanche* sp.) cannot live apart from a host-plant, the parasitic Cow-Wheat (*Melampyrum pratense*) can not only be a saprophyte as well—that is, nourish itself in decayed organic matter—but be independent of either means of support, though it has been discovered that its power of assimilating the carbonic acid of the air, and thereby making starch, is much enfeebled by its having acquired a parasitic habit.

The means by which a parasitic plant becomes attached to the host-plant begins with a growth in the epidermis and underlying cortical tissue, this being excited by the contact and then by multiplying the cells till a sort of pad is formed and applied to the root of the host-plant. Then vessels (tracheids) are formed extending from those of the root down the middle of this pad-like "sucker" till they reach and unite with the vessels of the root of the host-plant, and so the connection is effected and nourishment is drawn up into the parasite.

Saprophytes are plants which, as a rule, have no true and really green leaves, but live on decayed vegetable matters in the soil. As all plants do this, they are in a way saprophytic, but having retained their green leaves are not so called; moreover, they can assimilate carbonic acid. As an example is the common Bird's-nest Orchis (*Neottia Nidus-avis*), which is found in the dead foliage of Beech woods. The rhizome of this plant abounds with an endophytic fungus.

Epiphytic Roots.—Both the preceding must be distinguished from epiphytes, whose roots only cling to the external support, such as rocks, trees, &c., but derive no nourishment from them.

Thus tropical Orchids have long roots of a peculiar kind, the epidermal

* The above discovery appears to require confirmation as far as *all* tubers are concerned, for tubers may be formed in the axils of the leaves of the plants, and it is not clear how these could be infected by the fungus. The reader is referred to a series of papers in *Rev. Gén. de Botanique*, 1902.

cells of which form a strongly adhesive surface, by which the plant is firmly fixed. Moreover, when these aërial roots are green they can decompose carbonic acid; and lastly, being of a spongy texture, they can absorb water with great ease.

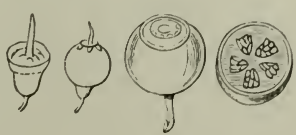
The aërial climbing roots of Ivy have no other function than, by firm adherence to a wall, rocks, or trees, to enable the plant to reach great heights, and so get to the sun and free air.

Symbiosis.—The nodules on the roots of leguminous plants are now well known to contain microbes, which, by some unknown means, are capable of "fixing" the nitrogen of the air which is then conveyed to the host-plant. This appears to account for the large amount of nitrogenous products in the seeds, &c., of such plants, as of Beans, Peas, and especially Lentils. Hence leguminous species are useful for manuring the soil, especially if dug in green, as they are then very easily decomposed. This was a plan adopted by the ancients, who discovered the value of leguminous plants (as Lupines) without knowing the reason why they are so nutritious when ploughed in.

Mechanical Force of Roots.—One other feature must be mentioned, and that is the enormous power that roots possess, both under the soil and by insinuating themselves among rocks, under walls, &c. A tree may often be observed raised above the ground, being supported by its great and now exposed, radiating roots. Those roots were at first altogether under the soil, but as they increased in diameter, the earth acting as a fulcrum, they raised the base of the trunk into the air; the soil being gradually washed away, the present appearance is the result.

With regard to the destruction of masonry, Sir J. D. Hooker writes as follows, in his "Primer of Botany" (p. 38): "In shrubs and trees the root-fibres as well as the tap-root thicken as they grow, become woody, and displace the earth laterally as well as in front; and with such force does growth go on that stones of walls are frequently displaced by roots. In tropical countries the destruction of buildings is often caused by the power of growing roots; and neither conquering nations, nor earthquakes, nor fires, nor tempests, nor rain, nor all put together have destroyed so many works of man as have the roots of plants, which have all insidiously begun their work as slender fibres."

As another remarkable case, the following may be mentioned. In the Pine wood along the northern slope of Table Mountain there is a combination of three "Stone" Pines. Their roots are more or less welded together at the base of the trunks. They stand upon a granite platform which the roots have upheaved to an astonishing degree. Many large, flat blocks are standing on edge partly embedded in the trunk; others are heaved up about them, and the granite base itself is raised throughout an area of about seventy feet in circumference!



INTERNAL STRUCTURE OF STEMS.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

[Lecture to the Students at the Society's Gardens, July 2, 1902.]

On cutting any rather soft herbaceous stem of one year across, within the *epidermis* or skin, will be seen a mass of colourless tissue, except near the circumference, where it is green. Just within this green layer will be seen a circle of dots. These are the cut ends of the so-called "fibro-vascular bundles," which for brevity I shall call "cords."

In order to support such a stem various kinds of tissues are resorted to, one of the commonest being called *collenchyma*, which might be translated "gluey-tissue." This consists of elongated several-sided cells, having the angles greatly thickened. It is found on the periphery of the stem, often forming external columns, as at the four corners of the square stem of the Dead-Nettle.

Another kind of supportive tissue on the circumference is called *sclerenchyma*, or "hard-tissue." It consists of long fibres with very thick walls. Thousands of these cells compacted together form very strong strands. They may be seen externally in the vertical raised lines on the stems of Docks.

If a stem becomes woody, as in shrubs or such herbs as Fuchsias, then the number of cords increases till they form a compact cylinder, separating off the pith or *medulla* in the middle from the *cortex* on the outside, while these cords are generally kept apart in places by means of the flat ribbon-like *medullary rays*. This cylinder of wood prevents the shoot from breaking under flexure.

We must now consider the structure of a woody shoot.

The tissues form two well-marked groups, the "cortical" and the "central cylinder," in an ordinary stem of a dicotyledon.

Within the epidermis is the active, growing layer out of which not only are *collenchyma* and *sclerenchyma* formed in herbaceous shoots, but the cork of woody ones. This layer now takes the name of *phellogen*, a Greek word meaning "cork-generator." When the leaf falls in autumn it is because this layer is formed right across the base of the leaf-stalk, and as the cells die as soon as they become cork the leaf is attached to a dead layer, so that it then falls away on a puff of wind.

The epidermis, cork, and phellogen are colourless, so that light penetrates to a deeper layer which becomes green by the development of chlorophyll granules under its influence.

The inner boundary of the cortex consists of a cylinder of cells which not infrequently contain starch held in reserve. Hence it is sometimes called the starch-layer as well as *endoderm*, that is, the "within" or lining skin; just as epidermis means the "upon" or superficial skin.

The usual difference between the stem of a dicotyledon and a monocotyledon is, that in the former the cords form a compact cylinder of wood having the *cambium*, or active layer which forms a fresh cylinder of wood, outside that of the previous year; whereas in a monocotyledonous stem the cords are scattered about, apparently without any order, as may be seen in a stem of Asparagus.

The central cylinder of the stem of the former commences with the *pericycle* immediately under the endoderm of the cortex. The cords abut against it. Each cord consists of *phloem*, *cambium*, and *xylem*. The first is composed of "sieve-tubes" and "companion-cells." The cambium is the permanently active layer, and then follows the wood, consisting of wood-fibres and vessels; within is the soft pith or medulla, this and the pericycle being connected by medullary rays. In a monocotyledon, as the cords are isolated, the cambium in each becomes useless, as it cannot form a united cylinder of wood, so that the stem, as a rule, cannot increase in diameter after it has attained its full size.

The pericycle, however, often undertakes some active work in compensation for the loss of the cambium, as in those liliaceous trees like *Dracæna*, which branch. In these the stem can increase in size.

The pericycle often plays an important part in herbaceous as well as woody stems. Thus, in all which are characterised by having a fibrous bark, as Hemp, Flax, Vine, Clematis, Honeysuckle, &c., it is this layer which makes fresh quantities of fibre every year in such as are perennials. The result is that the whole of the cortex outside of the pericycle is sometimes thrown off, and this originally deep-seated layer supplies the dead fibres which appear as a ragged coat on the surface of older shoots and stems.

In many annual flowering stems of monocotyledons, the pericycle gives great rigidity; for *all* the cords seen in a cross section are included within the pericycle; just as in a dicotyledonous stem, though situated irregularly in the monocotyledon. The pericycle may then form a dense sclerenchymatous sheath, giving great stiffness to such flower-stalks as of the Lily of the Valley, Ixias, &c.

Another use of the pericycle which is generally present in roots, though often in abeyance in stems, is to produce the secondary and other rootlets and root-fibres. These always arise from the pericycle, making their way through the overlying cortex by dissolving the tissue, and in fact living upon it, until they make their exit at the surface. This absorbing process is done by a "pocket" over the top which secretes a ferment capable of dissolving and digesting the mother-tissues in front of it.

In Tree-ferns a somewhat different arrangement and structure of the cords exist, in that, while being for the main part of their length separate, yet they join at intervals, so that if the whole could be isolated the cords would form a sort of network.

Very anomalous structures are seen in woody climbers, as the Lianes of tropical forests. These arise in consequence of the various strains to which their enormously long stems are inevitably subjected. Hence they must be flexible, elastic, and tough, acting as they do precisely like powerful cables.

These qualities are secured in various ways, as by a great increase in the size of the medullary rays and by their being almost like cork, in Bignonias. In others longitudinal ribs are produced, and the whole stem becomes twisted so that it closely resembles a cable of many strands. Such occur in the members of the order *Malpighiaceæ*.

In fact, the anomalies of woody climbers are innumerable.

HOW FRUITS ARE MADE.

By Rev. Prof. G. Henslow, M.A., V.M.H., &c.

[Lecture to the Students at the Society's Gardens, July 9, 1902.]

The Effects of Pollination and Fertilisation.—In considering how fruits are made, it is very obvious to all that in most cases, if no fertilisation has taken place by means of the pollen, the fruit falls prematurely without "setting"; but it is equally true that in some cases the ovary may swell and grow into an edible fruit without any seeds being present at all. Thus, we have grocers' currants and sultana raisins, both these being forms of seedless grapes; there are also seedless oranges, bananas, cucumbers, and pines.

This may result from either of two causes. In the case of grapes and oranges, it would seem that the effect of pollination is to introduce a stimulus to the growth and development of the ovary only. This frequently occurs in artificial hybridisation. Thus a large fruit is often formed by crossing Orchids, promising great things to the hybridiser, but it may finally be found to contain nothing but hairs and no seeds at all.

The usual effect of pollination is, of course, the fertilisation of the ovules, which then become seeds, each containing an embryo. Simultaneously with this, the ovary enlarges and acquires the characters of the fruit, peculiar to its kind.

Further, in many fruits the axis or floral receptacle takes part in forming the fruit, in the popular sense of the word. The enlargement and changes undergone in so doing are primarily the indirect effects of pollination.

We thus find the floral receptacle of the Strawberry can develop into an enormous mass of succulent tissue whereon are situated the true fruits in the form of seed-like bodies called "achenes." As another instance, the "hip" of the Rose is a hollow "receptacular tube" containing numerous and separate achenes.

In some instances pollination affects other accessory parts, as the calyx of the Mulberry. Of every little flower of the cluster which makes the "fruits," the four sepals become fleshy and purple, constituting the edible part, the true fruit or pistil in the middle being dry and seed-like.

Such have been called "pseudocarps," or "false fruits," since the edible part has nothing to do with the pistil, out of which the fruits are made.

As other examples, the cup of the acorn, of the Beech-mast and of the Spanish chestnut, as well as the leafy cupule of the Hazel and Hornbeam, are "after-growths," which would not have occurred had the seeds not been formed within the fruit by fertilisation.

So that, when we think of the importance of pollination for the fertilisation of the ovules, we must remember that everything else results indirectly from the stimulus set up in consequence of pollination, with or without fertilisation.

In other cases "pseudocarps" may be formed without any pollination, and even without there being any flower at all.

In many instances the ovaries are invested by a receptacular tube, *i.e.* "inferior" ovaries, as they are called; since this is of the nature of an axis, it may swell into a fruit-like body, even when the flower within it has been totally arrested.

This occurs in Pears, as the "Bishop's Thumb," and in the not uncommon condition of "pears on pears," as it might be called. In these several internodes of a branch swell into "pears" one above the other, there being no trace of a flower at all.

This method may account for some seedless Cucumbers and Bananas, both being "inferior" fruits.

Fruits of a Single Carpel.—To see how fruits of complicated structures arise from more simple conditions, it will be as well to begin with those having a single carpel only, like the familiar pea-pod.

A carpel is really an altered leaf. We must imagine the two halves of the leaf-blade to be folded together, as is so frequently the condition of young leaves when escaping from buds in spring. The margins are greatly thickened, as they have to carry and nourish the ovules. They are then called the "placentas." Fibro-vascular bundles now pass up them, sending off a little branch to each ovule. These vascular cords are wanting in an ordinary leaf. Then the lower part swells into a bag-like structure called the "ovary," which encloses the ovules, forming two rows along the two cohering margins. The upper part is drawn out into the style, the apex of which, having no skin or epidermis, is composed of projecting cells which catch and retain the grains of pollen. Such is the origin of the pea-pod.

The pollen-grains send down long tubes which enter the ovules and convey fertilising matters, by means of which an embryo is formed in each ovule.* As the embryo is formed, so the carpel grows and becomes the pod, the ovules becoming the peas or seeds.

When perfectly ripe the pods burst by contracting on drying up.

There are two ways in which such pods burst or dehisce. The pea-pod, called a "legume," splits down both edges into two halves, often curling up so that the seeds are scattered to a distance. The edge bearing the peas is called the "ventral suture," the other is the "dorsal suture," as it corresponds to the midrib of the carpellary leaf.

If the pod burst down one edge only, it is called a "follicle." This usually bursts by the ventral suture, as in Larkspur and Aconite; but in Magnolias, in which the pistil is composed of a dense mass of almost woody follicles, the seeds could not escape by the ventral, so Nature lets them out by the back door, or dorsal suture, instead.

If a pod contain only one seed, it generally becomes a tight-fitting covering to it, and is consequently indehiscent. This occurs in the Sainfoin. It is then the same thing as the achene. Familiar examples of this are the fruits of the Buttercup, Strawberry, and the achenes inside the hip of the Rose. Sometimes a legume forms a string of indehiscent parts investing each seed, being strongly constricted between them. It

* It is unnecessary to enter into minuter details of the process on this occasion.

breaks up into as many pieces, each containing a seed, and is indehiscent. Such a legume is called a "lomentum." It occurs in *Hedysarum coronarium*, cultivated in Malta as the 'Maltese Clover.'

The influence of pollination as well as the want of it is sometimes well seen both in pods and Strawberry fruits. In the former a constriction may often be noticed at one or more places where a pea is wanting. This is due to the fact that the ovules at those places happened not to get fertilised, so the pod also failed to enlarge. In the Strawberry, a little depression may sometimes be seen, where the achenes are crowded together, and the receptacle may be less or not at all coloured red. This is likewise due to the fact that by some mischance those individual carpels failed to get pollinated and their ovules to be fertilised. The receptacle in consequence failed to swell at that point. Again, Vegetable Marrows sometimes are suddenly constricted towards the stalk end. This is because only those ovules nearest the stigmas were fertilised.

In some cases the single carpel forming the fruit takes on a fleshy character, forming a sort of berry, as in the Baneberry and Barberry; but a commoner alteration is for the carpel to form a strong lining in addition to the soft flesh. Such a fruit is called a "drupe," and is seen in the Cherry and other members of the genus *Prunus*.

In the drupe the three layers have been distinguished as follows: The outer skin is called the "epicarp," the flesh is the "mesocarp," and the stone is the "endocarp," the three constituting the "pericarp," previously called the "ovary."

The fruit of the Raspberry and Blackberry is a cluster of tiny drupes, called "drupels."

Compound Fruits.—In by far the greater number of fruits the ovary, instead of being that of a single carpel as in the preceding cases, is composed of two or more coherent into one body, forming the so-called "compound" fruits.

They can be united in two ways. In one, the carpellary leaves are "open," *i.e.* not coherent by their edges as in a pea-pod, but resembling a bursting follicle. Each carpel is now joined to its neighbour, edge to edge. The result is a *one-celled* chamber, with rows of ovules down the wall of the ovary. This occurs in Violet and Mignonette fruits.

In others, and more generally, the carpels are closed from the first, like two or more pea-pods placed with their placenta-bearing edges in contact and then compressed, so that their sides cohere. We thus get a two, three, or more celled ovary, carrying the ovules down the angles in the middle, as may be seen in St. John's Wort, Lilies, Daffodil, &c.

Sometimes the partition-walls, or "dissepiments" as they are called, cease to grow with the fruit, so that a central column is formed out of the placentas. This occurs in the Pink family.

In the Primrose, in which there is a somewhat similar column called a "free central placenta," it would seem that it is formed of five "open" carpellary leaves, united by their edges; but only the basal parts of the marginal placentas, which swell up into a coherent column, bear ovules.

In some fruits this central support is not formed, so the ovule or ovules appear to arise from the bottom of the ovary, and are called "basilar." Such occurs in the achene-like fruit of Docks and in all Composites.

In all cases of Angiosperms at least, ovules appear to arise really from the edges of a carpellary leaf, and *not* from the floral receptacle or axis, as has been sometimes thought to be the case. There are many kinds of compound fruits, which may be grouped as *dry* or *fleshy*. Some are dehiscent, others are indehiscent.

The general term for a dry dehiscent fruit is "capsule," but there are several kinds which have received special names. Only the most important will be here mentioned.

In the Wallflower and most other Crucifers it is a long pod-like structure composed of two "open" carpels. It is called a "siliqua." Very small ones are called by the name "silicula," as of the Shepherd's Purse. They burst by two "valves" splitting off from below upwards, leaving a framework constructed out of the two opposite placentas. These are connected by an intermediate plate, formed by outgrowths from the placentas, which have united down the middle. It is called the "false dissepiment," because it is not formed by the sides of coherent "closed" carpels, as of a Lily.

In the Poppy "head" the several "open" carpels are united in a similar way, and have similar false dissepiments, but they do not meet in the middle as in the siliqua. These dissepiments carry the ovules, and their use is to convey the pollen tubes down to them, from the radiating stigmas in the Poppy, which may be seen outside on the top.

The Cocoanut is another interesting fruit. In the flower the pistil has a three-celled ovary, like that of a Tulip ; each cell should have two ovules at least, but only one gets fertilised out of the six. As this one grows the other chambers of the ovary get pushed aside (the same occurs in an Acorn), and the carpels now take on two distinct parts ; the outer part becomes fibrous and forms the enormous husk, the inner part becomes the shell. The one seed is the edible content, but the embryo is not inside. To find it, the one penetrable "eye" must be cut out like a plug and split down the middle, wherein the embryo will be discovered. The two "blind eyes" correspond to the two suppressed and abortive ovary-cells.

In the Henbane (*Hyoscyamus*), Poor Man's Weatherglass (*Anagallis*), and Plantain, as well as the Red Clover, the top of the fruit comes off by a circular dehiscence. The name given to this is a "pyxis" or "box."

In the Geranium the five carpels meet and are united in the middle, the styles being greatly elongated. In dehiscing each separates from a central support, composed of the coherent and elongated marginal placentas of the carpellary leaves.

In Balsams, closely allied to Geraniums, they acquire a high state of tension when ripe, so that the slightest touch causes the five carpels to separate and coil up, thereby throwing the seeds to a great distance. The siliquas of the Bitter-cress (*Cardamine hirsuta*), of the Crucifer family, behave in a similar way.

Of indehiscent, dry, compound fruits, there are the winged kinds, known as the "samara," and seen in Maple, Sycamore, Elm, and Birch, the wings being outgrowths from the backs of the carpels.

Achene-like fruits occur, as in grains of Corn (of two carpels), fruits of

Dock and Buckwheat (of three carpels). Of fleshy fruits are the familiar Grape, Potato, Tomato, Holly (the stones belong to the seeds), Mistleto, &c., in which the combined carpels form a fleshy covering to the seeds by the internal layer between the inner and outer epidermis becoming thick and juicy.

In the Orange it is different. The juicy tissue is formed of innumerable *hairs* which grow from the inner epidermis of the numerous carpels. Those hairs have swollen ends full of juice, and, being of different lengths, they fit in tightly together, thereby making a sort of false tissue.

The drupe is also imitated in compound fruits, as in an Olive, which is composed of two carpels; the outer part is oily, the inner forming the stone.

Inferior Fruits.—These are the result of flowers with inferior ovaries; that is, they are invested by a receptacular tube. The dry forms are seen in Daffodils, the "inferior capsule" of which bursts through the backs of the three carpels. In Orchids, three valves split off, leaving a framework of three placentas, as described in Crucifers.

Several dehisce by "pores," as Campanulas, just as Poppies and Snapdragons do, which are not "inferior" but "superior" capsules.

Of indehiscent dry, inferior fruits, the Umbellifers have two-carpelled achene-like compound fruits. When ripe, each carpel is detached from a Y-shaped support, formed from the combined placentas of the two carpels. The whole is called a "cremocarp," *i.e.* "suspended fruit," while the halves or separated carpels are "mericarps," *i.e.* "divided fruits."

The Acorn, Beech-mast, Spanish Chestnut are all inferior fruits and indehiscent, being composed of two or more carpels. As a rule all the ovules are arrested except one, as in the Cocoanut.

As with superior fruits, so are there many fleshy inferior ones. The word "berry" is restricted by botanists to the latter, though popularly used for any fleshy fruit without a stone. Hence a Gooseberry and Whortleberry with the remains of the calyx on the summit are true berries.

In the Bryony and other members of the *Cucurbitaceæ*, this usually distinguishing mark of a true berry is wanting, as the calyx articulates at the base and falls off.

In Apples and Pears, which carry the remains of the calyx, and sometimes the stamens at the top, the fruit is mainly composed of the receptacular tube. This not only encloses the carpels, as the hip of the Rose, but is *adherent* to them. This is done by the *inner* skin of the tube and the *outer* skins of the carpels being suppressed, so that the *two* intermediate tissues, *i.e.* of the tube and of the carpel, coalesce, the core representing the inner lining of the carpels, and is the only part readily detected. Such a fruit is called a "pome."

In the *Cucurbitaceæ*, the fruit of the Melon, Cucumber, and Gourd is known as a "pepo" and is somewhat peculiar. If a thin slice of Cucumber be held to the light, it will be seen that the placentas look like three anchor-shaped processes radiating from the middle, having the seeds suspended and facing the centre.

The peculiar arrangement is formed as follows :—The three carpels have their non-coherent edges facing the middle as usual, but their six margins or placentas, instead of uniting, grow outwards again till they reach the circumference. Then, turning round, they once more face the middle, and so bear their seeds standing in that direction. The outer wall acquires the well-known tough rind-like character ; but all the soft internal part of the ovary becomes succulent and juicy, completely filling up the cavities of the three ovary-cells, and so form the compact mass of the Cucumber, but the Melon remains with a central cavity.

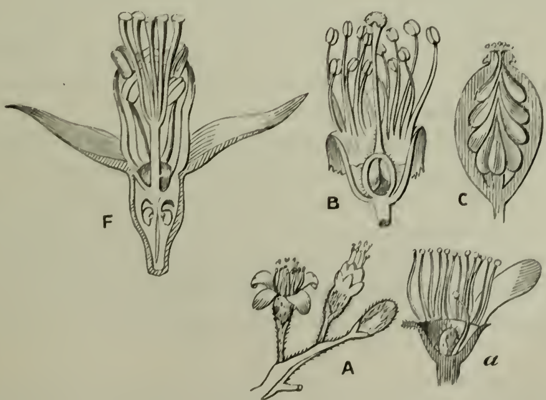
CONFLUENT FRUITS.—Of these the Fig, Mulberry, and Pineapple are familiar examples.

The Fig consists of a bag-like receptacle formed out of the flower-stalk or peduncle and closed by minute scales at the "eye." Just inside of the eye and spread over the top of the internal cavity *may* be male flowers ; but as a rule there are none, being (with rare exceptions) only found in the "wild" or *Caprificus* Fig. All the rest of the flowers in a Fig are female, and usually abortive. The pistils of the minute female flowers consist of two coherent carpels ; the outer part gelatinises, while the inner hardens and resembles a seed ; but it never contains one in the ordinary edible Figs.

The Mulberry fruit, as stated above, consists of a cluster of female flowers in which the calyx alone becomes edible, the pistil forming a seed-like body within it.

GYMNOSPERMOUS FRUITS.—These have no pistil at all, and it is only the ovules which become naked seeds, with or without accessory appendages.

In Pines the confluent fruit is a cone consisting of carpellary scales with seeds, often winged when ripe. In Cypress, Thuyas, &c. the scales assume a peltate character, giving a globular form to the fruit, called a "galbulus." In the Juniper there are only three scales, with one ovule at the base of each. On ripening they close up, forming the so-called "berry." In the Yew the single seed is somewhat stony and remains green, but a fleshy cup grows round it, being an outgrowth from the axis.



MENDEL'S PRINCIPLES APPLIED TO ORCHID HYBRIDS.

By Charles C. Hurst, F.L.S., F.R.H.S.

(*Second Paper.*)

In the first paper (vol. xxvi., pp. 688–695) I endeavoured to show the value of Orchid hybrids for observations in heredity.

As an illustration of this I gave the results of analyses of the inheritance of 4,548 pairs of specific characters in the first generation, in accordance with the methods adopted by Mendel, and detailed in his remarkable paper, a translation of which was given in the Society's Journal, vol. xxvi. p. 1.

As a result of these observations, the following may be laid down as a general rule:—

That in Orchid hybrids of the first generation single specific characters are inherited in all degrees of blending; forming, on the whole, a perfect series between the respective characters of the two parents.

This result in Orchid hybrids differs materially from that obtained by Mendel in his first crosses with races of Garden Peas.

In Mendel's experiments one parental character always proved dominant over the other one, giving no intermediate forms. The reason of this apparent discrepancy can, I think, be easily explained on the basis of the difference between specific and racial characters. But as the question of dominance or intermediacy in the first generation is only of secondary importance, I will leave its discussion for the present, and at once proceed to that more vital question, the separation of characters in the second generation.

From both the biological and the practical points of view, the most important and far-reaching result of Mendel's experiments is the brilliant speculation by means of which he explained his practical formula for the separation of characters in the second generation.

Mendel's theory may be briefly described as follows:—

That the determinants of each single character in the germ-cells of hybrids (both pollen and egg-cells) are pure and not hybrid in their nature: representing alternately the respective character either of the one parent or the other of the hybrid, but not both.

For instance, the hybrid Orchid *Paphiopedilum* × *Leeanum* is the product of the two species *P. Spicerianum* and *P. insigne*.

According to Mendel's theory, the germ-cells of *P.* × *Leeanum* will not contain hybrid determinants for any single character, but one germ-cell will contain determinants of pure *P. Spicerianum* for that character, while another germ-cell will contain determinants of pure *P. insigne* for that same character; the process being apparently according to the law of chance.

Of course, when all the single characters are taken into account together, each germ-cell would naturally contain determinants of both

P. Spicerianum and *P. insigne*, but according to Mendel's theory there would be no determinants of the hybrid *P.* × *Leeanum* itself.

This theory of Mendel is evidently quite different from anything that has been advanced before, and if proved, will undoubtedly revolutionise all previous theories of heredity.

This in its turn would materially alter the present aspect of biology towards Evolution.

It is obvious that Mendel's theory of the purity of the determinants can only be tested by experiment, and in Orchids it can be tested by breeding from the hybrid *P.* × *Leeanum* or any other primary hybrid and observing the results.

Mendel tested his *Pisum* crosses in two ways only: firstly, by self-fertilisation of the first crosses, and secondly, by re-crossing the first crosses with one or other of their own parents. I have already carried out these two experiments with the hybrid *P.* × *Leeanum*, but the results have not yet come to maturity: nor is there, so far as I know, sufficient material available at present to test the matter in these two ways.

But, fortunately, we are by no means confined to Mendel's two methods; there are other ways open equally reliable as a test. One of these is immediately available, and that is the crossing of the hybrid *P.* × *Leeanum* with another species (distinct from its own parents), namely *P. Boxallii.*

During the past four years, forty-nine hybrids of *P.* × *Leeanum* ♀ crossed with *P. Boxallii* ♂, and *vice versâ*, have flowered in my collection, out of about sixty plants of that cross under raising, and these have given a fair opportunity for the study and the practical application of Mendel's theory. I may say in passing that there is no intrinsic difference perceptible in the reverse cross.

In accordance with the recognised rule for naming Orchid hybrids, these secondary hybrids are all to be considered forms of the original *P.* × *Hera*, raised by Messrs. J. Veitch & Sons, of Chelsea, in 1892.

For the purpose of this paper the forty-nine individuals of *P.* × *Hera* will be distinguished by the numbers given them in the order in which they first flowered; though a few of them have already received varietal names on account of their horticultural merits.

The accompanying photographs give a good idea of the flowers of thirty-two of these hybrids which happened to flower together last winter. It will be noted that the variation in these hybrids is remarkable; indeed, of the forty-nine already flowered no two are exactly alike, and the extreme forms are very distinct indeed. With such a wide range of variation in all the different characters of form and colour, it is impossible to classify them with any pretence to scientific precision; but if we follow Mendel's method and select a single character, we can then group them easily.

When I first examined these hybrids in the light of Mendel, I selected, as the single character, the colour of the dorsal sepal of the flower; as this seemed to me to be the most conspicuous character, and probably the most useful one from the practical point of view of the Orchid-grower.

But after a more detailed examination of the hybrids, their parents and their grand-parents, I felt bound to come to the conclusion that the colour of the dorsal sepal could not in any sense be regarded as a single Mendelian character, but was undoubtedly a composite one, made up of three distinct characters, viz.:—

(1) The ground-colour; (2) the various markings upon the ground-colour; and (3) the median band, bar, or stripe.

These three characters seem to be inherited independently of one another, with hardly any correlation, and the different combinations of these three characters serve to make up the colour of the dorsal sepal of the flower.

Having finally selected these three single characters, each of course to be considered separately, on its own merits, the next question was to see if they fulfilled the other conditions laid down by Mendel. In Mendel's experiments he found that, to test the matter fairly and thoroughly, the characters must not only be *single*, but also *differential* and *constant*.

That each of these three characters fulfils both these conditions is evident for the following reasons:—

1. They are differential because in their nature they are specific, *i.e.* peculiar to the species, and for that reason are perhaps even more suitable for investigations in heredity than the more or less artificial races used by Mendel. At the same time it must be admitted that they have a certain disadvantage in being of the blended or intermediate type of inheritance in the first generation, rather than the dominant or exclusive type of Mendel's races.

But this disadvantage, I find, is more apparent than real, and though no doubt more complex to work out, yet the results are equally reliable if the investigator possesses an intimate knowledge of the material with which he is working.

2. That these specific characters are constant as well as differential and single is also obvious because they belong to natural species, whose parents and ancestors have practically been the same specifically for many generations, and thus they should be less liable to reversion or change than mere racial or varietal characters whose origin and fixation must have been comparatively recent. In other words, the question of ancestry is practically eliminated. If necessary, a further proof of this is to be found in a study and comparison of the different varieties of the three natural species with which I have been working, viz.:—*P. Spicerianum*, *P. insigne*, and *P. Boxallii*; all three being clear-cut and well-defined species. Of the three, *P. insigne* is certainly the most variable, covering apparently a wider area of country than the other two; but however much its varieties vary among themselves, they still all retain their specific characters intact, as do the comparatively few varieties of the other two species.

Having satisfied ourselves that the characters selected fulfil the conditions laid down by Mendel, we can at once proceed to the details of the investigation.

It will be remembered that we set out with the idea of testing Mendel's theory as to the purity of the single character determinants in the germ-cells of hybrids.

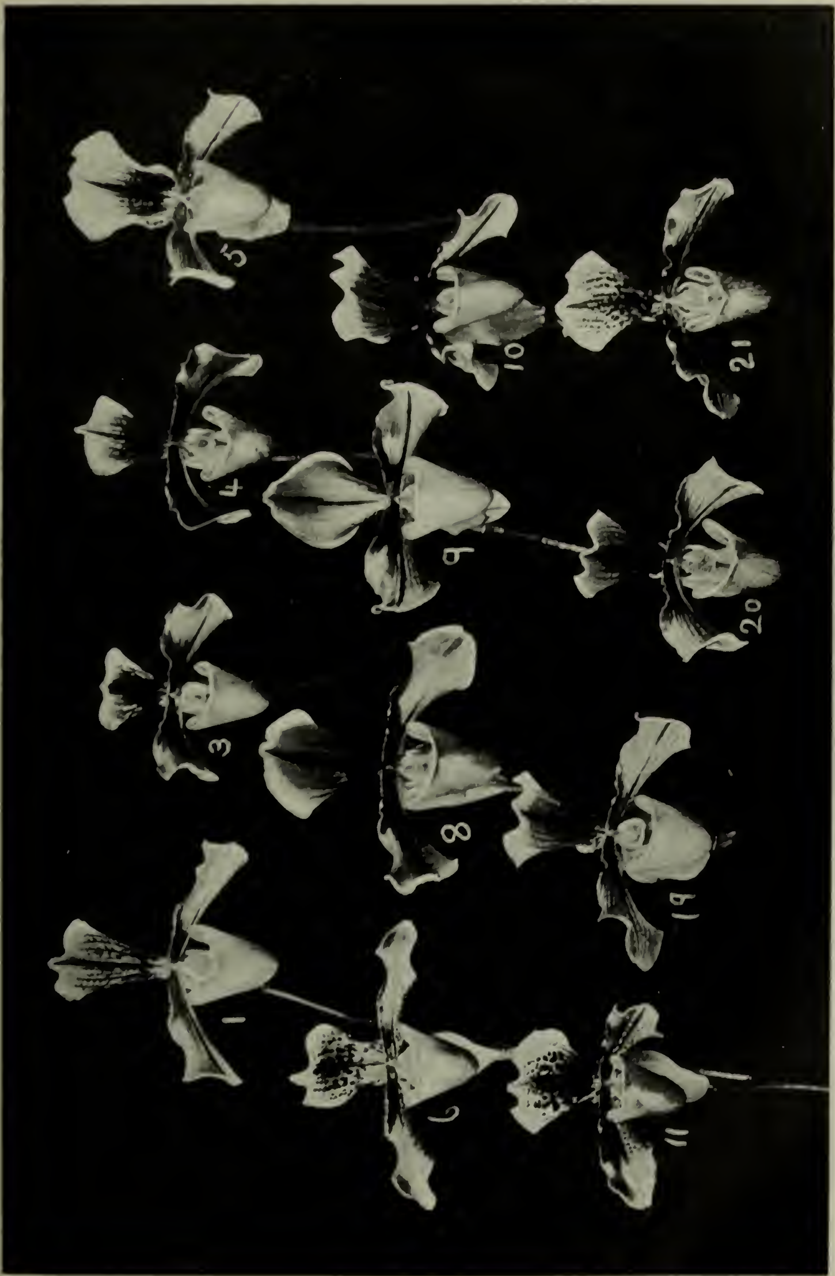


Fig. 167.—Paphiopedilum × Hera, vars. (P. × Leeanum × P. Boxallii).

To do this, we have selected the hybrid *P.* × *Leeanum* (the product of *P. Spicerianum* and *P. insigne*), and have crossed it with the species *P. Boxallii.*

Fig. 168.—Paphiopedilum × Hera, vars. (P. × Leeanum × P. Boxallii).

For the sake of convenience and brevity we will call *P. Spicerianum*, S; *P. insigne*, I; *P.* × *Leeanum*, SI; and *P. Boxallii*, B.

Our forty-nine hybrids of *P.* × *Leeanum* crossed with *P. Boxallii* will therefore be SI × B.

Now, if Mendel's theory be correct, the hybrid SI will form determinants of any single character in its germ-cells, which will be either S or I, but not SI.

Then, if SI be crossed with B, the progeny will come out for any single character, either BS or BI (on the average in equal numbers, according to the law of chance); and on the other hand they cannot come out as BSI or even SI, if Mendel's theory is correct.

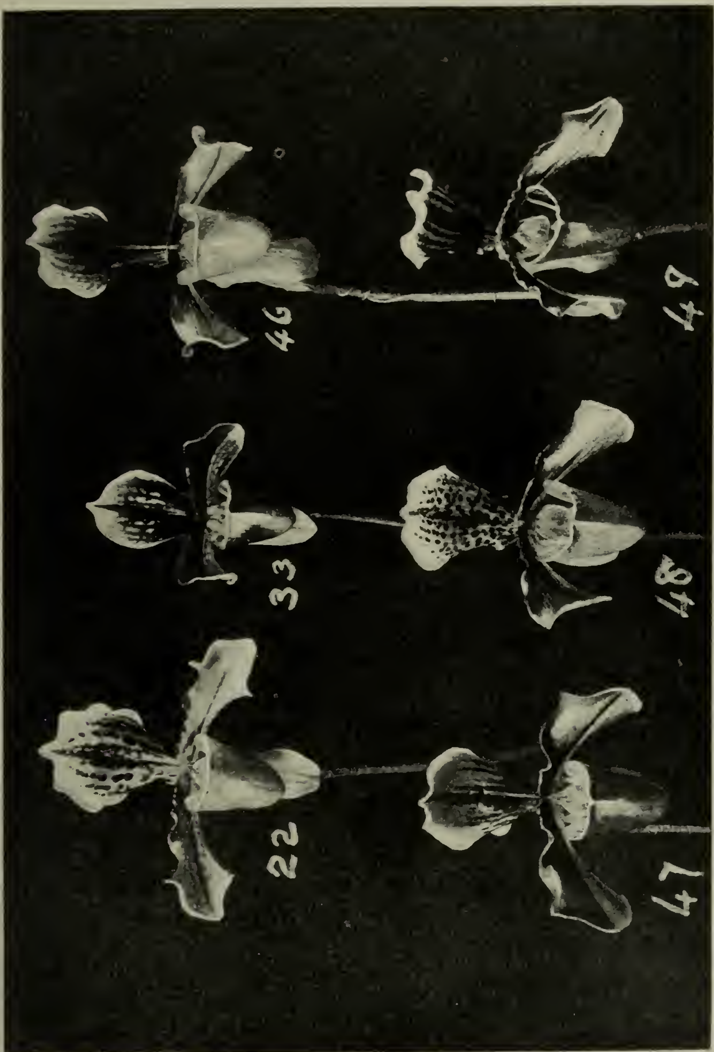


Fig. 169.—Paphiopedilum × Hera, vars. (P. × Leeanum × P. Boxallii).

In order to test the matter thoroughly it is evident therefore that, in addition to the above-mentioned species and hybrids, we must also know the characters of the collateral hybrids BS and BI, so as to be able to compare them with our hybrids of SI × B. Fortunately this is comparatively easy, as large numbers of both BS and BI have been raised, figured, and described. The former BS, the hybrid between *P. Spicerianum* and *P. Boxallii*, is known as *P.* × *Calypso*, and was first raised by Messrs. Veitch in 1891.

The latter, BI, the hybrid between *P. insigne* and *P. Boxallii*, is known as *P.* × *Schlesingerianum*, and was first raised by Messrs. Seeger & Tropp, of Dulwich, in the same year.

Specimens of these hybrids and their varieties are in my collection, so that I have been able to compare them all side by side with my *P* × *Hera* (SI × B) hybrids.

In order that readers may follow the results of my analysis of the forty-nine hybrids of SI × B, and compare them for themselves by means of the photographs, I will give the details of each of the three single characters in the three original species and the three hybrids concerned, that is to say, as far as the poverty of language will permit; for it is a well-known fact that verbal descriptions, try how one may, quite fail to represent the forms and colours of Orchids as they appear to our eyes.

To those who know the species and hybrids concerned in this investigation, the accompanying photographs (figs. 167, 168, and 169) will speak more eloquently than words.

The following are the details of the characters :—

1. *The Ground-colour of the Dorsal Sepal.*

(*a*) In S this is white, with a small green area at the base.

(*b*) In I it is yellow-green, with a broad white apex.

(*c*) In B it is dark green up to the apex, with a narrow margin of white around the edges.

(*d*) In SI it is white in the upper half and yellow-green in the lower half, the size and colour of these areas varying between those of the two parents S and I.

(*e*) In BS it is white in the upper half and dark green in the lower half, the size and colour of these areas varying between those of the two parents B and S.

(*f*) In BI it is yellow-green, with white apex and margins, the size and colour of these areas varying between those of the two parents B and I.

An analysis of the 49 hybrids SI × B, obtained by careful comparison with the above forms in regard to the single character of the ground-colour of the dorsal sepal, gives :—

20 BS, comparable with the various forms of *P.* × *Calypso* (BS), and 29 BI, comparable with the various forms of *P.* × *Schlesingerianum* (BI). In no case does there appear to be either a BSI or SI. In regard to this single character, therefore, the facts are apparently in accordance with Mendel's theory.

2. *The Markings upon the Ground-colour of the Dorsal Sepal.*

(*a*) In S these are generally absent, though there are a few claret-coloured hairs scattered over the white surface of the flower, giving it a rosy tint.

(*b*) In I the ground-colour, except the apex, is regularly covered with spots, which are brown on the green and purple on the white areas.

(*c*) In B the ground-colour, except the apex and margins, is irregularly covered with purple-black blotches, more or less confluent.

(*d*) In SI the ground-colour is partly covered with dots, brown on the green and purple on the white areas ; these dots vary in size and number as they approach either parent, S or I.

(*e*) In BS the ground-colour, except the apex and margins, is covered with stripes and mottlings more or less suffused, purple-black on the green and purple on the white areas ; these markings vary in size and number as they approach either parent, B or S.

(*f*) In BI the ground-colour, except the apex and margins, is regularly covered with large spots, black-brown on the green and dark purple on the white areas ; these spots vary in size and shape as they approach either parent, B or I.

An analysis of the 49 hybrids SI × B, obtained by careful comparison with the above forms in regard to the single character of the markings on the ground-colour of the dorsal sepal, gives :—

26 BS, comparable with the various forms of *P.* × *Calypso* (BS), and 23 BI, comparable with the various forms of *P.* × *Schlesingerianum* (BI). In no case is there among the forty-nine hybrids a form approaching either SI or BSI.

As regards this single character, therefore, the facts appear to be in accordance with Mendel's theory.

3. *The Median Band, Bar, or Stripe of the Dorsal Sepal.*

(*a*) In S this is highly developed and clear-cut, being a solid bar of dark purple extending from base to apex.

(*b*) In I it is quite absent.

(*c*) In B it is somewhat obscure, generally irregular in outline and mostly confined to the upper middle of the dorsal sepal, and rarely extends up to the extreme apex ; in colour it is purple-black, with suffused margins of purple.

(*d*) In SI, when present, it is usually faint, taking the form of dotted or suffused lines.

(*e*) In BS it is well developed from base to apex, and quite intermediate in size and colour between B and S.

(*f*) In BI it is either quite absent or is represented faintly by linear spots of purple-black.

An analysis of the 49 hybrids of SI × B, obtained by careful comparison with the above forms in regard to the character of the median band of the dorsal sepal, gives :—

30 BS, comparable with the various forms of *P.* × *Calypso* (BS), and 19 BI, comparable with the various forms of *P.* × *Schlesingerianum* (BI), there being no case of either BSI or SI.

As regards this single character, therefore, the facts are apparently in accordance with Mendel's theory.

For the sake of clearness and comparison, I have put into tabular

Analysis of Forty-nine Hybrids of
Paphiopedilum × Leeanum × P. Boxallii = P. × Hera.

No. of Hybrid	Ground colour	Markings on the Ground-colour	Median Band
1	BI	BS	BS
2	BI	BS	BS
3	BS	BS	BS
4	BS	BS	BS
5	BS	BS	BS
6	BI	BI	BI
7	BI	BS	BS
8	BI	BS	BS
9	BI	BS	BS
10	BI	BI	BS
11	BS	BI	BI
12	BS	BI	BS
13	BI	BI	BS
14	BI	BS	BS
15	BI	BI	BI
16	BS	BI	BI
17	BI	BS	BS
18	BI	BI	BI
19	BI	BI	BS
20	BI	BS	BS
21	BS	BI	BI
22	BI	BI	BI
23	BS	BS	BS
24	BS	BS	BS
25	BS	BI	BI
26	BS	BI	BI
27	BI	BS	BI
28	BS	BI	BI
29	BI	BS	BS
30	BS	BS	BS
31	BI	BI	BS
32	BS	BS	BS
33	BS	BS	BS
34	BI	BS	BS
35	BS	BI	BI
36	BI	BI	BI
37	BS	BS	BS
38	BS	BI	BI
39	BI	BI	BI
40	BI	BI	BI
41	BI	BI	BI
42	BS	BS	BS
43	BS	BS	BS
44	BI	BS	BS
45	BI	BS	BS
46	BI	BS	BS
47	BI	BS	BS
48	BI	BI	BI
49	BI	BI	BI
Total 49	20 BS 29 BI	26 BS 23 BI	30 BS 19 BI

Sum total . . 76 BS + 71 BI.

form the details of the analyses of the three single characters, side by side, and under the respective numbers of the individual hybrids.

In this way readers may compare for themselves my analyses with the accompanying photographs, which show well the extent of the colour areas and the forms of the markings, if not the actual shades of colour, the last-named really being less differential and consequently of less importance.

From the table it will be seen that the totals of the three single characters added together give 76 BS + 71 BI, which, considering the small numbers used, is a fair approximation to the equality which Mendel's theory presumes.

That is to say, the determinants in the germ-cells of SI are found in equal proportions of S and I, according to the law of chance. As far as these few experiments go, it may, I think, be fairly said that they confirm Mendel's theory of the purity of the determinants in the germ-cells of hybrids: that is, so far as practical results are concerned. The biologist would further require these BS and BI forms to be self-fertilised for several generations to see if they remain pure BS and BI in those characters, as they appear to be on the surface. I have arranged to carry on the experiment in this way, and have already a number of seedlings up, but I fear that some time must elapse before they arrive at the flowering stage. Those readers who read my first paper on this subject (vol. xxvi. pp. 688–695) will be somewhat surprised at the results given above, because at that time I said that I did not see how Mendel's theory could be maintained with Orchid hybrids in face of the facts then before me.

At that time I was under the impression that the whole colour of the dorsal sepal of the flower was a single character in the Mendelian sense. A glance at the table will show that on that basis Mendel's theory could not be maintained, because, if the above three characters were taken together as a single character, the result would work out as follows: Out of the 49 hybrids there would be 11 BS + 10 BI + 28 BSI, which result would of course not be in accordance with Mendel's theory of the purity of the determinants in the germ-cells of hybrids. A short time afterwards I discovered that the apparent single character, *i.e.* the colour of the dorsal sepal of the flower, was without doubt a composite one, made up of three single characters, as detailed above. I therefore decided to postpone the publication of this paper until the hybrids flowered again, with the present result.

Just a word or two, before I conclude, on the practical aspect of Mendel's principles as applied to hybridisation in general and to Orchid hybridisation in particular. While, from the biological point of view, we cannot yet say with certainty that Mendel's principles are proved beyond doubt, yet so far as the matter has been carefully tested in many different genera, and by several independent observers in several countries, there can be no doubt that there is a substantial agreement with the principles laid down by Mendel. In these circumstances I think that the practical hybridist would be wise to adopt Mendel's principles as a working hypothesis and base his calculations upon it. If Mendel be ultimately proved to be right, the hybridist will be justified by his results. If, on the contrary, Mendel's theory has ultimately to be modified (it cannot be altogether disproved), even then I feel sure that the hybridist will not have strayed very far from the truth, and for all *practical* purposes Mendel's principles may be safely accepted as a working formula for the hybridist in general, and the Orchid hybridist in particular.*

* Probably the practical hybridist, who has not time to study the inner recesses of the Mendelian hypothesis, will have some difficulty in applying Mendel's principles in a useful way to the best advantage.

On this particular aspect of the question, I hope to have an opportunity of making a few suggestions in the forthcoming "Orchid Stud Book." In the meantime, those who wish to gain a more detailed insight into Mendel's work and principles will do well to consult Mr. W. Bateson's hand-book on "Mendel's Principles of Heredity" (Cambridge University Press, 1902), in which there is also a most useful and comprehensive bibliography.

FRUIT-TREES IN POTS.

By T. Alfred H. Rivers, F.R.H.S.

[A Paper read before the Horticultural Club.]

The Secretary has asked me to read a ten minutes' paper on pot fruit-trees for amateurs. It is rather a large subject to condense within these limits, but I will do my best under the conditions imposed.

To begin with, "amateurs" is a wide term, including the man with one or two greenhouses and perhaps a rough gardener, and also the man with a large range of houses, a head gardener, and complete staff. I propose to deal with the smaller establishment. The love of flowers is ingrained in most of us; the love of fruit is, I think, natural to all. With pot fruit-trees we combine the two, and have the double enjoyment of the flowers, which are really beautiful, in the spring, and the fruit, equally pleasing to the eye and palate, later on. The amateur who intends to grow them must bear in mind that to do a few trees well is far more satisfactory than attempting a greater number than one can manage properly. He must guard against overcrowding, an error easily perpetrated in the wish to have many sorts of fruit ripening over a long season.

It is desirable to grow the different fruits each in a house to themselves if it can be managed; if, however, one wishes to have a mixed houseful of, say, Peaches and Nectarines and Plums, the latter should be kept together at one end. One can then minister properly to the requirements of each in the matter of ventilation, &c. If a greenhouse, already built, is to be utilised as an orchard-house, efficient ventilation, especially top ventilation, must be provided, if not already there. The best form of orchard-house is a span roof. If a new house is built, it should be not less than 18 feet wide, 4 feet 6 inches to the eaves, and 10 feet to the ridge; the length of such a house may conveniently be from 20 to 50 feet or more. Ventilators, 18 inches wide, hinged at the bottom, run along each side of the house, 1 foot below the eaves, and top ventilators, 2 feet by 3 feet wide, are at intervals of 5 feet alternately on either side of the ridge. Troughing should be provided to catch the rainwater from the roof and store it in a tank, in the house if possible; rainwater is most valuable for syringing. The inside of the house must be kept clean, rafters and glass being thoroughly washed before the trees are set out in the spring. Glass, especially cheap glass, often has little air bubbles in it; these focus the sun's rays like a burning-glass, and burn spots on the tender young leaves beneath, spoiling them utterly or making them unsightly. The effect is most noticeable when the sun blazes out after rain. A dab of paint on the bubbles, inside the house, neutralises their effect. They are often a long way from the seat of injury and difficult to locate. Fruit-trees should be stood on, or as near as possible to, the floor of the house. If a greenhouse, to be converted into an orchard-house, has permanent staging which cannot be entirely done away with, it should be lowered to near the floor level. The pots must not be stood directly upon a slate bench or upon the ground; some cinders should be placed underneath them to insure proper drainage. If on a bench, a good bed of fine cinder ashes is essential to prevent undue evaporation. If the pots are on the ground, a thin layer of cinder ashes all over the surface of the beds gives the house a neat appearance. They are easily raked over and kept clean.

All fruit-trees in pots require repotting every year; this may be done directly the leaves begin to fall in October. The tree is taken out of its pot and the outer soil raked away with a two-pronged claw, till a ball of earth containing the larger roots is left. If the tree is healthy and doing well, the soil which is removed will be full of rootlets, which answer to the leaves on the part of the tree above ground and do duty for one season only. A clean pot, of the same size or of one size larger if necessary, is crocked and filled with soil, rammed fairly tight, to a height which will bring the tree to the same level with the pot rim as it was before. The tree is then placed in the pot, held so that the stem is in the middle and keeps vertical, whilst soil is rammed firmly in all round the ball, and the pot filled up to within about half an inch of the top of the rim. In potting, a little soil should be used at a time and rammed firm with a wooden truncheon before adding more. The soil to be used is a good turfy, fibrous loam, or as near this as is obtainable, three quarters, mixed with one quarter of rotten stable manure; for stone fruits some lime or old mortar rubble should be added. It should be mixed a little time before using and kept under cover, so as not to be sodden with rain when it is required; on the other hand, it should not be allowed to get over dry and dusty. After they have been repotted the trees should be given some water, and may be stood close up together in the house or outside.

In severe weather, outside or in, barley straw should be packed round and over the pots to keep the frost out. Little or no water need be given the trees in the house during November and December. Early in February the trees may be pruned, and in the end of the month the house set out, the trees being placed about three feet apart. A good smoking with tobacco paper should be given, and it is desirable to brush the trunks and larger branches with a mixture of quassia and soft soap, using a hard paint-brush. If the trees have been properly pinched during the summer, pruning is a simple matter of shortening the last season's growth to behind the point at which it was first pinched. Dead wood and that not required to furnish the tree must be cut out. In pruning Peaches and Nectarines the shoots must always be cut to a wood-bud, either contained in a triple eye or solitary, easily distinguished at this time when the flower-buds are rounded and plump. Often they have slender shoots with flower-buds all up them and one wood-bud only, at the tip. These are left intact to carry a fruit or two, and are cut right out the following spring. Supposing the flowers all fall and no fruit set on such a shoot, it should be cut right out at once. If they cannot be properly spaced by pruning, the shoots should be tied into position with a piece of raffia. By March, in a cold house, the Peach-trees will be in full flower; the Pears rather later than the stone fruits, and Apples last of all.

If there are not plenty of bees in the houses to do it, they must be fertilised with a camel-hair brush. Plenty of air must be given at this stage.

When the fruits are set and the leaves growing, the house should be kept closer and the syringe used freely, damping down well at night to obtain a moist and growing atmosphere. Peaches and Nectarines will be found to push too many growths along their shoots ; these would be over-crowded if left, and must be disbudded—that is, about every alternate bud should be cut right out—and most of the remainder must be stopped by pinching out the growing point; only the end bud being allowed to extend, and one or two others required to fill up or cut back to.

When the stone fruits are beginning to swell, dead calyces, &c., must be removed. In most cases the fruits will require thinning ; one must be careful not to do this too thoroughly at the early stage. With Pears and Apples especially, many of the blooms drop without setting at all, others after the young fruits have attained some size, so that until one knows which are going to mature they should be left to themselves.

Peaches, Nectarines, and Apricots do not thin themselves in the same way ; they set as a rule a great many—too many—fruits, all of which would mature, or try to do so, if allowed. They must have their crop reduced to within reasonable limits, and to do this one should go over it at least three times, once just after the fruit is set, again when it is about the size of a nut, and finally after stoning is finished. After Peaches, &c. have stoned, and when Apples and Pears are swelling, the trees must be fed up to enable them to mature their crop ; they should be top-dressed, and may now be given liquid manure about twice a week. Equal parts of horse-droppings and kiln dust are mixed together and made into a bed about a foot deep, which is then saturated with liquid manure. This is ready for use the day after it is made. The mixture is placed on the surface of the soil, about two inches deep, near the rim, sloping down towards the stem of the tree, thus making a hollow to hold the water. It should be renewed when the fruit is colouring. Summer-pinching controls the growth of the tree. When a shoot has made about eight good leaves it should be pinched back to five ; the leading shoot on a pyramid may be allowed to extend rather more. The top shoots on a tree, always the most vigorous, are pinched first ; this keeps them from taking the lead and retaining it. A second pinching of the after-growth is sometimes necessary. Bushes or round-headed half standards of Peaches, Nectarines, and Apricots are the easiest for the amateur to manage ; they approach most nearly to the natural shape of the tree.

When picking Peaches and Nectarines, snip the stalks of the fruit with a pair of Grape scissors ; if one tries to twist it off without doing this the fruit may easily be damaged. The fruits should not be picked just after the tree has been watered, or the flavour will be insipid.

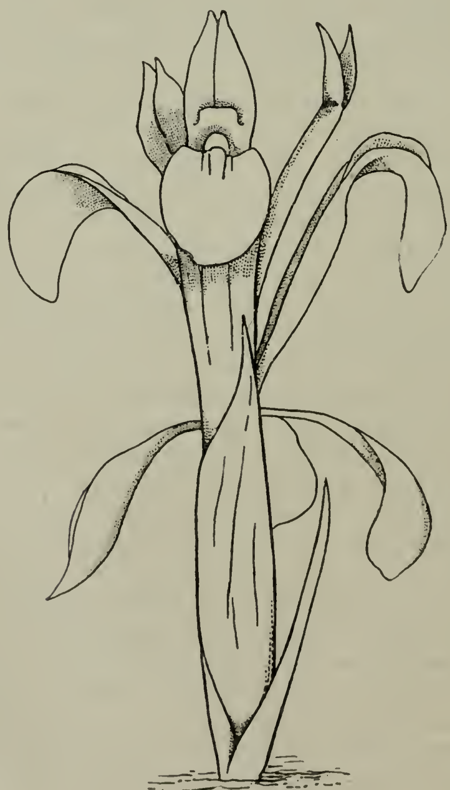
Apples, Pears, and Plums may have their fruit set under glass, and the trees then be plunged in borders outside to ripen it. In this way one can grow more trees than could be fruited in an orchard-house and be sure of getting Pears, which are such an uncertain crop in the open.

Insects are really easy to deal with under glass if never allowed to get the upper hand. Aphides are killed by fumigation with vaporising compounds, which must be used directly they are noticed, and are used with safety at any time even when the trees are in flower. Red spider, the attacks of which are observed at once from the marbled appearance of the upper side of the leaves, thrives in a dry heat. It is kept down by the syringe, used so as to force the water against the under surface of the leaves, and by damping down the house, thus obtaining a moist atmosphere. Syringing must be discontinued as soon as the fruit colours.

A single 4-inch hot-water pipe should run round the orchard-house to enable one to keep out frost when the trees are in flower. A small-sized saddle boiler is sufficient.

There is much more to be said on this subject which cannot come within the scope of a short article such as this; but there is very little difference to-day in the rules for the management of an orchard-house from those given in my grandfather's book, which was first written in 1849 or 1850.

There are at the present time (October 21) at Sawbridgeworth Plums still on the trees of such varieties as 'Coe's Golden Drop,' 'Late Orange' (a splendid pot Plum), 'Grand Duke,' 'Monarch,' 'President,' 'Primate,' &c., and of course many kinds of Apples and Pears are still not gathered.



HORTICULTURE IN EGYPT.

By Lionel Sandars, F.R.H.S.

Horticulture in modern times in Egypt may be said to date from the early years of the nineteenth century, when H.H. Mohamed Ali sent his gardener, a Belgian named Nicolas Bové, to Yemen and India to collect a number of rare trees and shrubs for the Viceregal Gardens. Some of these plants still exist, and may be seen in the Palace Garden at Shubra, a suburb of Cairo.

Then, in the beginning of 1836, the garden at the Island of Roda, famous for its Nilometer and for the Arab tradition that it was there that Moses was found by Pharaoh's daughter, was started by Ibrahim Pasha, who had in his service a Scotchman named James Traill, sent out by the Horticultural Society of London, now the R.H.S. According to Delchevalerie—to whose pamphlet, entitled "Le Parc Public de l'Esbekieh au Caire," I am indebted for much of the past history of gardening in Egypt—such trees as *Jacaranda mimosæfolia* and *Citharexylum quadrangulare*, which are found everywhere, *Mangifera indica*, which does well south of Cairo, *Oreodoxa regia*, *Tectona grandis*, and *Dalbergia Sissoo* were first imported in the time of Ibrahim Pasha.

The garden at Roda is still an interesting place, from the number of trees that can be seen there and nowhere else in Egypt; but the island lies low, and has constantly been washed by the Nile flood, to the prejudice of many of the smaller shrubs and plants that were introduced by Ibrahim Pasha.

Ibrahim Pasha was succeeded by Abbas, who did little for horticulture, and the Viceroy Said did even less, as he is said to have cut down any trees or shrubs that were likely to interfere with the movements of his troops.

It was not until the visit of Ismail Pasha to the Paris Exhibition of 1867 that there was any revival in the interests of horticulture. The Viceroy was much struck, not only by the architecture of the buildings of Paris, but also by the gardens and fine avenues of trees that lined the Boulevards, and he determined to beautify Cairo and make it as much like Paris as possible. He therefore applied to the Préfet de la Seine, who recommended the appointment of M. Delchevalerie.

On Ismail Pasha's return to Cairo immense works were undertaken. New streets were made, gardens were laid out, and roads were lined with trees, the *Albizzia Lebbek* being generally chosen. These trees were collected from the villages of the Delta, and were brought to Cairo in boats. Thousands of *Albizzia Lebbek* were thus transplanted, and the work continued for nearly ten years. The result can now be seen. Visitors to the Pyramids drive under an avenue about eight miles long, and not only the town itself but also the promenades outside Cairo have trees on either side.

Unfortunately the result has been somewhat spoilt by a desire to obtain an immediate effect. There is a certain amount of monotony in seeing so many rows of *Albizzia Lebbek*, and it would have been better to have made more use of the *Poinciana regia*, *Jacaranda mimosæfolia*, and those Palms which do well in Egypt even if some years were to intervene before the avenues attained any appreciable size.

Financial difficulties made it impossible for Ismail Pasha to continue the improvements he had undertaken, and when he ceased to be Khedive the expenses had to be considerably curtailed. Many of the plantations were neglected, and some of the finest trees which were planted by Ismail Pasha's orders in the Public Gardens at Alexandria were cut down as being of no value.

When I first came to Egypt, in 1882, most of the gardens at Ramleh, the principal suburb of Alexandria, were in a very poor state. The owners seemed to care nothing for flowers, and left things generally to the Arab gardeners. Now the native's idea, unless he is guided, is to lay out a garden with a number of small beds and paths so narrow that two people cannot walk abreast. The beds are always surrounded by a border of *Alternanthera* (a haven for snails); all the large trees and shrubs are placed close to the path, and the small plants in the middle of the beds.

As no money, or hardly any, was spent, the only way of filling a garden was by taking the overstock from one's neighbours, and the result was that every garden contained the same varieties and the same flowers. 'La France,' 'Gloire de Dijon,' 'Maréchal Niel,' and 'Cramoisie Supérieur' Roses were seen in profusion. All gardens contained specimens of *Albizzia Lebbek*, *Tamarix arborea*, *Melia Azedarach*, with now and again a *Citharexylum quadrangulare*, a *Poinciana regia*, or a variety of *Ficus*. The principal climbers and shrubs were *Ipomœa*, *Luffa cylindrica*, *Acalypha*, and *Pittosporum*. To these, if the owners were English, were added a few annuals.

The private gardens in Cairo contained a certain number of Palms and other rarer plants, though they were not to be compared with their beauty of to-day.

So things continued with but slight improvement until the late Lady Cromer suggested in 1895 that something might be done to further the interest in horticulture, and proposed that the native gardeners, who make their living by selling flowers in the winter to tourists and others, should be encouraged to grow more and better varieties. With this object in view it was decided to hold a flower show at Cairo in January 1896. The show, which was opened by H.H. the Khedive, was a great success, and was followed by another at Alexandria in the following April. Two small local shows had been held in previous years at Alexandria, and the Alexandria Horticultural Society is the senior society in point of existence, but it must be admitted that without the initiative from Cairo, the patronage of H.H. the Khedive, and the support of H.H. Prince Hussein Kamel Pasha and of the late Lady Cromer, very little would have been done in Alexandria in the way of horticulture.

These shows, both in Cairo and Alexandria, have increased in importance every year. When they were first started, few of the exhibitors knew the difference between a Tea Rose and a Hybrid Perpetual, and they still unfortunately remain in ignorance of the names of many of the most beautiful trees and shrubs in their own gardens. But gradually more and more interest has been taken, many new shrubs and plants have been imported, and the difference in the gardens is very great.

The owners now understand that few things will grow in desert sand; that Nile mud, with its rich propagating properties, must be introduced if any result is to be obtained; and that the laying out of beds cannot be left to the natives.

Along the canal banks there are many tufts of Indian Doub Grass (*Cynodon Dactylon*); these have been imported into the gardens of Ramleh, and good croquet lawns are by no means uncommon.

Indian Doub Grass has also been tried with success on the race-course at Alexandria, and may be seen at the public gardens of the Barrage, near Cairo, which have been well laid out by Mr. Draper, a former student at Kew.

In 1901 the Alexandria Horticultural Society published a list of plants cultivated in Egypt. This list, which was compiled from notes kept for many years by Rear-Admiral Blomfield, R.N., shows how varied the vegetation is in Egypt. Numbers of plants that do not require a tropical heat or a frost to check their growth can be found in the country. Palms, Crotons, and Stephanotis can be seen side by side with Viburnums, Honeysuckles, and Elders.

Hybrid Perpetual Roses have only one short flowering season, but Tea Roses bloom in profusion for eight or ten months in the year. They do best as dwarf Roses, and, if the soil is good, grow to a height of about six or seven feet in three years. 'Marie Van Houtte' and 'Madame Charles' quickly cover trelliswork, and flower practically all the year round. 'G. Nabonnard,' 'Dr. Gull,' 'Maman Cochet,' and 'Madame Jules Grolez,' a hybrid Tea, but having all the appearance here of a true Tea Rose, and many others make fine bushes.

It is, however, for the flowering trees and shrubs that Egypt is the most remarkable. *Poinciana regia*, *Jacaranda mimosæfolia*, and *Melia Azedarach* have already been mentioned. To these should be added *Bauhinia purpurea* and *B. variegata*, *Tecoma stans*, *Erythrina indica* with its cluster of red flowers but brittle wood, *Erythrina Corallodendron*, *E. Crista-galli*, *Schinus terebinthifolius* (the substitute for Holly at Christmas), *Datura suaveolens*, *Poinsettia*, *Plumeria*, *Hibiscus* in its many varieties, and the Oleander, which the Arabs will not cut, as it is supposed to produce a disease of the eyes.

Duranta Plumieri is almost naturalised at Alexandria, and fine hedges are made of *Buddleia madagascariensis*.

The *Bougainvillæa*, with its purple or red bracts, and *Bignonia venusta*, with its orange flowers, brighten the gardens of Cairo throughout the tourist season, and besides these other climbers, such as *Antigonon leptopus*, *Beaumontia grandiflora*, perhaps our finest climber, several varieties of *Passiflora*, Jasmine, &c., can be seen in flower at different seasons.

The "List of Plants" above referred to gives the names of thirty-one Palms that have been known to exist in the gardens of Egypt since 1870. Some of these may have disappeared, but their places have certainly been taken by later importations, of which notice has been given to the

Alexandria Horticultural Society. The varieties most frequently met with are *Caryota urens*, *Cocos flexuosa*, *Phœnix canariensis*, *Phœnix dactylifera*, the common Date tree, *Pritchardia filifera*, and *Sabal umbraculiferum*.

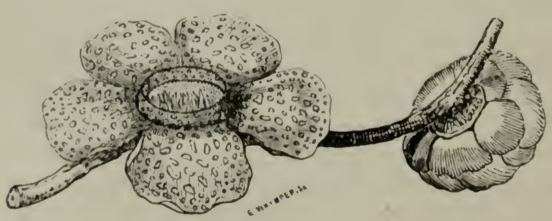
Although some of the commoner herbaceous plants, such as Pæonies, Phlox, Rudbeckia, &c., have not proved successful, and Rhododendrons and Azaleas last but two or three years, yet annuals do well; and it is a question whether it would not be worth some one's while to collect the seed which should ripen better in Egypt than in many countries in Europe. A small movement in the direction of exportation has already begun. Freesias, Roman Hyacinths, and certain other bulbs increase so rapidly that it is hoped some day to collect a number sufficient to send them to the London market. A commencement was made with Lilies, as it was noticed that the *Lilium Harrisii* increased in size and in quantity in the Ramleh Gardens, but when planted in the fields it was found that the weeding, attention, and other expenses, would cost more than the value of the bulbs at a public auction. Perhaps this experiment of Lilies was abandoned too early, and it may be recommenced when the results of the exportation of other bulbs has been ascertained.

It may be of interest to state that neither *Papyrus antiquorum*, the Egyptian paper reed, which has succeeded so well in Sicily ever since it was sent there by Ptolemy as a present to Hiero about B.C. 250, nor *Nelumbium speciosum*, the Sacred Bean, to be found depicted on many of the ancient monuments erected subsequent to the Persian invasion, can be seen in an uncultivated state in Egypt, and it is even doubted whether either of these plants grew without attention in the time of the ancient Egyptians.

With regard to fruits and vegetables, there is a large export trade in Onions. Tomatos are sent in quantities to Marseilles and Trieste, and Cabbages, green Artichokes, and a small variety of Marrow are shipped to different ports in the Levant. Other vegetables, such as Asparagus, Cauliflowers, Peas, and Beans, do well and come in during their season.

Dates, Figs, Quinces, *Anona squamosa*, Oranges, and Bananas are the usual fruits of the country. Pears and Apples do not succeed, and have to be imported. Grapes are grown, but are largely supplemented by supplies from the Greek Isles.

Both the Oranges and Bananas have unfortunately been attacked by a disease which renders the plants unproductive. Many of the Banana plantations round Alexandria have already been rooted up, and other crops have taken their place.



REPORT ON TOMATOS AT CHISWICK, 1902.

SEVENTY-FOUR stocks of Tomatos were received for trial, and thirty-seven of the best known older varieties were grown for comparison with them. Two plants of each were grown-on, and fruited in ten-inch pots under glass; a row of four plants of each were planted outside on a warm south border to test their merits for open-air culture. The season proved to be a very bad one for Tomatos, being cold and wet, with very little sun, and consequently the majority of the varieties did not set their fruits so feely as in former years, but the trial distinctly proved the value for open-air cultivation of those varieties which carried heavy crops in spite of the unfavourable climatic conditions, and all ripened some fruit of good size, form, and colour. The Committee examined the collection on September 12.

F.C.C.=First-class Certificate.
A.M.=Award of Merit.

1. Abundance (Sutton).—Medium size, round, smooth, red, good form; averaging three fruits in a cluster; solid, and of good flavour. Moderate crop inside, heavy crop outside.

2. Acme (J. Veitch).—Medium size, round, smooth, purplish red; averaging four fruits in a cluster; not solid, and of only fair flavour. Light crop inside, moderate outside.

3. Acquisition (J. Veitch).—Medium to large size, flattish round, purplish crimson; averaging three fruits in a cluster; solid; poor flavour. Moderate crop both inside and outside.

4. All the Year Round, **F.C.C.** April 28, 1895 (J. Veitch).—Medium size, longish round, bright red, smooth; averaging five fruits in a cluster; solid; good flavour. Heavy crop both inside and outside. The best of the King Humbert type.

5. A 1 (Sutton).—Medium to large, deep round, smooth, red; averaging three fruits in a cluster; solid, and of very good flavour. Moderate crop inside, very heavy crop outside.

6. Beauty (Masters).—Large, flat round, smooth, handsome, red; averaging two fruits in a cluster; solid; fair flavour. Moderate crop inside, very light crop outside. Similar to 'Perfection.'

7. Best of All (Sutton).—Rather large, round, smooth, red; averaging three fruits in a cluster; solid; good flavour. Moderate crop inside, light crop outside.

8. Brinton's Best (Masters).—Medium size, round, smooth, red; averaging three fruits in a cluster; not solid, and of poor flavour; very long-jointed in growth. Moderate crop inside, and light crop outside.

9. Carter's Seedling (Carter).—Medium size, deep round, smooth, red, handsome; averaging four fruits in a cluster; solid; good flavour. Moderate crop both inside and outside.

10. Cestrian (Dickson's).—Very similar to No. 13. Light crop both inside and outside.

11. Chiswick Peach, **F.C.C.** August 15, 1899 (J. Veitch).—See Report, Vol. xxv. page 173. Moderate crop inside; of no value for open-air culture.

12. Combination (Atlee Burpee).—Medium size, round, smooth, purplish crimson; averaging two fruits in a cluster; solid; poor flavour. Light crop both inside and outside.

13. Crimson King (Dickson's).—Medium to large, round, smooth, deep red; averaging three fruits in a cluster; solid; fine flavour. Good crop inside, light crop outside.

14. Crimson Sun (R. Veitch).—Similar to 'Perfection.' Moderate crop inside and outside.

15. Daniels' No. 1 (Daniels).—Very similar to 'Perfection.' Moderate crop inside and outside.

16. Duke of York, **F.C.C.** July 23, 1895 (Carter).—Large, round, smooth, red; averaging three fruits in a cluster; solid; good flavour. Light crop inside and outside.

17. Dwarf Sun (Sutton).—Medium size, round, smooth, lemon-yellow; averaging three fruits in a cluster; solid; excellent flavour. Moderate crop inside, and light crop outside. A short-jointed variety, with thick fleshy foliage.

18. Dyer's Seedling (Dyer).—Medium size, deep round, smooth, dark red; averaging five fruits in a cluster; solid; fair flavour. Good crop inside, heavy crop outside.

19. Early Empress (Dickson's).—Medium to large size, round, smooth, red; averaging six fruits in a cluster; moderately solid, and of good flavour. Moderate crop inside, and a very heavy crop outside.

20. Early Ruby (J. Veitch).—Medium size, irregular in shape, red; averaging four fruits in a cluster; not solid, and of only fair flavour. Moderate crop both inside and outside.

21. Eccentric (Goody).—Medium size, flattish round, smooth, red; averaging three fruits in a cluster; fairly solid; poor flavour. Moderate crop inside, light crop outside.

22. Eclipse (Sutton).—Medium size, flattish round, smooth, deep red; averaging five fruits in a cluster; solid, and of good flavour. Good crop inside, moderate crop outside.

23. Eye Wonder (Watkins & Simpson).—Medium to large, round, smooth, bright scarlet; averaging five fruits in a cluster; solid; good flavour. Moderate crop both inside and outside.

24. Fairfield (J. Veitch).—Rather large, flattish round, smooth, red; averaging four fruits in a cluster; solid; excellent flavour. Moderate crop inside, poor crop outside.

25. Flying Dutchman (R. Veitch).—Medium size, round, smooth, red; averaging five fruits in a cluster; solid; good flavour. Moderate crop inside, very heavy crop outside.

26. Fordhook Fancy (Atlee Burpee).—Medium size, flattish round, smooth, purplish crimson; not solid, and very acid flavour. Light crop both inside and outside.

27. Fordhook First (Atlee Burpee).—Medium size, round, smooth, crimson; solid; fair flavour. Poor crop inside and outside.

28. Frogmore Selected, **F.C.C.** April 24, 1894 (J. Veitch).—Medium

to large, deep round, smooth, scarlet; averaging five fruits in a cluster; very solid, and of good flavour. Moderate crop inside, heavy crop outside.

29. Golden Jubilee, **F.C.C.** May 26, 1897 (J. Veitch).—Large, round, smooth, bright yellow, faintly tinged with red on the exposed side; averaging five fruits in a cluster; solid; excellent flavour. Moderate crop inside, light crop outside.

30. Hillside Comet, **A.M.** July 25, 1899 (Watkins & Simpson).—Medium size, deep round, smooth, scarlet; handsome; averaging six fruits in a cluster; solid; good flavour. Heavy crop inside and outside. This variety is best known as 'Comet.'

31. Holmes' Futurity (Holmes).—Small, round, smooth, bright red; producing great clusters of fruit; moderately solid; good flavour. Good crop both inside and outside. With a little further selection this should prove a valuable market variety.

32. Invergill Scarlet (Barr).—Medium size, round, smooth, scarlet; averaging three fruits in a cluster; moderately solid; poor flavour. Light crop both inside and outside.

33. Invergill Pink (Barr).—Similar to No. 32.

34. Invincible (Blackstock).—Medium to large, round, smooth, rich crimson; averaging seven fruits in a cluster; solid; fine flavour. Heavy crop both inside and outside.

35. John Bull (R. Veitch).—Very similar to No. 14 except in colour, which is a reddish purple. Light crop both inside and outside.

36. Large Early (Atlee Burpee).—Medium size, round, smooth, purplish red; averaging two fruits in a cluster; solid; fair flavour. Light crop both inside and outside.

37. Leek Beauty (Bermingham).—Medium size, round, smooth, red; averaging five fruits in a cluster; solid; good flavour. Moderate crop inside, heavy crop outside. Growth very short-jointed.

38, 39. Lister's Prolific (Lister).—Medium size, round, smooth, red; handsome; averaging six fruits in a cluster; solid; fine flavour. Good crop inside, very heavy crop outside.

40. Magnum Bonum (Sutton).—Medium to large, flattish round, smooth, red; averaging three fruits in a cluster; solid; good flavour. Moderate crop inside, heavy crop outside.

41. Manor Park Prolific (Austin).—Medium size, deep round, smooth, scarlet; averaging three fruits in a cluster; moderately solid; fair flavour. Light crop inside and outside.

42. Marvel (Watkins & Simpson).—Medium size, irregular in form, red; averaging four fruits in a cluster; solid; fair flavour. Moderate crop inside, heavy crop outside. Very similar to 'Turner's Prolific.'

43. Maincrop (Laxton).—Very similar to No. 54.

44. New Giant Tree (Goody).—Medium to large, flattish round, smooth, red; averaging three fruits in a cluster; solid; poor flavour. Moderate crop both inside and outside.

45. Noble (Atlee Burpee).—Similar to 'Perfection.'

46. Peachblow (Sutton).—Medium size, flattish round, smooth, reddish purple; averaging five fruits in a cluster; solid; good flavour. Moderate crop inside, light crop outside.

47. Peerless (Sutton).—Medium to large, flattish round, smooth, scarlet; averaging five fruits in a cluster; solid; excellent flavour. Moderate crop inside and outside.

48, 49. Pierremont Prolific (Kent & Brydon).—Medium size, deep round, smooth, dark red; averaging four fruits in a cluster; solid; good flavour. Moderate crop inside and outside. A very short-jointed variety.

50. Prince of Wales (Sutton).—Medium size, round, smooth, rich golden yellow; averaging three fruits in a cluster; solid; fine flavour. Moderate crop inside, light crop outside.

51. Princess of Wales (Sutton).—Medium size, round, smooth, red; handsome; averaging five fruits in a cluster; solid; good flavour. Heavy crop both inside and outside.

52. Primum (Laxton).—Medium size, deep round, smooth, red; averaging four fruits in a cluster; moderately solid; fair flavour. Moderate crop inside, heavy crop outside.

53. Pointing's Trophy, **F.C.C.** August 20, 1877 (Watkins & Simpson).—Large, round, smooth, red; averaging three fruits in a cluster; solid; poor flavour. Light crop both inside and outside.

54. Profit (Laxton).—Small, round, smooth, red; averaging four fruits in a cluster; solid; fair flavour. Light crop inside, heavy crop outside.

55. Quarter Century (Atlee Burpee).—Very similar to No. 26, except that the fruit is more crimson.

56. Royal Chester (Dickson's).—Medium size, deep round, smooth; handsome; averaging four fruits in a cluster; solid; good flavour. Moderate crop both inside and outside.

57. Royal Sovereign, **A.M.** July 26, 1892 (Dickson's).—Medium size, round, smooth, golden yellow; averaging three fruits in a cluster; solid; excellent flavour. Light crop both inside and outside.

58. Satisfaction (Sutton).—Medium to large; round, smooth, deep-red; averaging four fruits in a cluster; very solid; good flavour. Heavy crop inside, light crop outside.

59. Scarlet Queen (Dickson's).—Medium size, long, of the 'King Humbert' type, smooth, deep red; averaging four fruits in a cluster; moderately solid; fair flavour. Heavy crop inside, light crop outside.

60. Stone (Masters).—Similar to 'Perfection.'

61. Sturdy King (Lansdell).—Large, deep round, smooth, red; averaging four fruits in a cluster; solid; good flavour. Moderate crop both inside and outside. Very sturdy habit.

62. Superb (Kent & Brydon).—Small, round, red, smooth; averaging five fruits in a cluster; solid; poor flavour. Heavy crop both inside and outside.

63. Sunbeam (Sutton).—Rather small, egg-shaped, smooth, golden yellow; averaging five fruits in a cluster; solid; fine flavour. Moderate crop inside, light crop outside.

64. The Garland—long racemes (Dobbie).—Similar to the 'Currant' Tomato, but with rather larger fruits.

65. The Garland—short racemes (Dobbie).—Same as No. 64, with shorter racemes. Both Nos. 64 and 65 produced good crops inside, and light crops outside.

66. The Matchless (Atlee Burpee).—Same as 'Perfection.'

67. Unique (Laxton).—Rather large, deep round, smooth, red; averaging three fruits in a cluster; solid; good flavour. Moderate crop inside, light crop outside.

68. Utility (Laxton).—Medium size, round, smooth, rich red; averaging five fruits in a cluster; solid; good flavour. Heavy crop both inside and outside.

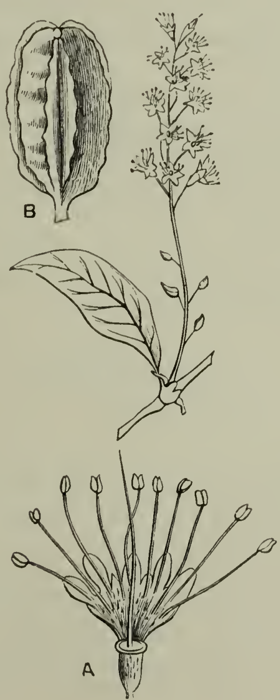
69. Vanguard (Laxton).—Medium to large, round, smooth, red; averaging four fruits in a cluster; moderately solid; fair flavour. Rather light crop both inside and outside.

70. Veitch's Glory (Masters).—Medium size, round, slightly corrugated, red; averaging five fruits in a cluster; solid; good flavour. Good crop both inside and outside.

71. Waterloo (Thomas).—Medium size, round, smooth, scarlet; averaging five fruits in a cluster; solid; excellent flavour. Moderate crop inside, heavy crop outside.

72. Ward's Seedling (Ward).—Very similar to No. 71.

73, 74. Winter Beauty, **A.M.** April 18, 1899 (Sutton, Barr).—Medium size, flattish round, smooth, deep red; averaging six fruits in a cluster; solid; excellent flavour. Good crop inside, very heavy crop outside. This variety promises to be a very free-bearing and valuable outdoor variety.



REPORT ON PERENNIAL ASTERS GROWN AT CHISWICK, 1902.

(Michaelmas Daisies.)

A collection of 220 species and varieties was grown, of which ninety had been in the collection at Chiswick since the trial of these plants, conducted in 1892, the Report of which will be found in the Journal, vol. xv. p. 238. The genus is a large one, and very important for the embellishment of the out-door garden in autumn. Altogether, something like 200 species are known to botanists, and the garden forms and varieties are legion.

North America is the headquarters of the genus; many species are found in Mexico, China, Japan, Asia, and Europe. Asters vary much in habit, and are mostly planted in the herbaceous border and wild garden, but many of them are well adapted for grouping in beds on the turf, and the dwarf varieties are eminently suited for the rock garden. They are easily cultivated, but prefer a rather heavy damp soil to one that is very light and dry. In order to secure the best results, plants should be divided every spring, as it is a mistake to allow them to occupy the same ground undisturbed for indefinite periods.

The specimens referred to below were planted in spring, in rows three feet wide and two feet apart in the rows, on ground that had been trenched and heavily manured the preceding autumn. All grew well, and many of them yielded great quantities of flowers. The collection was examined by the Floral Committee on several occasions, who recommended awards to meritorious varieties.

The awards made in 1892 are incorporated in the present Report. The height which each attains in the soil of Chiswick is also given, and the time of flowering roughly indicated by the words "early," "mid-season," and "late." With the exception of species, garden forms that failed to secure any award are not mentioned.

A.M. = Award of Merit.
× × × = Highly Commended.
× × = Commended.

1. Acris, × × × 1892.—Height 2 feet 6 inches; pyramidal habit; leaves 1-1½ inch long, linear-lanceolate, sessile, pale green; very free-flowering; stellate flowers, blue or lilac. A continuous bloomer. Mid-season. Introduced from the South of Europe in 1731.

2. Acris nanus, **A.M.** October 13, 1902.—A dainty variety, remarkable for the great quantity of purplish-blue flowers, which are deeper in colour and appear about a week or so later than those of the type. It grows 16 inches high, and is of very dense, bushy habit. A splendid plant for the rock garden as well as for a prominent place in the herbaceous border.

3. Amellus amelloides, × × × 1892.—Height 2 feet; sturdy branch-

ing habit; very free-flowering; flowers $2\frac{1}{2}$ inches in diameter, dark lilac-purple. Mid-season.

4. Amellus bessarabicus, **A.M.** October 1, 1902.—Height 2 feet; stiff, branching, bushy habit; exceptionally free-flowering; flowers $2\frac{1}{2}$ inches in diameter, lilac-purple, paler than those of No. 3. A continuous bloomer. Mid-season.

5. Amethystinus (syn. bostoniensis) × × 1892.—Height 5 feet; upright branching habit; leaves $1-1\frac{1}{2}$ inch long, lanceolate, entire; very free-flowering and quite distinct; flowers amethyst-blue, borne on long, rather narrow racemes. Late. North America.

6. Canus.—Height 2 feet; rather diffuse habit; leaves 1–2 inches long, lanceolate, sessile, with whitish tomentum on the under sides; flowers rather small, deep blue. Early. Europe.

7. Cordifolius, × × × 1892.—Height 2 feet; compact, upright, branching habit; radical leaves cordate-ovate, later ones lanceolate, toothed, deep green; flowers small, pale lavender or lilac, borne in spreading, much-branched panicles in great profusion. Mid-season. North America, 1759.

8. Cordifolius albulus, × × × 1892.—Of more upright habit than the type, from which it also differs by reason of its flowers being greyish-white.

9. Cordifolius Diana (syn. Photograph), × × × 1892.—A graceful variety, of erect bushy habit, and wonderfully free-flowering; flowers small, pale lilac.

10. Cordifolius elegans (syn. undulatus), **A.M.** October 13, 1902 (Dobbie).—One of the tallest of the group, and quite a week later than the type in coming into blossom; very free-flowering; flowers pale lavender. A continuous bloomer.

11. Cordifolius Ideal, × × × October 13, 1902 (Beckett).—Similar in habit to No. 9, and quite as floriferous, but its small flowers, borne in long, elegant panicles, are of a deeper shade of lavender or lilac. Mid-season.

12. Cordifolius profusus, **A.M.** October 15, 1901 (Beckett).—A seedling from No. 9. Height 4 feet; loose, spreading habit; very free-flowering; flowers small, light lavender. Mid-season.

13. Cordifolius Sweetheart, × × × October 13, 1902 (Perry).—Another free-growing, much-branched variety, with an abundance of flowers, paler than those of No. 9. Mid-season.

14. Corymbosus (syn. Biotia corymbosa), × × × 1892.—Height 2 feet 6 inches; rather slender habit, with purple stems; leaves large, cordate-ovate, toothed, deep green; moderately free-flowering; flowers white. Early. North America.

15. Corymbosus Perseus, × × 1892.—A distinct and pleasing variety, bearing an abundance of starry white flowers, $\frac{3}{4}$ of an inch in diameter. It is not quite so vigorous or so early to flower as the type.

16. Curtisii, × × 1892.—Height 3 feet; sturdy habit; leaves ovate-lanceolate, acuminate; free-flowering; flowers rather small, purplish blue, borne in loose panicles. Early. North America.

17. Dahuricus (Willmott).—Height 2 feet 6 inches to 3 feet; rather slender, spreading habit; leaves 1–2 inches long, lanceolate, sessile, acuminate, pale green; very free-flowering; flowers $\frac{1}{2}$ an inch in diameter, pale blue. Early. Central Siberia.

18. Diffusus.—Height 4 feet; branching, spreading habit; leaves 9 inches long, rather thin, lanceolate, serrated, those on the flowering branches very small; flowers small, white, touched with purplish violet. Early. North America, 1777.

19. Diffusus horizontalis, × × × 1892 (as a rock-garden plant).—A useful variety for the rockery, as it is of dense, spreading habit, and rarely exceeds 2 feet high; stems dark and leaves bronze-tinted; exceptionally free-flowering; flowers small, brownish red and white. Later than the type.

20. Diffusus pendulus (syn. Nondescript), × × 1892.—A tall, slender-growing variety, with wiry, arching stems; leaves small and bronze-tinted; flowers small, white, borne in long racemes. Late.

21. Drummondii, × × × 1892 (Dobbie).—Height 5 feet; stems purple, much branched; leaves lanceolate; very free-flowering; flowers small, lavender. Late. North America.

22. Drummondii Cora, × × 1892.—A free-growing variety, of erect habit; very free-flowering; flowers ½ an inch in diameter, pale pink. Earlier than the type.

23. Dumosus.—Height 11 inches; very dense, bushy habit; leaves small, linear; free-flowering; flowers small, white, touched with pink. Early. North America, 1734.

24. Eminens.—Height 18 inches; very bushy, spreading habit; stems purple and wiry: leaves small, linear-lanceolate; free-flowering; flowers small, light blue. Early. North America.

25. Ericoides, × × 1892 (Beckett).—Height 3 feet 6 inches; close, compact habit, with long ascending branches clothed with small, linear, bright green leaves; flowers small, white, borne in great profusion in long, much-branched racemes. This is one of the most attractive of small-flowered Michaelmas Daisies. Late. North America, 1758.

26. Ericoides Clio, × × 1892.—Not quite so tall as the type; bushy habit; leaves linear, pale green; free-flowering; flowers ¾ of an inch in diameter, pale pink.

27. Ericoides Hon. Edith Gibbs, **A.M.** October 9, 1900 (Beckett).—A free-growing, graceful variety, with great numbers of dainty pale lavender flowers.

28. Ericoides Ophir, **A.M.** October 1, 1902 (Beckett).—Habit similar, but flowers larger than those of No. 25, and tinged with pink.

29. Ericoides Sensation, **A.M.** October 1, 1902 (Beckett).—An improvement on No. 25.

30. Lævis, × × × 1892.—Height 4 feet 6 inches; slender, graceful habit; leaves 4 to 5 inches long, clasping the purple stems, firm, oblong acute, bright green; free-flowering; flowers 1 to 1½ inch in diameter; bright blue. Late. North America, 1758.

31. Linosyris, × × 1892.—Height 2 feet; erect habit; leaves crowded, linear, pale green; flowers deep yellow. Late. Europe.

32. Macrophyllus.—Height 3 feet; diffuse habit; leaves large, 8 inches long, thick, cordate-ovate, serrated, deep green; shy-flowering; flowers pale lilac, borne in loose panicles. Early. North America, 1739.

33. Multiflorus, × × × 1892.—Height 4 feet; diffuse habit; leaves

small, linear, deep green; flowers small, white, borne freely in long racemes. Mid-season. North America, 1732.

34. Novæ-Angliæ præcox, × × × 1892.—A vigorous, early-flowering variety, with large, deep purple flowers.

35. Novæ-Angliæ pulchellus, × × × 1892 (Dobbie).—Height 4 feet 6 inches; strong free-branching habit; very free-flowering; flowers large semi-double, violet, shaded blue. Mid-season.

36. Novæ-Angliæ roseus, × × × 1892.—Rather slender habit; moderately free-flowering; flowers rose-pink, borne in racemes. The latest of the N.-A. group to flower.

37. Novæ-Angliæ rubra, × × × 1892 (Dobbie).—Height 4 feet 6 inches; strong habit; rather shy-flowering; flowers large deep rose or red. Late.

38. Novæ-Angliæ W. Bowman, × × × October 13, 1902 (Willmott).—Height 5 feet; vigorous habit; free-flowering; flowers large, rosy purple. Late. Received as "N.-A. elegans."

39. Paniculatus, × × 1892.—Height 4 feet 6 inches; graceful habit; leaves ovate-lanceolate; flowers small, pale blue. Early. North America, 1640.

40. Paniculatus blandus, × × 1892.—Height 5 feet; dense, bushy habit; leaves lanceolate; moderately free-flowering; flowers $\frac{3}{4}$ of an inch in diameter, white, suffused with lilac. Mid-season.

41. Paniculatus Edwin Beckett, **A.M.** September 24, 1902 (Beckett).—Height 4 feet; loose, spreading habit; very free-flowering; flowers small, delicate lilac. A continuous bloomer. Early.

42. Paniculatus W. J. Grant, × × × 1892.—A distinct variety, of graceful habit; very free-flowering; flowers pale mauve. Mid-season.

43. Patulus (syn. pallens), × × × 1892 (Dobbie).—Height 3 feet 6 inches; bushy, spreading habit; leaves oblong-lanceolate, bright green; very free-flowering; flowers rather small, pale lilac-purple, passing to a lighter shade. Early. North America.

44. Polyphyllus, × × × 1892.—Height 4 feet 6 inches; branching habit; leaves 3–4 inches long; very free-flowering; flowers rather small, white, fading to pink. Mid-season. North America.

45. Prenanthoides, × × × 1892.—Height 3 feet; compact, bushy habit; leaves 6 inches long, ovate-lanceolate, clasping the rather slender stems; very free-flowering; flowers small, mauve. North America.

46. Puniceus, × × × 1892 (Dobbie).—Height 5 feet; very bushy, sturdy habit; leaves 4–5 inches long, oblong-lanceolate, serrated; very free-flowering; flowers 1 inch in diameter, pale lavender or lilac, borne in large much-branched umbels. Early. North America, 1710.

47. Puniceus lucidus, × × × 1892.—Rather taller than the type; stems purple; free-flowering; flowers $1\frac{1}{2}$ inch in diameter, pale lilac. Early.

48. Puniceus pulcherrimus, × × × 1892 (Dobbie).—Height 6 feet; vigorous, upright, branching habit; very free-flowering; flowers large, greyish white, borne on stout spikes. A distinct and excellent late-blossoming variety, well adapted for the back of the herbaceous border.

49. Sagittifolius, × × 1892.—Height 3 feet 6 inches; vigorous, diffuse habit; stems reddish brown; leaves ovate-lanceolate, upper ones

linear-lanceolate ; moderately free-flowering ; flowers small, purple or lilac, suffused with violet. Early. North America.

50. Salicifolius.—Height 5 feet ; strong bushy habit ; free-flowering ; flowers pale lilac. Early. North America, 1760.

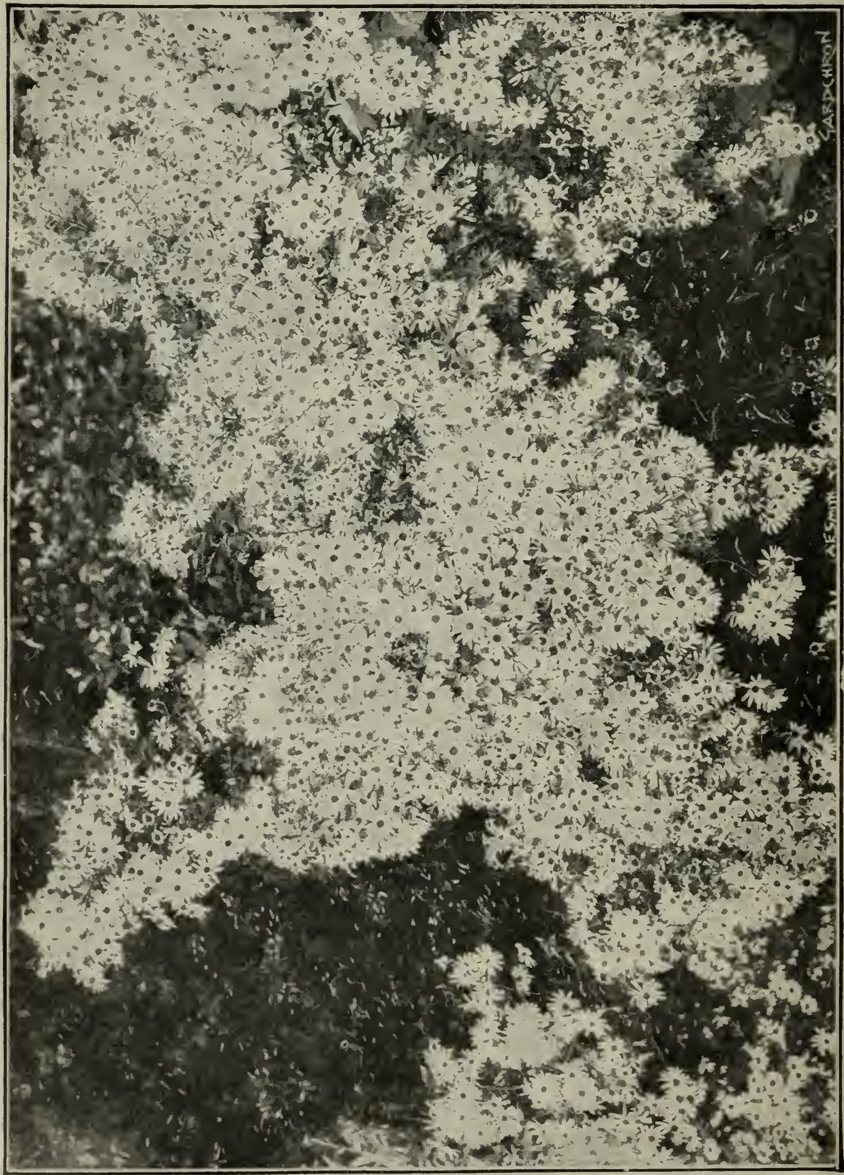


Fig. 170.—Aster Shortii. (*Gardeners' Chronicle.*)

51. Shortii, × × × September 24, 1902.—Height 3 feet 6 inches ; slender, graceful habit ; leaves 4 inches long, ovate-lanceolate, almost entire ; very free-flowering ; flowers small, pale purplish blue. Early. North America. (Fig. 170.)

52. Sibiricus.—Height 2 feet; bushy, spreading habit; leaves oblong-lanceolate, acuminate, serrated; flowers purplish mauve. Early. Siberia, 1768.

53. Spectabilis, × × 1892 (Willmott).—Height 18 inches; erect, branching habit; leaves oblong-lanceolate, rather rough; free-flowering; flowers with long petals, blue or bright lilac. Mid-season. North America, 1777.

54. Tardiflorus.—Height 2 feet; compact, rather slender habit; leaves oblong-lanceolate, serrated; very free-flowering; flowers 1 inch in diameter, blue. Early. North America, 1775.

55. Tradescanti (Dobbie).—Height 4 feet 6 inches; erect, branching habit; leaves narrow, finely serrated; very free-flowering; flowers small, white. Late. North America, 1633.

56. Turbinellus, × × × 1892.—Height 3 feet 6 inches; upright habit; leaves 3–4 inches long, lanceolate, clasping the stem; moderately free-flowering; flowers pale mauve or lilac. Mid-season. North America.

57. Umbellatus, × × × 1892.—Height 6 feet; strong, diffuse habit; leaves 3–4 inches long, oblong-lanceolate, deep green; free-flowering; flowers white, borne in broad umbels. North America.

58. Undulatus, × × × 1892.—Height 3 feet 6 inches; sturdy, bushy habit; leaves 3–4 inches long, ovate-lanceolate; very free-flowering; flowers small, pale violet. Early. North America, 1699.

59. Versicolor Antigone, × × × 1892.—Height 3 feet 6 inches; slender habit; free-flowering; flowers 1 inch in diameter, white, passing to rose or lilac. Mid-season.

60. Vimineus, × × 1892.—Height 3 feet 6 inches; very compact, slender, bushy habit, the lower branches spreading out almost horizontally; leaves small, lanceolate; very free-flowering; flowers small, white. Mid-season. North America, 1800.

61. Vimineus Delight, **A.M.** October 13, 1902 (Beckett).—An improvement on the type both in habit and flower. It is of slender growth, and bears numerous small pure white flowers. Mid-season.

62. Vimineus Freedom, × × × October 13, 1902 (Beckett).—This differs from the type by reason of its freer-flowering qualities. Mid-season.

63. Vimineus perfectus, **A.M.** September 24, 1902 (Beckett).—Another slender-habited variety and exceptionally free-flowering; flowers very small, white, suffused and tipped with pink. Mid-season.

The undermentioned are garden forms raised principally between Lævis and Novi-Belgii:—

64. Albion, × × 1892.—Height 5 feet; dense, bushy habit; flowers 1 inch in diameter, white. Early.

65. Apollo, × × × 1892.—Height 5 feet; sparsely branched; stems purplish; free-flowering; flowers 1½ inch in diameter, lilac or deep blue. Early.

66. Archer Hind, × × × 1892 (Dobbie).—Height 4 feet; strong, branching habit; free-flowering; flowers 1–2 inches in diameter, rosy lilac. Mid-season.

67. Arcturus, × × 1892.—Height 4 feet 6 inches; sturdy habit; stems

T 2

almost black; moderately free-flowering; flowers 1½ inch in diameter, deep rosy lilac. Early.

68. Argus, × × 1892.—Height 4 feet 6 inches; compact, bushy habit; stems purple; rather shy-flowering; flowers 1½ inch in diameter, lilac purple. Early.

69. Ariadne, **A.M.** October 13, 1902.—Height 5 feet 6 inches; strong, branching habit; very free-flowering; flowers 1½ inch in diameter, light blue. Mid-season.

70. Aurora, × × × 1892.—Height 3 feet 6 inches; branching habit; stems purple; moderately free-flowering; flowers 1½ inch in diameter, lilac-purple or lavender. Early.

71. Berenice, × × × 1892.—Height 5 feet; diffuse habit; stems purple; free-flowering; flowers lilac-purple. Mid-season.

72. Calliope, **A.M.** October 13, 1902.—Height 4 feet 6 inches; strong, spreading habit; very free-flowering; flowers 1½ inch in diameter, pale mauve. Late.

73. Captivation, **A.M.** October 9, 1900 (Beckett).—Height 3 feet 6 inches; very compact, bushy habit; free-flowering; flowers pale pink, touched with white. Late.

74. Catulus, × × 1892.—Height 3 feet; dense, bushy habit; very free flowering; flowers ¾ of an inch in diameter, white, suffused with pale lavender. Mid-season.

75. Celestial, **A.M.** September 2, 1902.—A chance seedling. Height 4 feet 6 inches; sturdy habit; very free-flowering; flowers 1½ inch in diameter, light blue. A continuous bloomer.

76. Ceres, × × 1892.—Height 5 feet; erect habit; moderately free-flowering; flowers 1½ inch in diameter, white. Early.

77. Coombe Fishacre Brightness, **A.M.** October 13, 1902 (Beckett).—Flowers larger and brighter than those of the ordinary Coombe Fishacre. Height 4 feet 6 inches; bushy, branching habit; very free-flowering; flowers pink, touched with rose. Late.

78. Cordelia, **A.M.** October 13, 1902 (Willmott).—Height 4 feet; upright, sturdy, branching habit; very free-flowering; flowers rather small bright blue. Very showy. Late.

79. Daisy Peters, **A.M.** September 24, 1902 (Sturgis).—Seedling from Mrs. W. Peters, and an improvement on No. 109. Height 3 feet 6 inches; upright, bushy habit; very free-flowering; flowers large, pure white.

80. Decorus, × × × 1892.—Height 3 feet 6 inches; bushy habit; moderately free-flowering; flowers 1 inch in diameter, pale blue tinged with pink. Mid-season.

81. Densus, × × × 1892 (Dobbie).—Height 3 feet; bushy, spreading habit; very free-flowering; flowers 1–1½ inch in diameter, deep blue. Mid-season.

82. Discolor, × × 1892.—Height 4 feet; rather sparsely branched; moderately free-flowering; flowers 1½ inch in diameter, white and soft lilac. Early.

83. Dorothy, **A.M.** September 24, 1902 (Willmott).—Height 4 feet; strong, spreading habit; very free-flowering; flowers large, pale lavender. Early. A continuous bloomer.

84. Edna Mercia, × × × October 13, 1902 (Perry).—Height 3 feet

6 inches; very strong habit; stems purple; flowers large, deep rose. Late. A continuous bloomer.

85. Elsie Perry, **A.M.** October 13, 1902 (Perry).—Height 4 feet; strong,

FIG. 171.—ASTER NOVI-BELGII, VAR. FLORIBUNDUS. (*Gardeners' Chronicle.*)

branching habit; stems purple; very free-flowering; flowers semi-double, rather small, bright pink. Late. A continuous bloomer.

86. Fanny, × × 1892 (Dobbie).—Height 4 feet; bushy, spreading habit; free-flowering; flowers $1\frac{1}{2}$ inch in diameter, bright blue, touched with lilac. Mid-season.

87. Flora, × × 1892.—Height 5 feet; strong habit; free-flowering; flowers lilac. Mid-season.

88. Floribundus. × × × 1892 (Dobbie).—Height 5 feet 6 inches; erect habit; stems purple; very free-flowering; flowers 1½ in diameter, rosy purple. Mid-season. (Fig. 171.)

89. Formosissimus, × × × 1892 (Dobbie).—Height 4 feet 6 inches; slender habit; moderately free-flowering; flowers 1½ inch in diameter, deep rosy-lilac or blue. Mid-season.

90. Fortunæ, × × 1892.—Height 5 feet 6 inches; strong, bushy habit; moderately free-flowering; flowers 1½ inch in diameter, pale lilac or lavender. Late.

91. F. W. Burbidge, **A.M.** September 24, 1902 (Dobbie, Willmott).—Similar to but an improvement on No. 105. Height 4 feet 6 inches; dense, bushy habit; exceptionally free-flowering; flowers 2 inches in diameter, rosy lilac. Early.

92. Harper Crewe, × × × 1892.—Height 5 feet; rather sparsely branched; free-flowering; flowers 2 inches in diameter, white, shading to rose with age. Early.

93. Harvard, × × × 1892.—Height 5 feet; upright, rather slender, branching habit; stems purple; leaves lanceolate, clasping the stem; very free-flowering; flowers rosy mauve, borne in long panicles. Mid-season.

94. Horace, × × 1892.—Height 4 feet; sturdy habit; moderately free-flowering; flowers 1 inch in diameter, deep lilac. Mid-season.

95. Irene, × × 1892.—Height 4 feet 6 inches; slender habit; moderately free-flowering; flowers 1 inch in diameter, deep lilac. Early.

96. Janus, × × × 1892.—Height 5 feet; rather sparsely branched; free-flowering; flowers 1½ inch in diameter, white. Early.

97. Jessie Crum, × × × October 13, 1902 (Willmott).—Height 5 feet; strong, branching habit; very free-flowering; flowers 1 inch in diameter, mauve. Late.

98. John Wood, × × × 1892 (Dobbie).—Height 4 feet; branching habit; very free-flowering; flowers 1½ inch in diameter, white. Early.

99. Juno, × × 1892.—Height 5 feet; vigorous bushy habit; moderately free-flowering; flowers purple. Mid-season.

100. Lævigatus, **A.M.** September 24, 1902 (Willmott).—Height 2 feet 6 inches; dense, upright habit; exceptionally free-flowering; flowers 1 to 1½ inch in diameter, bright rosy-mauve, shading to pink. Early. Received as "Longifolius formosus."

101. Lilacinus, × × 1892.—Height 4 feet; bushy, spreading habit; moderately free-flowering; flowers 1 to 1½ inch in diameter, lavender-blue. Early.

102. Litoreus, × × 1892.—Height 4 feet; bushy, spreading habit; free-flowering; flowers 1 inch in diameter, white, suffused with pink. Early.

103. Minerva, × × × 1892.—Height 4 feet 6 inches; strong, branching habit; moderately free-flowering; flowers 1½ inch in diameter, deep rosy lilac. Mid-season.

104. Mrs. W. Peters, **A.M.** September 7, 1897 (Sturgis).—Height 3 feet; bushy habit: very free-flowering; flowers large, white. Early.

105. Noir d'Angen, × × × 1892.—Height 4 feet; dense, bushy habit; very free-flowering; flowers lilac. Early. Not quite so good as No. 91.

106. Pluto, × × 1892.—Height 4 feet 6 inches; bushy habit; moderately free-flowering; flowers 1 inch in diameter, pale purple. Mid-season.

FIG. 172.—SEEDLING ASTER 'HON. EDITH GIBBS.' (*The Garden.*)

107. Proserpine, × × × 1892.—Height 6 feet; strong, branching habit; free-flowering; flowers 1 to $1\frac{1}{2}$ inch in diameter, rosy mauve. Mid-season.

108. Psyche, × × 1892 (Dobbie).—Height 4 feet; slender, graceful habit; moderately free-flowering; flowers 1 inch in diameter, lilac. Late.

109. Purity, × × 1892 (Dobbie).—Height 4 feet; strong, spreading habit; free-flowering; flowers 1½ inch in diameter, white. Early.

110. Pygmalion, × × × 1892 (Willmott).—Height 15 inches; very bushy, spreading habit; free-flowering; flowers light blue. Early.

111. Ravennæ, × × × 1892.—Height 5 feet; sparsely branched; free-flowering; flowers 1½ inch in diameter, bright lilac or heliotrope. Early.

112. Robert Parker, × × × 1892 (Dobbie).—Height 5 feet 6 inches; vigorous, branching habit; very free-flowering; flowers 2 inches in diameter, lavender-blue. Mid-season.

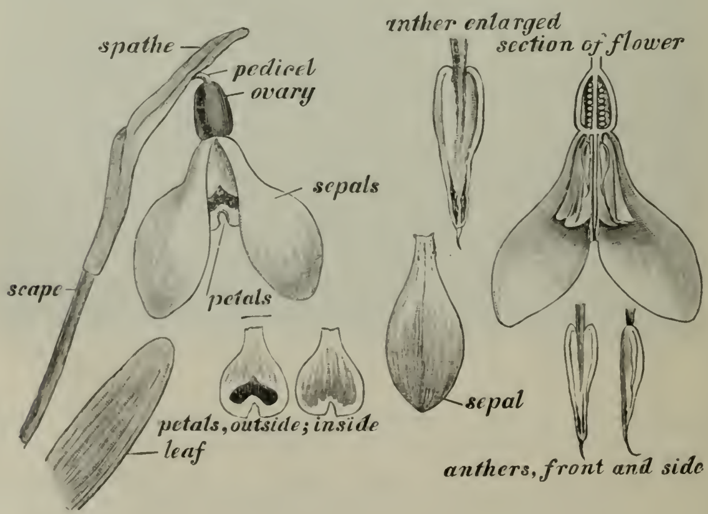
113. Semi-plena, × × × October 13, 1902 (Willmott).—Height 4 feet; very compact, branching habit; very free-flowering; flowers large, semi-double, lavender-blue. Mid-season. Received as "flore-pleno," but as the flowers are not perfectly double the Committee decided to change the name to the one it now bears, which is more descriptive than the one under which it came.

114. Stella, × × 1892.—Height 2 feet 6 inches; compact, bushy habit; moderately free-flowering; flowers 1½ inch in diameter, rosy lilac. Early.

115. Top Sawyer, **A.M.** September 24, 1902 (Dobbie, Willmott).—Similar to Robert Parker, but thought to be superior to it. Height 5 feet; vigorous habit; free-flowering; flowers 2 inches in diameter, semi-double, bluish lilac. Mid-season.

116. Vesta, × × × 1892.—Height 3 feet; bushy habit; moderately free-flowering; flowers 1 inch in diameter, greyish white. Early.

117. Virgil, × × × 1892 (Dobbie).—Height 4 feet; erect habit; free-flowering; flowers 1½ inch in diameter, deep heliotrope. Mid-season.



REPORT ON PHLOXES AT CHISWICK, 1902.

A collection of 340 varieties of Phloxes was planted in oblong beds on the north side of the long vinery between the Paxton house and the west wall, close to the council room, and on a large break of ground on the south side of the garden. Each variety was represented by two plants, and in some cases by four, and occasionally even six were grown. A mulching of stable litter was given early in May. The summer of 1902, being so very wet, suited these moisture-loving plants admirably; nearly all of them made satisfactory growth, and many of them yielded an abundance of flowers, especially the varieties named 'Sylphide,' 'Beatrice,' 'James Farquhar,' 'Croix du Sud,' 'Kaiser Wilhelm,' 'Miss Pemberton,' 'Sesostris,' 'Coquelicot,' 'Éclaireur,' 'Bouquet de St. Cyr,' and 'Le Vengeur.'

The Floral Committee examined the collection several times, and decided that, as there are so many too-much-alike Phloxes in gardens, only those varieties which received awards should be recorded.

A.M. = Award of Merit.
× × × = Highly Commended.
× × = Commended.

1. Africaine, × × August 16, 1892 (Forbes).—Height 2 feet 6 inches; sturdy habit; free-flowering; flowers white, splashed with pale purple.

2. Aspasie, × × August 2, 1892 (Forbes).—Height 2 feet; very bushy habit; moderately free-flowering; flowers purplish-rose, with a paler eye.

3. Avalanche, **A.M.** July 24, 1894 (Paul).—Height 18 inches; sturdy habit: very free-flowering; flowers cream-white, with a lemon eye.

4. Beatrice, **A.M.** July 27, 1897 (Forbes, Dobbie).—Height 2 feet; very bushy habit; very free-flowering; flowers large, closely packed on stiff spikes; colour rose-pink, with a purple eye.

5. Belvedere, × × August 16, 1892 (Forbes, Veitch).—Height 18 inches; rather slender habit; free-flowering; flowers large, deep-rose, flushed with purple and shaded white near the eye.

6. Béranger, **A.M.** July 27, 1897 (Forbes).—Height 3 feet; compact, sturdy habit; free-flowering; flowers large, rose-pink touched with violet near the purple eye.

7. Boule de Feu, × × × August 16, 1892 (Barr).—Height 2 feet; sturdy habit; free-flowering; flowers large, bright salmon-scarlet, with a rosy-crimson eye.

8. Bouquet de St. Cyr, **A.M.** July 27, 1897 (Barr).—Height 3 feet; bushy habit; free-flowering; flowers large, pure white, with a prominent rosy-purple eye.

9. Coquelicot, **A.M.** July 27, 1897 (Barr, Forbes, Paul, Veitch, Dobbie).—Height 2 feet; rather slender habit; very free-flowering; flowers large, rich orange-scarlet with a crimson eye. An improvement on Etna.

10. Countess of Mar, × × × August 16, 1892 (Forbes).—Height 3 feet; rather slender habit; free-flowering; flowers rather small, blush-white with a deep crimson eye.

11. Croix du Sud, × × × August 16, 1892 (Forbes, Barr).—Height 2 feet 6 inches; sturdy habit; free-flowering; flowers large, borne on large spikes, blush-white, with a crimson eye.

12. Delicata, × × × August 16, 1892 (Barr, Forbes).—Height 3 feet 6 inches; sturdy habit; very free-flowering; flowers white, with a faint suspicion of lilac near the eye.

13. Éclaireur, **A.M.** August 23, 1892 (Barr, Veitch, Dobbie).—Height 2 feet; sturdy habit; very free-flowering; flowers unusually large, borne on long spikes; colour rosy purple, with a paler eye.

14. Enchantment, × × × August 16, 1892 (Forbes).—Height 2 feet; compact bushy habit; free-flowering; flowers borne on large spikes, rosy lilac, occasionally streaked with white.

15. Épopée, × × × July 28, 1892 (Barr).—Height 2 feet; sturdy habit; free-flowering; flowers rosy purple, suffused with white near the crimson eye. Paler than Éclaireur.

16. Etna, **A.M.** August 8, 1893 (Barr).—Height 2 feet; slender habit; free-flowering; flowers scarlet, touched with orange.

17. Eugène Danganvilliers, **A.M.** August 10, 1897 (Barr, Forbes).—Height 2 feet 6 inches; compact, bushy habit; very free-flowering; flowers large, pale lilac, with a conspicuous white eye.

18. Eugène Schotte, × × August 16, 1892 (Forbes).—Height 2 feet; strong habit; free-flowering; flowers rather small, light purple, shading to white near the eye.

19. Événement, **A.M.** July 27, 1897 (Veitch, Forbes, Dobbie).—Height 2 feet 6 inches; vigorous habit; free-flowering; flowers salmon-rose, with a deeper eye.

20. Faust, × × × August 30, 1892 (Barr, Dobbie).—Height 2 feet; sturdy habit; very free-flowering; flowers large, white, with a suffusion of light purple near the eye.

21. Ferdinand Cortez, × × × August 12, 1902 (Forbes, Paul, Veitch, Dobbie).—Height 2 feet; sturdy habit; free-flowering; flowers clear rose-pink, touched with salmon.

22. Fiancée, **A.M.** July 25, 1899 (Forbes, Paul, Dobbie).—Height 2 feet; very bushy, compact habit; free-flowering; flowers large, borne on stiff spikes, pure white, with a lemon eye.

23. Flambeau, × × × August 2, 1892 (Barr).—Height 3 feet; strong habit; free-flowering; handsome spikes of orange-scarlet flowers, with a deep crimson eye.

24. Henri Murger, × × × July 22, 1892 (Barr).—Height 2 feet; sturdy habit; very free-flowering; flowers large, white, with a faint suspicion of pink near the crimson eye.

25. Iris, **A.M.** August 14, 1894 (Dobbie, Forbes, Paul).—Height 2 feet; rather slender habit; free-flowering; flowers violet, shaded blue.

26. James Farquhar, × × × August 12, 1902 (Forbes).—Height 3 feet; strong habit; very free-flowering; flowers large, white, faintly suffused with purple or mauve. A distinct and pretty variety.

27. John Forbes, × × August 2, 1892 (Forbes).—Height 3 feet

6 inches; vigorous habit; moderately free-flowering; flowers large, pink, with a prominent crimson eye.

28. Kaiser Wilhelm, × × × August 12, 1902 (Barr).—Height 3 feet 6 inches; rather slender habit; flowers rosy scarlet, with a deep crimson eye.

29. La Matilde, **A.M.** August 10, 1897 (Ware).—Height 3 feet; sturdy habit; free-flowering; flowers large, purplish violet.

30. Le Mahdi, **A.M.** August 15, 1899 (Forbes, Paul).—This is an improvement on Iris.

31. Leonardo da Vinci, **A.M.** September 10, 1895 (Barr).—Height 2 feet 6 inches; strong habit; very free-flowering; flowers large, white, with a conspicuous crimson eye.

32. Le Soleil, **A.M.** August 10, 1890 (Barr, Forbes).—Height 2 feet; sturdy, bushy habit; very free-flowering; flowers rose-pink, shaded white.

33. Le Vengeur × × × August 12, 1902 (Barr, Veitch).—Height 2 feet 6 inches; sturdy habit; very free-flowering; flowers large, rosy purple or carmine, with a deeper eye, similar to Éclaireur, but deeper.

34. Longchamps, × × × August 16, 1892 (Forbes).—Height 3 feet 6 inches; strong habit; very free-flowering; flowers white, with a purplish-violet centre.

35. Lord Raleigh, **A.M.** July 27, 1897 (Barr, Veitch),—Height 2 feet 6 inches; sturdy habit; free-flowering; flowers large, bluish purple, with a purplish-crimson eye.

36. Matador, × × × July 27, 1894 (Barr, Forbes, Dobbie).—Height 2 feet; sturdy habit; moderately free-flowering; flowers rich orange-scarlet, with a crimson eye.

37. Michael Cervantes, **A.M.** August 23, 1892 (Paul).—Height 3 feet; sturdy habit; free-flowering; flowers cream-white, with a large rosy-carmine eye.

38. Miss Pemberton, **A.M.** September 21, 1897 (Paul).—Height 2 feet; very sturdy habit; very free-flowering; flowers large, salmon-pink, with a rosy-crimson eye.

39. Molière, **A.M.** September 12, 1893 (Barr, Forbes).—Height 3 feet; strong habit; moderately free-flowering flowers; pale rose-pink, passing to white near the carmine eye.

40. Neptune, × × × August 2, 1892 (Veitch).—Height 3 feet; bushy habit; moderately free-flowering; flowers pink, with a rosy-purple eye.

41. Panama, × × × August 30, 1892 (Barr, Forbes).—Height 2 feet; strong habit; very free-flowering; flowers large, white, with a lemon eye.

42. Pantheon, × × × August 16, 1892 (Barr, Forbes, Veitch).—Height 2 feet 6 inches; sturdy habit; flowers large, salmon-pink, with a light purple eye.

43. Paul Bert, × × × August 16, 1892 (Barr, Forbes).—Height 3 feet; vigorous habit; free-flowering; flowers large, mauve, passing to white.

44. Pureté, × × August 2, 1892 (Dobbie).—Height 3 feet; sturdy habit; very free-flowering; flowers small, white, with a lemon eye.

45. Regulus, × × × August 16, 1892 (Barr, Forbes).—Height 2 feet; sturdy habit; very free-flowering; flowers large, rosy-salmon or rose-pink, paler near the rose-coloured eye.

46. Roi des Roses, × × August 2, 1892 (Forbes).—Height 3 feet; rather slender habit; flowers bright salmon-pink, with a crimson eye.

47. Sesostris, × × × August 12, 1902 (Barr, Forbes).—Height 3 feet; vigorous habit; very free-flowering; flowers large, bright rosy-purple, with a crimson eye.

48. Sylphide, **A.M.** September 24, 1902 (Dobbie, Forbes, Paul).—Height 2 feet 6 inches: compact, bushy habit; exceptionally free-flowering; flowers large, pure white, with a faint lemon eye. The best white-flowered Phlox yet raised.

49. Torpilleur, **A.M.** July 27, 1897 (Forbes).—Height 2 feet 6 inches; strong habit; very free-flowering; flowers large, bright rose, with a paler eye.

50. William Muir, × × × August 16, 1892 (Barr).—Height 3 feet 6 inches; slender habit; free-flowering; flowers rosy purple, with a crimson eye.

51. William Robinson, × × × August 16, 1892 (Barr, Forbes).—Height 3 feet 6 inches; vigorous habit; free-flowering; flowers large bright salmon, with a rosy-purple eye.

REPORT ON POTATOS AT CHISWICK, 1902.

Thirty-five stocks of Potatos were sent for trial, and thirty well-proved varieties were grown side by side for comparison. The whole collection was planted on April 1, in rows three feet apart, the "sets" being eighteen inches apart in the rows, on ground that had been ridge-trenched the previous autumn. A good dressing of decayed manure and burnt garden refuse was incorporated when trenching. The season was a very poor one for Potatos, as all the stocks were "cut" by frost in the middle of May, followed by a wet, cold summer, causing more disease to appear than for a number of years past; but in spite of these drawbacks, the majority of the varieties made excellent growth, and produced good crops, in many instances free from disease. The Fruit and Vegetable Committee examined the collection on three occasions, and they decided that the value of the trial would be greatly enhanced if the best late varieties were kept until December 5, and then cooked, after being stored about two months, which was done. The following varieties, by reason of their heavy crop and good appearance, were selected for cooking to test their quality, viz.:—

Alderman	Northumbria
Brydon's Crompton	Pioneer Earliest
Commonwealth	Professor Walker
Dalmeny Beauty	Shamrock II.
Dobbie's Favourite	Snowdrop
Earl Roberts	Snowdrop Improved
Henry Fincham	Springfield
New Century	The Marfield

Victoria Improved.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.

1. Alderman (Sharpe).—Flattish round; white; eyes shallow; handsome; moderate size; very heavy crop, free from disease; haulm moderate and sturdy. Mid-season. A very promising variety.

2. British Premier (Lister).—Round; pink; eyes deep; very large and coarse; heavy crop, slightly diseased; haulm moderate and sturdy. Mid-season or late.

3. Brydon's Crompton (Kent & Brydon).—Round; white; eyes full; moderate size; good crop, much diseased; haulm moderate and sturdy. Mid-season or late.

4. Chester Favourite (Dicksons).—Round; white; russety; good shape; eyes shallow; medium size; heavy crop, free from disease; tall, strong haulm. Mid-season or late.

5. Commonwealth, **A.M.** September 12, 1902 (Scammell).—Flattish round; white; russety; handsome; medium size; eyes shallow; great crop, free from disease; moderate haulm. Mid-season or late.

6. Coronation (D'Alcorn).—All diseased.

7. Dalmeny Beauty (Smith).—Round ; white ; eyes shallow ; medium to large ; handsome ; great crop, free from disease ; tall, vigorous haulm. Late. The heaviest crop in the collection, and a very promising variety.

8. Diamond Jubilee (Dicksons).—Round ; white ; eyes shallow ; medium size ; light crop, free from disease ; short haulm. Second early.

9. Dobbie's Favourite (Dobbie). — Round ; white ; russety ; eyes shallow ; good shape ; medium size ; very heavy crop, free from disease ; tall, strong haulm. Late.

10. Earl Roberts (Bradley).—Pebble shape ; eyes full ; white ; medium size ; heavy crop, free from disease ; moderate haulm. Mid-season.

11. Early London (Thomas). — Flattish round ; white ; russety ; eyes full ; handsome ; good crop, free from disease ; moderate haulm. Early.

12. Henry Fincham (Fincham).—Round ; white ; eyes rather deep ; medium size ; good crop, free from disease ; tall, strong haulm. Late.

13. Improved Glory of Denbigh, **A.M.** August 13, 1901 (Hughes).—See vol. xxvi. p. 872.

14. Masterpiece (Green).—Round ; white ; russety ; eyes shallow ; great crop of small tubers, free from disease ; tall, vigorous haulm. Late.

15. New Century, **A.M.** August 14, 1902 (Dicksons).—Kidney ; white ; eyes full ; good shape ; medium size ; very heavy crop, free from disease ; moderate haulm. A very fine early variety.

16. Northumbria, **A.M.** August 14, 1902 (Wythes).—Round ; white ; very russety ; handsome ; eyes shallow ; heavy crop, free from disease ; tall, strong haulm. Mid-season, or late.

17. Pearl (Sharpe).—Kidney : white ; eyes full ; uneven in size ; moderate crop, free from disease ; short, sturdy haulm. Early.

18. Pioneer Earliest Kidney, **A.M.** August 14, 1900 (Dicksons).—See vol. xxv. p. 170.

19. Pride of Chester (Dicksons).—Flat, round, varying to pebble shape ; white ; eyes full ; handsome ; moderate crop, free from disease ; short, sturdy haulm. Mid-season.

20. Professor Walker (Barr).—Round ; white ; eyes rather deep ; large, heavy crop, free from disease ; very tall, strong haulm. Late.

21. Royal Standard (Dicksons).—Round ; white ; eyes shallow ; variable in size ; fair crop, free from disease ; moderate haulm. Mid-season or late.

22. Shamrock II. (Appleby).—Good crop, much diseased after lifting.

23. Snowdrop, **F.C.C.** August 30, 1883 (Barr).—Flat, round ; white ; eyes full ; handsome ; heavy crop, free from disease ; moderate, sturdy haulm. Second early.

24. Snowdrop Improved (Barr).—Same as No. 23.

25. Springfield (Dobbie).—Round ; pale pink ; eyes rather deep ; russety ; very heavy crop, free from disease ; haulm tall and vigorous. Late.

26. Storm King (King).—Round ; white ; small ; and very poor crop, much diseased ; short haulm. Early.

27. The Dickson (Dicksons).—Kidney; white: eyes full; large; good shape; moderate crop, slightly diseased; haulm tall and vigorous. Mid-season.

28. The Marfield (Bristow).—Flat, round; white; very russety; eyes shallow; heavy crop, free from disease; tall, strong haulm. Late. A promising variety.

29. Trevor's Seedling (Hughes).—Flat, round; white; russety; eyes full; medium crop, free from disease; moderate, sturdy haulm. Mid-season.

30. Unnamed (Kime).—Similar to No. 29, but taller in the haulm.

31. Up-to-Date (Barr).—Flat, round; white; russety; eyes full; large; heavy crop, free from disease; very tall, strong haulm. Late.

32. Victoria Improved, **A.M.** December 5, 1902 (Sharpe).—Flat, round; white; eyes rather deep; good shape; large; very heavy crop, free from disease; tall, vigorous haulm. Mid-season or late. This variety was excellent when cooked.

33. Victory (Wythes).—Flat, round; white; eyes rather deep; moderate crop; free from disease; tell, strong haulm. Late.

34. Walnut-leaf Kidney (Dean).—Small and poor crop. This variety never succeeds at Chiswick.

35. Wythes' Maincrop (Wythes).—Flat, round; white; russety; eyes shallow; good crop, free from disease; moderate, sturdy haulm. Late. This is distinct from 'Maincrop Kidney,' which received a **F.C.C.** in 1883.

The Committee wished to be entered on the Minutes their appreciation of the admirable manner in which the Potatos are cooked and placed before them at Chiswick.

REPORT ON DWARF AND RUNNER BEANS AT CHISWICK, 1902.

Sixteen stocks of Dwarf and Runner Beans were sent for trial, all being sown on May 14, in ground that had been deeply trenched and heavily manured the previous winter. With one or two exceptions, all made good growth and cropped well.

F.C.C. = First-class Certificate.
A.M. = Award of Merit.

1. Brittle Wax (Atlee Burpee).—Not a success.

2. Earliest of All (Carter).—Not a success.

3. Early Favourite, **A.M.** April 27, 1897, as a forcing variety (J. Veitch).—Dwarf; foliage small, pods long; straight; handsome; very heavy crop.

4. Early Wonder (J. Veitch).—Very dwarf; foliage small; pods of moderate length, straight, thick, fleshy; heavy crop.

5. Epicure (Sutton), Climber (French).—Foliage of moderate size; pods long and slightly curved; heavy crop.

6. Excelsior (Sutton), Climber (French).—Foliage large; pods very long, straight; handsome; very heavy crop. The best of this class.

7. Holborn Wonder (Carter).—Dwarf; foliage rather large; pods long, straight; handsome; great crop. A very early variety.

8. Invincible (J. Veitch).—Dwarf; foliage large; pods of moderate length, thick, curved, almost like a Scarlet Runner; great crop, and a continuous bearer. A very productive variety.

9. Mammoth Seedling Runner (Carter), Scarlet Runner.—This is of the 'Painted Lady' type, but the pods are much longer and broader, and borne in great profusion.

10. New Stringless Green-pod Bush (Atlee Burpee).—Dwarf; foliage of moderate size; pods long, curved, thick, fleshy; heavy crop.

11. Princess of Wales (Sutton), Climber (French).—Foliage large; pods long, straight, fleshy; heavy crop.

12. Tender and True, **F.C.C.** September 3, 1891 (Sutton), Climber (French).—Foliage moderate in size; pods long, straight, handsome; heavy crop.

13. Ten Week (Carter), Climber (French).—Foliage of moderate size; pods long, broad, straight, and fleshy, almost like a Scarlet Runner; very heavy crop.

14. The Duke (Wrench).—Dwarf; foliage rather large; pods long, broad, straight, handsome; great crop. A continuous bearer.

15. Veitch's Hybrid (J. Veitch).—Dwarf; foliage small; pods short, thick, straight; very heavy crop. A continuous bearer.

16. Dr. Masters sent a supposed hybrid between a Dwarf French Bean and a Pea. The seed was almost the colour of a Pea, and rounder than the French Bean usually is, but in foliage, flower, and pods, the plant was exactly the same as a Dwarf French Bean, and the seed from the plant also identical.

MISCELLANEOUS VEGETABLES AND FRUIT AT CHISWICK, 1902.

Beet.

Willow-leaved (J. Veitch).—This variety has pretty, dark, narrow foliage ; but, though ornamental, the root is too small to be useful.

Borecole.

Veitch's Exhibition (J. Veitch).—Plant of sturdy growth and medium height, with a mass of finely curled foliage. A very handsome variety.

Broad Bean.

Green Leviathan (Carter).—A green-seeded form of the well-known "Leviathan," with the same sturdy habit, and immense long pods.

Cabbage.

1. Danish Roundhead (Atlee Burpee). Plants very dwarf ; heads of medium size, firm, round, and heavy.
2. Early Baseball (Atlee Burpee).—Plants dwarf ; heads rather small, deep round, and very firm.
3. Precocity (R. Veitch).—Plants dwarf, compact ; heads of medium size, rather conical, firm, with a small spread of outer leaves.
4. Robert Wrench (Wrench).—A very fine selection of the "Enfield Market" type.

Carrot.

Blood Red (Carter).—Roots of medium size, beautiful shape, and deep rich colour, with a very tender flesh.

Cauliflower.

Early Emperor (Carter).—Plant rather large, sturdy, producing large, compact, pure white heads of perfect shape.

Cucumber.

1. Fordhook Frame (Atlee Burpee).—A ridge variety, thickly covered with spines, and of moderate size.
2. Fordhook Pickling (Atlee Burpee).—A small ridge variety.

Egg Plant (Aubergine).

Black Beauty (Atlee Burpee).—Fruits of average size, of a very dark purple colour.

Fig.

Red Turkey (Westropp).—Proved the same as Brown Turkey.

Maize.

1. Perfection Sugar (R. Veitch).—Plant about 3 feet high, with large cobs, of excellent flavour when cooked.

2. Golden Bantam (Atlee Burpee).—Very similar to No. 1.

Melon.

Conqueror (Goody).—Raised from "Munro's Little Heath" crossed with an American variety, and supposed to be hardy, but it did not prove so in the cold, sunless summer of 1902.

Mustard.

Fordhook Fancy (Atlee Burpee).—A curled form of the ordinary Mustard.

Onion.

1. Gibraltar (Atlee Burpee).—Bulb deep round with a deep brown skin, solid and heavy. Requires a little more selection.

2. Pink Prize-taker (Atlee Burpee).—Bulb deep round, solid, with a bright purplish skin.

3. Yellow Globe, Australian (Atlee Burpee).—The same as our British stock.

Parsley.

1. New Perpetual (Carter).—Foliage beautifully curled and of a medium size, on dwarf, compact plants. Fine stock.

2. Unique (Lister).—A very dwarf and deeply curled variety.

Parsnip.

1. Model (Carter).—Roots thick, handsome, and not too large, in fact, just the size and shape a Parsnip should be.

2. Selected (Lister).—A rather large, full-crowned variety, of good shape.

Pepper (Capsicum).

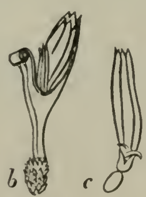
Chinese Giant (Atlee Burpee).—A very large, ugly-podded variety. Syn. "Bull's Nose."

Squash.

Fordhook Bush (Atlee Burpee).—Fruits white, round, slightly corrugated, of medium size, and freely produced on sturdy plants.

Shallot.

Veitch's Exhibition (R. Veitch).—A very large and productive variety, with a brownish-purple skin.



MISCELLANEOUS IMPLEMENTS, MANURES, &c., AT CHISWICK, 1902.

Beetlecute (Valls).

A non-poisonous powder that is deadly to ants, beetles, and cockroaches, and is invaluable where these pests are troublesome.

Cement Nonex (Street).

A dark slate-coloured cement that sets very hard, with a very smooth surface, on stone, brickwork, and hotwater-pipe joints.

Chelsea Horticultural Manure (J. Veitch).

For the third season in succession, this manure has proved its value for all pot plants, Vines, and Peaches, but for Figs especially it is the best chemical manure we have tried.

Frame (Burton).

A very good two-light frame, glazed with 21-oz. glass, and very portable. By removing a few bolts, the frame is easily taken to pieces, and readily moved for a long or short distance, or could be packed in a small space under cover when not in use.

Ipswich Broom (Flowers).

A wide, flat birch broom, the twigs of which are kept in place by a removable screwed plate, making it easy to fill again when the twigs are worn. A capital broom for sweeping-up leaves or cut grass.

Ivorine Label (Hughes).

In this garden the writing on these labels quickly becomes coated with a thick black film, covering the writing.

Powder-distributing Bellows (M. de Luzy Frères).

One of the most useful implements we have tried for distributing sulphur or tobacco powder. The powder is blown in a very fine shower, covering all the foliage evenly, with very little waste of powder.

Sécateur, Improved Double-cutting (J. Veitch).

This is by far the best pruning implement we know, being remarkably easy to work, handy in size, and making very clean cuts.

Three-pronged Watering Tool (Robertson).

A tool intended to make holes in the ground in dry weather to permit water passing into the soil freely. A good steel fork is quite as serviceable, and more convenient to use.

Weed Extractor (Beach).

A small, narrow-headed tool for pulling up weeds. In damp weather it acts very well for uprooting Daisies, Plantains, and Dandelions on lawns.

MISCELLANEOUS FLOWERING PLANTS AT CHISWICK, 1902.

A.M. = Award of Merit.
× × × = Highly Commended.

Amaranthus.

1. Henderi (J. Veitch).—A very uncommon annual, about 2 feet high, with long purple leaves, changing to bright crimson.

2. Superbus (J. Veitch).—Height 18 inches; plants of stronger growth than the last named, but the leaves are not so richly coloured.

Antirrhinums.

3. Majus, Veitch's Strain (R. Veitch).—A very good selection of the strong-growing varieties.

4. Mixed (Forbes).—The flowers are large and variously coloured.

5. Selected (Lister).—A good strain; plants of sturdy habit; very free-flowering; flowers large and variously coloured.

6. Tom Thumb (R. Veitch).—Plants of dwarf habit; free-flowering; colours various.

7. Tom Thumb Black Knight (R. Veitch).—Plants of compact, sturdy habit; flowers deep crimson or maroon.

Arctotis.

8. Grandiflora, **A.M.** July 16, 1901 (Wade).—A pretty South African sun-loving annual, with single Chrysanthemum-like flowers about 3 inches in diameter. The ray-florets are white, suffused with lilac, with a conspicuous yellow band near the heliotrope-coloured disc. The flowers are borne on stout stems, and close up at night.

Asters (Annual).

9. Comet Express (R. Veitch).—A very good variety, with pure white flowers.

10. Comet Flesh-coloured (Carter).—Height 1 foot to 15 inches; sturdy habit; flowers flesh-pink.

11. Comet Mixed (Carter).—Height 15 inches; flowers large and variously coloured.

12. Comet Rose-coloured (Carter).—Height and habit same as No. 10. Flowers rose-pink.

13. Comet Victory (Atlee Burpee).—Height 1 foot; flowers large, deep rose-pink.

14. Daybreak (Watkins & Simpson).—Height 1 foot to 15 inches; plants of compact, branching habit; flowers white, flushed with pink.

15. Early Hohenzollern (Roemer).—An early white Comet variety.

16. Hohenzollern Rose Extra Early (Roemer).—An ordinary rose-coloured variety.

17. Hohenzollern White (Roemer).—Similar to No. 15, but not quite so early.

18. Purity (Watkins & Simpson).—Height 15 inches; plants of branching habit; flowers of good shape, pure white.

Asters (Michaelmas Daisies).

19. Paniculatus cæruleus (Armitage).—Height 3 feet; branching, spreading habit; very free-flowering; flowers light blue.

20. Unnamed (Tayler).—Did not flower.

Balsam.

21. Defiance Exquisite (Atlee Burpee).—An ordinary variety with pale pink flowers.

22. Defiance White (Atlee Burpee).—Similar to the ordinary white-flowered Balsam.

Begonia.

23. Queen Anna (Atlee Burpee).—Similar to *B. semperflorens* 'Princess Beatrice.'

Carnation.

24. Mrs. Harkett (Harkett).—A medium-sized, sweet-scented pink flower, with fringed petals.

Celosia.

25. Thompsoni magnifica (Lorenz).—An excellent strain of *C. pyramidalis.*

Chrysanthemum.

26. Horace Martin, **A.M.** September 24, 1901 (Wallace).—A rich yellow sport from the crimson 'Madame Marie Massé.'

Clarkia.

27. Pulchella Tom Thumb, double crimson (Watkins & Simpson).—Height 9 inches; very free-flowering; flowers double crimson.

28. Pulchella Tom Thumb, double purple (Watkins & Simpson).—This differs from the last named by reason of its flowers being purple.

29. Pulchella Tom Thumb, double white (Watkins & Simpson).—Height 10 inches; compact bushy habit; very free-flowering; flowers double pure white.

Coleus.

30. Sunset Strain (Atlee Burpee).—A strong-growing strain, but the leaves are rather dull in colour.

Delphinium.

31. Blue Butterfly, **A.M.** July 17, 1900 (Carter).—A dainty annual Larkspur, 10 inches high, of bushy branching habit, and very floriferous. The flowers are deep blue, and the rich green leaves are deeply cut.

Diascia.

32. Barberæ (J. Veitch).—A free-growing South African annual, about 1 foot high, with an abundance of loose pink flowers borne on slender stems.

Dimorphotheca.

33. Ecklonis (R. Veitch).—The Transvaal Marguerite. A diffuse-growing species, 2 feet 6 inches high, from South Africa, with Marguerite-like flowers 3 inches across. The ray-florets are white, and the centre or disc violet-blue.

Dolichos.

34. Darkness (Atlee Burpee).—A semi-climbing plant with Bean-like leaves and dark mauve-coloured Pea-shaped flowers. Seed-pods purple.

35. Daylight (Atlee Burpee).—A cream-white form of No. 34.

Eschscholtzia.

36. Californica canaliculata rosea (R. Veitch).—A delightful little plant with pale primrose-yellow flowers; externally the colour is soft rose.

37. Compacta 'Mandarin' (J. Veitch).—Plants of compact bushy habit; flowers orange-red.

38. Compacta 'Rose Queen' (Watkins & Simpson).—Height 1 foot; sturdy habit; free-flowering; flowers rose, passing to silvery-pink.

Gaillardia.

39. Veitch's Compact Strain (R. Veitch).—A very fine strain, with large, richly-coloured flowers.

Godetia.

40. Duke of York (Carter).—Height 18 inches; sturdy habit; free-flowering; flowers rosy crimson, many of the petals edged with white.

41. Grandiflora rosea fl. pl. (J. Veitch).—Height 18 inches; flowers semi-double, pale flesh or pink, with a crimson base.

42. Sunset (Watkins & Simpson).—Height 10 inches; bushy habit; very free-flowering; flowers rosy-crimson, with a white centre.

Helianthus.

43. H. G. Moon, **A.M.** September 25, 1900 (Bennett-Poë).—A lovely single yellow Perennial Sunflower, raised between *H. lætiflorus* and *H. multiflorus*. The broad ray-florets are deep golden yellow.

Heliotrope.

44. Lemoine's Giant mixed (R. Veitch).—A vigorous-growing strain, with huge heads of flowers varying in colour from pale lavender to dark blue.

Lantana.

45. Dwarf compact hybrids (Watkins & Simpson).—Plants of dwarf, compact habit; very free-flowering; flowers pink, rose, white, orange, &c.

Lathyrus odoratus (Sweet Pea).

46. Admiration (Atlee Burpee).—Flowers large, deep mauve.

47. American Queen (Atlee Burpee).—Standards rose; wings pink.

48. Black Knight (Sydenham).—Flowers larger and deeper than No. 76.

49. Blanche Burpee, **A.M.** July 23, 1895 (Sydenham ; Atlee Burpee).—Flowers white.

50. Captivation (Sydenham).—Standards reddish purple ; wings purple.

51. Coccinea, × × × July 27, 1898 (Sydenham).—Very large flowers, of a bright rosy-scarlet shade.

52. Countess of Cadogan, **A.M.** July 14, 1897 (Sydenham).—Flowers large, lavender-blue, touched with mauve on the reverse of standard.

53. Countess of Lathom (Sydenham).—Flowers delicate pink.

54. Duchess of Sutherland (Sydenham).—Flowers large and of great substance, white, suffused with blush pink.

55. Duke of Westminster, × × × July 27, 1898 (Sydenham).—A handsome flower, with large purple standards and violet wings, veined with purple.

56. Emily Henderson, **A.M.** June 26, 1894 (Sydenham).—Large white flowers.

57. Gorgeous, × × × July 13, 1900 (Sydenham).—Flowers large and of good shape ; standards pale salmon ; wings bright rose.

58. Hon. F. Bouverie (Sydenham).—Very pale pink self.

59. Lady Grisel Hamilton, **A.M.** July 14, 1896 (Sydenham).—Flowers pale blue or lavender.

60. Lady Mary Currie, **A.M.** July 14, 1897 (Sydenham).—Flowers orange pink, suffused with rosy-mauve.

61. Lottie Eckford (Sydenham).—Flowers large, mauve, edged with blue.

62. Majestic (Atlee Burpee).—Standards rose ; wings rose-pink.

63. Mars, **A.M.** July 23, 1895 (Sydenham).—Flowers large and of excellent shape ; standards rich crimson ; wings shaded rose-purple.

64. Miss Willmott (Sydenham).—Very large salmon-pink flowers.

65. Mixed bush varieties (Atlee Burpee).—Principally light-coloured varieties of semi-climbing habit.

66. Mrs. Eckford, **A.M.** July 21, 1891 (Sydenham).—Flowers large, cream white or pale primrose.

67. Navy Blue, × × × July 23, 1900 (Sydenham).—Flowers large, deep blue, wings shaded with purple.

68. Oriental, × × × July 27, 1898 (Sydenham).—Flowers salmon-pink.

69. Othello (Sydenham).—Flowers deep maroon, touched with purple.

70. Prima Donna (Sydenham ; Atlee Burpee).—Flowers pale pink.

71. Prince Edward of York, **A.M.** July 14, 1896 (Sydenham).—Standards orange-red : wings rose, suffused with purple.

72. Queen Victoria, **A.M.** July 14, 1896 (Sydenham).—Large cream-white flowers, with a faint suspicion of pink.

73. Royal Rose (Sydenham).—Large, well formed, rose-coloured flowers, the wings paler than the standards.

74. Sadie Burpee, × × × July 27, 1898 (Sydenham).—An improvement on No. 56.

75. Salvation Lassie (Atlee Burpee).—Lovely pale rose-coloured flowers.

76. Stanley, **A.M.** July 8, 1890 (Sydenham).—Standards maroon ; wings purple.

77. Triumph (Sydenham).—Flowers large and of great substance; standards rose, mottled with white; wings white, suffused with pale purple.

78. Venus, **A.M.** July 21, 1891 (Sydenham).—Deeper than No. 53.

79. White Snapdragon (Atlee Burpee).—White Snapdragon-like flowers.

Cupid Sweet Peas.

80. Alice Eckford (Roemer).—Flowers large and substantial; standards rose-pink; wings white.

81. America (Atlee Burpee).—Standards rosy-crimson; wings white, speckled and flushed with purplish crimson.

82. Beauty (Roemer).—Very free-flowering; flowers large and of great substance; standards pale pink; wings blush white.

83. Countess of Radnor (Roemer).—Flowers lavender or pale mauve.

84. Cupid (Roemer).—Flowers white.

85. Mixed (Atlee Burpee).—A fair selection.

86. Pink Cupid (Roemer).—A pretty variety, with large rose-pink flowers.

Littonia.

87. Modesta (Beddome).—A South African greenhouse plant suitable for clothing pillars. It grows from three to six feet high, and bears rich orange bell-shaped flowers in summer.

Lobelia.

88. Formosa (Carter).—Plants of loose spreading habit, with purple flowers.

89. Compacta (Carter).—Plants of bushy habit; very free-flowering; flowers rich blue.

Nicotiana.

90. Macrophylla gigantea (J. Veitch).—Similar to *N. Tabacum.*

91. Sylvestris, **A.M.** July 25, 1899 (Carter).—A beautiful plant for sub-tropical gardening. It is of more sturdy habit than *N. affinis*, and grows four feet or so high, supplied with large pale green leaves, and remarkable for its profusion of long tube-shaped, drooping, pure-white, sweet-scented flowers, borne in terminal and axillary corymbs.

Papaver.

92. Dwarf Shirley Hybrids (J. Veitch).—A delightful strain of dwarf-growing varieties, with richly-coloured flowers.

93. Picotee (Carter).—Height 18 inches; plants of sturdy habit; very free-flowering; flowers single and semi-double; colours various.

Pelargonium (Zonal).

94. Beauty (Toundrow).—A dwarf variety, with bright scarlet flowers.

Pentstemons.

95. Grandiflorus, Veitch's strain (R. Veitch).—A good strain, with large variously-coloured flowers.

96. Selected (Forbes) } Similar to No. 95.
97. Selected (Lister) }

Petunia.

98. Defiance (Atlee Burpee).—A remarkably good strain, with large, richly-coloured flowers, mostly with mottled throats.

99. Lord Courtney (R. Veitch).—Plants of spreading habit; very free-flowering; flowers small, bright rose. A continuous bloomer.

Rudbeckia.

100. Bicolor superba (R. Veitch)—Height 2 feet; branching habit; flowers large, rich yellow, the basal portion of petals heavily stained with velvety-brown.

Salpiglossis.

101. Mixed (Carter).—A splendid strain. The plants are of branching habit, and bear great quantities of large, richly-coloured flowers.

Stock.

102. Ten Week Monarch (Carter).—Height 2 feet 6 inches; flowers large, pure white.

Tagetes (Marigolds).

103. African Lemon, Lister's Incomparable (Lister).—Height 2 feet; plants of bushy habit; flowers large double, lemon-yellow.

104. African Orange, Ball of Fire (Lister).—Stock mixed.

105. French Striped, Lister's Select Selected (Lister).—A splendid strain. The flowers are rich golden-yellow, striped with crimson.

106. French Striped grandiflora (R. Veitch).—Similar to No. 105.

Torenia.

107. Fournieri compacta (J. Veitch).—Height 5 inches; compact bushy habit; wonderfully free-flowering; flowers like those of the type.

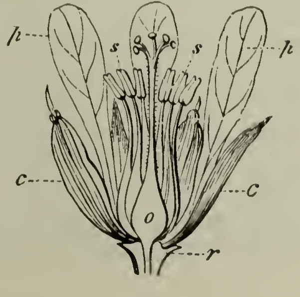
Tropæolum.

108. Ivy-leaved (Carter).—A free-growing variety, with an abundance of bright scarlet flowers.

Wallflower.

109. Blood-red Annual (J. Veitch).—Height 2 feet; plants of bushy habit; very free-flowering; flowers fragrant, blood-red.

110. Parisian Early Blood-red, **A.M.** November 9, 1897 (J. Veitch).—Plants of sturdy branching habit; exceptionally free-flowering; flowers fragrant, large, yellow touched with bronze.



COMMONPLACE NOTES.

By the SECRETARY and the SUPERINTENDENT.

THE NEW HALL.

EVERY Fellow knows by this time that a new hall for the Society to hold its meetings in, with new offices, is now being built in Vincent Square, in a direct line between Westminster Abbey and Victoria Station, and hardly more than a stone's-throw removed from the great main artery of Victoria Street. His Majesty the King has caused a most gracious letter to be sent to the Council, expressing his earnest hope that success may attend our efforts, enclosing therein a cheque for one hundred guineas. His Royal Highness the Prince of Wales has most kindly written also, and sent a cheque for fifty guineas. In all, £21,000 has been promised, but £40,000 is required. Surely every Fellow should contribute SOMETHING? Would not *every* Fellow like to feel that he had at least a few bricks of the building to his own individual credit? One lady who can only afford £1 1*s*. writes: "I only wish I could promise a larger subscription. But I venture to make a suggestion. Would not every Fellow

(1) Give *at least* one guinea;

(2) Get at least one new Fellow for the Society this next year; and

(3) Double his or her annual subscription until the New Hall is out of debt?

These things I will gladly do, as I can afford no more. Could you not suggest that everyone should do no less?"

These words have the true ring of generosity about them, and they certainly ought to stir us all up to do at least as much; and of course many—very many—if they had but the same spirit, could do more.

People sometimes make excuse and say they did not send anything because they did not know whom to send to. All cheques or postal orders should be drawn in favour of the Treasurer, Royal Horticultural Society, and the names of new Fellows and the glad announcement of doubling the subscription should be sent to the Secretary, R.H.S. Office, 117 Victoria Street, Westminster, S.W.

DEAD WOOD IN FOREST TREES.

It is frequently said that we have more insect and fungoid pests to contend against now than was the case a comparatively few years ago. How far this is correct is open to question. But, supposing it to be true, there is no doubt about the blame resting on our own shoulders. In every direction, including some of the best managed estates, we see quantities of dead branches and dead trees which are absolutely teeming with fungi, and are therefore a standing menace to all surrounding trees, the fungi on them only waiting for a favourable opportunity to attack fresh subjects, working destruction possibly slowly, but none the less surely. We have pointed this danger out to more than one tree-lover and planter, and the answer is, almost invariably: "Oh, I think dead trees (or dead branches) very picturesque, and I would not have them removed and burnt on any account; and, after all, the danger can only be very remote." In the case of Oak-trees, we have heard it said that it is bad forestry to cut the dead limbs out of the trees. But why? We should like to know the reason why Oak-trees, more than others, resent the dead wood being removed.

In our opinion the cause of death or decay in so many comparatively young trees, is in great part due to permitting so much dead wood to remain. Not only is it worse than useless, for its beauty is at least open to doubt, whereas its danger is absolutely certain, for it swarms with fungi and with insect foes, which immediately enter a fresh tree whenever a branch is broken or a limb cut off, and so the enemy goes on working destruction without a check. Not only should dead trees be promptly cut down and removed to the woodyard, but also all dead or dying limbs, taking care, of course, to paint the wound over at once with a good coat of tar, thus preventing any fungi entering. If left only for a day or two, the enemy has very likely entered the tree, and it is then little good painting the wound afterwards. If tree lovers would remember this and act upon it, injury to our trees would be greatly reduced, and the beauty of the countryside improved.

The question of how to prune forest trees is not so well understood everywhere as it ought to be. This is proved by seeing limbs sawn off sometimes a foot or more from the trunk or main branches. The consequence is that the portion left decays back into the tree itself, giving a free entry to all foes, and also to wet, the certain parent of decay. On the other hand, if the branch is cut off close to the trunk, and the edges of the wound pared round with a sharp knife or with a chisel, and followed up with a coating of tar at once, the tree quickly begins to cover the wound with new bark, and in a few years it is quite covered up—that is, of course, if the tree is healthy and in vigorous growth.

Fig, "Bourjassotte Grise."

This delicious Fig is also known as "Grizzly Bourjassotte," and out of the large collection grown in the Society's gardens it is surpassed by none, and equalled by very few; in fact, as an all-round variety, we think it is unrivalled. The tree is a good grower and sure bearer; the fruit is of medium size, of a rather oblate shape, with dark-red, juicy flesh, of the richest flavour. Another great advantage of it is that the fruit is not prone to split when ripening. If we were confined to one variety only, and had our choice, this is unquestionably the one which we should choose; and as fresh Figs are growing rapidly in favour for dessert, this sterling variety should be included in every collection, however small. All the Figs at Chiswick are grown in pots, but, judging from its habit in comparison with other and better known varieties, we have no doubt that it would succeed equally well planted out under glass, or planted out in the open, against a warm wall, in those localities where Figs are wont to ripen fruit outdoors.

Lime-trees and their "Drip."

A distinguished Fellow of the Society writes that he has been informed most positively that the rain-drip from Lime-trees is very destructive to any plants growing beneath, more destructive than the rain-drip from any other tree would be, and that it has been particularly noticeable this year. He can, however, see no reason why it should be so, and asks "Is there anything in the Lime particularly, of all trees, to injure anything growing below it?" On inquiry we have found that his informant is by no means alone in attributing deadly consequences to the vicinity of a Lime-tree; on the contrary, a belief in its ill effects is very widespread indeed. But we believe it is absolutely erroneous to fasten the blame upon the tree. The Lime, as everybody knows, is peculiarly subject to attacks of aphides, which excrete a sweet sticky substance, which in hot seasons is so abundant that it drips from the trees on to any growth below, injures it by sealing up its respiration pores, and causes all the dust and dirt of the atmosphere to accumulate upon it. The past summer has, however, not been by any means a hot one, and has consequently been comparatively free from aphis, and beyond this aphis-drip (which is absolutely distinct from rain-drip) there is nothing in a Lime-tree to injure anything below it more than in any other kind of tree.

It will further be obvious that the more frequently it rains the more it will wash off the aphis-drip deposit, and cleanse the leaves of plants below, and in this way the rain-drip will do actual good instead of harm.

To make Poppies Last in Water.

A correspondent who is enthusiastic over Shirley Poppies tells us that she has overcome their most serious defect, which consists in the difficulty of so treating them as to get them to last fresh in water instead of drooping their heads within an hour or two of being gathered. She says: "I always cut my Poppies early, say 8.30 A.M., and I take out with me into the garden a jug half full of *boiling* water, and put the flower-stems into it, and leave them in the jug quite half an hour before arranging them in vases filled with warm water. They will then last, with stiff and upright stems, for two days, without either leaves or blossoms drooping. I found putting them into *cold* water was of little use, but since I started with boiling or almost boiling water I have never failed." This did not reach us till after the Poppy season was over, so that we have not ourselves tried it.

Pruning Apple-trees.

A Fellow asks how it is that his bush trees of 'Irish Peach' and 'Yorkshire Beauty' never bear even a moderate crop of fruit. He says that all his trees are pruned on the same system, and yet that these two varieties may be classed as absolute failures.

The practice of pruning all varieties in the same way is surely the very cause and reason of the failure? Many varieties of Apples have a peculiar habit quite different from their brethren, and therefore require a different style of pruning: such varieties, for instance, as 'Irish Peach' and its seedling, 'Early Peach,' 'Yorkshire Beauty,' 'Mr. Gladstone,' 'Lady Sudeley,' and a few others. All these varieties form fruit-buds at the points of the current year's shoots, and to prune off all the points means cutting off all the best fruit-buds. A certain amount of cutting back, no doubt, is necessary in order to form a properly-balanced tree; all shoots growing in towards the centre of the tree, and those which rub against and chafe their neighbours, should also be cut out; but if all other shoots are left intact, good crops are practically assured, unless the climatic conditions of the season are unfavourable.

Again, that beautiful variety, 'Gascoigne's Scarlet,' is frequently condemned as a shy bearer, because it resents close or hard pruning; yet, if the young wood is left to nearly its full length when pruning, a mass of fruit-buds are formed on it from base to summit the next season, succeeded by a splendid crop of its handsome fruit the year after, and this abundant fertility checks rampant growth, and the tree continues to fruit freely afterwards. Severe pruning may answer with many varieties when grown in a dwarf or restricted form, but other varieties refuse such treatment, and show their dislike by producing little or no fruit, and a plethora of wood and foliage. Fruit-growers should study the various and varying characteristics of each variety, and direct their management accordingly.

Tree for Wet Soil.

A Fellow asks, "Can you tell me of any evergreen Conifer which would be likely to stand wet soil in which even the Scots Fir has slowly dwindled and died?" It is exceedingly difficult to think of any tree which will put up with stagnant wet, but the one from which we should hope most and which fairly fulfils the conditions of "evergreen" and "Conifer" is *Taxodium distichum.* True, it is not evergreen in dry places, but it generally is so in wet ones. It is a handsome and hardy tree in most situations, attaining a height of 100 feet or more. The trunk is reddish-brown in colour, and of a fibrous texture, contrasting charmingly with the soft light green leaves.

Beetles and Ants.

Who has not known the disappointment of finding some favourite flower-spike or some opening blossom eaten through and destroyed by cockroaches or other beetles? Who has not seen pot plants flag and die from an invasion of ants taking up their residence among the roots? We are not sure whether the ants really eat the roots or not, but we are inclined to attribute the ruin they bring about partly to the mechanical effect which they produce upon the soil by separating it into such minute dry particles, and partly to the acid secretion which the ants themselves give off; but the damage done is unfortunately too self-evident.

These remarks are suggested by a really pitiful appeal from a Fellow, who says: "Last year I so swarmed with wasps that they spoilt almost all my Peaches. I destroyed twelve nests in my own garden! This year I have very few, but the ants have done more damage than even the wasps did last year." Now ants are always very difficult to get rid of, and ordinarily we should only have been able to advise "boiling water on the nests when they are not too near the trees, and pans or saucers sunk in the ground and partly filled with treacle and water with a little arsenic well stirred up in it." It is needless to point out how dangerous a remedy this is where children or dogs may be about. However, we do not now advise this method. For some little time ago we were told that there was a powder called Vall's Beetlecute, which is very inexpensive, and perfectly harmless both to men and animals, but which was certain death to all cockroaches, beetles, ants, and such like. We were somewhat sceptical about this preparation when it was first brought to our notice, but after a careful trial we have found it really does effect almost all that is claimed for it. It is essential that the powder be kept dry, and at Chiswick we have scattered it on bits of thin slate or board which we have laid in the stove and propagating pits at night, collecting all the powder that is left in the morning before watering and syringing were begun. Used in this way and repeated for several nights running we have found it really very effective, not that the beetles or ants were found dead, but that they were conspicuous by their absence just where they had previously made their presence most objectionably realised. A sixpenny tin will enable anyone to make a similar experiment, and if they will only bear in mind to "keep their powder dry," and to repeat the offer and supply of it for several nights running, we think their experience will be the same as ours. It is a pleasure to know that this powder was the invention of a lady, and she tells us it is as useful in the kitchen as in the stove and greenhouse.

Winter Manuring of Fruit-trees.

Large fruit-growers usually manure their fruit-trees during the winter months with farmyard manure, and the resulting crops amply repay them for the labour and outlay. But all over the country a most valuable fertiliser is practically wasted, and treated as a nuisance, viz. the contents of cesspools, drainage from manure-heaps, cattle-sheds, stables, &c. In country places one constantly sees all this invaluable liquid manure running into drains, ditches, and brooks, instead of being collected in tanks for putting on the land, and the general loss must be enormous. In the winter months the supply of such liquid is usually large, and if collected and put on the ground amongst fruit-trees once a week, or as much oftener as may be necessary to prevent waste, the soil is charged with plant-food, which must react beneficially on the health and vigour of the trees and on the quantity, quality, size, and cleanness of the crops the following season. Many fruit-trees bear only in alternate years probably only through exhaustion from producing a good crop of fruit, and require a year to recuperate before they are able to bear another crop. But trees that are kept healthy and strong by liberal supplies of plant-food, given as above, would produce crops annually, unless the climatic conditions happened to be adverse. There would be no danger of the liquid being too strong for the trees, as, the roots being more or less dormant in winter, injury would be almost impossible; and another advantage, especially with large standard trees, would be that the soil would be moistened for a considerable depth, whereas for a number of years, owing to the smallness of the rainfall, the soil has been comparatively dry a foot or two below the surface. We have given as much as 100 gallons to one large tree at once, and found a very marked improvement in wood, foliage, and fruit the following season.

N.B.—Strong liquid manure should never be given in summer when the ground is dry and the sun powerful. At such times it should be diluted with at least three parts of water to one of liquid manure.

India-rubber.

Much interest is now being taken in the growth of rubber-yielding trees, and many Fellows living abroad may be glad to know where to look for information. A Fellow who has recently been reading the matter up kindly sends the following note :—" You may find many useful, notes and hints in the 'Kew Bulletin of Miscellaneous Information' under the following dates and headings:—May 1890, 'Lagos Rubber'; July 1890, 'Columbian Rubber'; March 1892, 'Sources of Rubber Supply'; July 1893, 'Para Rubber in Ceylon'; March and April 1896, 'Rubber Industry at Lagos'; September and October 1896, 'Cultivation of India-rubber in Assam'; October 1898, 'Para Rubber.' See also the Consular Report of rubber-growing countries published by the Foreign Office. It seems very difficult to estimate the probable yield of rubber per acre, as so many different figures are given by different people, due probably to the many different kinds of rubber-yielding trees and to the various climates concerned."

Artificial Manure for Gardens.

A Fellow, who forgot to sign his name, writes to us thus :—

" I have some thought of using artificial manure for my garden instead of stable manure, which is very difficult to get. My garden is well drained, and the soil light and good; the question is whether the artificial manure fully takes the place of stable manure? If in your opinion this is so, what manure would you advise for general garden purposes?"

We are not of opinion that any artificial manure "*fully* takes the place of stable," especially if it is used year after year continuously. Why this is so it would take too long here to explain. Artificial is an excellent substitute for stable manure, and it is a magnificent addition to it, but we do not think it can ever take its place entirely for a series of years. For such a soil as described in the above letter, we should advise a mixture of 1 oz. of nitrate of soda, 1 oz. of muriate of potash, and 2 ounces of superphosphate to every square yard. Precaution should be taken in two ways: first, only to put it on when the crops are actually growing, and root action consequently active, otherwise the potash and nitrate, being so soluble, will be wasted if put on when the roots are at rest or the land fallow. Secondly, it should be carefully strewn on the ground, and not sprinkled all over the foliage. Such an artificial manure might be used two years consecutively, but in the third we should advise stable dung, and if from cow-stables the better for light land. Far better, however, would be a light dressing of dung dug-in in February, and then half the amount of artificial when the plants are in growth.

BOOKS RECEIVED.

"Agricultural Botany." By Professor M. C. Potter, M.A., F.L.S., F.R.H.S., &c. (Methuen, London.) 4*s*. 6*d*.

This interestingly written "Botany" might quite as well have been called "horticultural" as "agricultural," for it is in reality a delightfully plain and easy text-book for the elements of botany and vegetable physiology. The charm of the present book consists in the comparative absence of technical terms and difficult words. Professor Potter says "Scientific knowledge is often expressed in needlessly technical language," with which we most cordially agree. We can heartily commend the book to any ignorant person who wants to learn how plants grow, of what members they consist, how they feed and on what food, how they multiply, and by what diseases and enemies they are specially attacked. It is amply illustrated, and is a perfectly readable book for anyone wishing to gain "a little knowledge" which cannot prove "a dangerous thing" in this instance, but is more likely to lead on to the desire to acquire a still fuller grasp of the subject.

"Children's Gardens." By the Hon. Mrs. Evelyn Cecil. (Macmillan, London.) 6*s*.

All who really love any hobby or pursuit love to make disciples, and this spirit—the spirit of endeavouring to inoculate the rising generation with her own almost inexhaustible love of gardens—breathes through Mrs. Evelyn Cecil's book from cover to cover. Let us say at once that it is not intended for quite babies, but children of ten years old and upwards may well be imagined deeply interested in this unassuming volume and learning from it "a sound foundation of the rudiments of gardening." There are plenty of pictures, evidently from photographs, scattered about the book to brighten it and add to its interest. It is divided into the four seasons, each of which is described with its principal and best flowers, with full instructions how to work and what to work at and plan for during each season. Happy children, born in these later days! There were no such books when we were boys and girls. Perhaps that makes us all the more enjoy such children's books as this when our own second childhood is not very distant.

"Trees and Shrubs for English Gardens." By E. T. Cook. (Newnes, London.) 12*s*. 6*d*.

Another of the charming volumes of the "Country Life" Library, and right royally does it maintain the credit of the series. Mr. Cook is to be congratulated on having supplied a distinct want, and he is also to be envied by many in having a publisher who will allow him such a wealth of glorious illustrations, of which there are nearly 150 full-page reproductions from photographs. And herein consists both their value and their beauty, for they are not, as is so often the case with illustrations, imaginary fancy pictures which could not under any circumstances be realised, but they are plain matter-of-fact representations of existing specimens, and are all singularly beautiful. It is invidious to mention any in particular where all are so nearly perfect, and yet we must direct attention to the plates of *Pinus Pinaster*, and of the Lime in its winter aspect, from either of which you may discern that nature can be more beautiful than art. The letterpress of the work is as useful as the plates are ornamental. It gives directions for planting each tree or shrub, the situations they like, the method and time of pruning (if required), and different modes of propagation. A delightful gift-book for any country house.

"Systematic Botany, A Handbook of." By Dr. E. Warming, with a Revision of the Fungi by Dr. E. Knoblauch. Translated and edited by Professor M. C. Potter. (Swan Sonnenschein, London.) 15*s.*

This is a complete classification of the vegetable kingdom as far as "Families" (equivalent of Bentham and Hooker's "Cohorts") and Orders, with excellent illustrations of types. In Dicotyledons the divisions are replaced by two sub-classes: (1) containing the apetalous and polypetalous orders, as *Choripetalæ*; sub-class (2) being composed of the gamopetalous orders. Several orders are redistributed, *e.g.* under *Curvembryæ Caryophylleæ* adjoin several apetalous families, while *Euphorbiaceæ* stand by *Malvaceæ*, &c.

"Injurious and Useful Insects." By Professor L. C. Miall, F.R.S. (Bell, London.) 3*s.* 6*d.*

A most interesting little book, but it is more an introduction to the study of entomology than a handbook of insects of economic interest. To anyone wishing to learn something about the anatomy and life-history of insects, and who has little or no previous knowledge of these subjects, this book will be most useful. It is very well printed and is profusely illustrated with very good figures. The author says in the preface: "This little book has been written for beginners who are willing to take some pains to acquire a practical knowledge of insects, and are specially interested in the application of entomology to agriculture, horticulture, and forestry." There can be no doubt that the destruction of injurious insects would be far better and more intelligently carried out if those who were engaged in the work had some knowledge of the habits and life-history of the various insects they were dealing with. At present the average gardener and farmer, and many amateur cultivators, are lamentably ignorant on this subject. Those, however, who only want a book to tell them how to destroy the pests that are injuring their crops, without knowing or learning anything about them, may find other works more suitable. The present book is divided into four parts. The first answers the question, What is an insect? and gives directions as to how to dissect a cockroach, and various details of its anatomy. The second gives an account of the life-history, &c., of a few species belonging to each of the five principal natural orders in which insects are classified, namely, those containing beetles, butterflies and moths, bee-like insects, two-winged flies, aphides and scale insects. There is also a chapter on a few common insects of other orders. Part III. (which we think would have been better placed before Part II.) gives a descriptive account of the larger orders of insects, with short notices of remarkable forms. The fourth part deals with "the destruction or mitigation of insect pests," and in it is given an account of the steps taken to destroy the Gipsy moth in the State of Massachusetts, among which are many suggestions that may be of use to fruit-growers in this country. An account is also given of the devastation caused by the "fluted scale insect" among the orange groves of California, and its destruction by means of a ladybird introduced from Australia. This is followed by a chapter on "Remedies for Injurious Insects: Washes and Sprays." In commenting on arsenical preparations, which are usually sold in a powder, it is not mentioned that they can be obtained in the form of a paste, in which condition they are much safer to handle, as the powder so easily blows about; and, as these substances are extremely poisonous, it is well to avoid any chance of inhaling any of the powder. In recommending poisoned baits for the destruction of wire-worms, this may be useful in gardens, but in fields where several acres are infested the cost of the operation would be prohibitive. The author calls attention to the necessity of clearing off the weeds from neglected corners, and the immediate destruction of all rubbish, instead of making a compost-heap on which all kinds of pests can breed. These precautions, though frequently urged on cultivators, are only too often overlooked. The book concludes with a chapter on the "Value of Expert Knowledge," and an index. As regards "expert knowledge," it is more likely to be obtained by mastering the contents of this little work than of any other we are acquainted with, and we can confidently recommend it to all students of economic entomology.

"Wild Fruits of the Country." By F. E. Hulme, F.L.S., F.S.A., &c. (Hutchinson, London.) 12*s.* 6*d.*

We entirely agree with the author that the fruits of autumn are in their way fully as beautiful as are the flowers of summer. He expresses an unquestionable truth when he says that "to the real lover of Nature the appreciation of her works is all-embracing, excluding all idea of depreciation, exalting nothing at the expense of anything else." Few lovers of "the Great Green Book," however, need such an *apologia* as an introduction to so charming a book, so charmingly illustrated, as Mr. Hulme here presents us with. No one who has once seen a good bush of the wild Guelder Rose in full berry by the brookside in Norfolk, or of the Spindle-wood in the hedgerows on chalk lands in Kent, will ever question the glorious beauty and surpassing grace of the wild fruits of our country. Mr. Hulme has not, however, been content to give us the fruits only, but has added flowers and leaves as well in almost every case to his beautiful and life-like illustrations, and in the descriptions has dealt very fully with the history of the plant and its habit, and the sort of places where one is likely to come across it.

"Wood: a Manual of the Natural History and Industrial Applications of the Timbers of Commerce." By G. S. Boulger, F.L.S., &c. (Edward Arnold, London. 1902.) Price 7*s.* 6*d.*

In a manual of a little over 300 pages it is quite impossible to do justice to the woods of commerce, whether in a descriptive or commercial sense. From a strictly theoretical point of view the work is to be recommended; but it is sadly deficient in such matters as would appeal directly to those who have even a limited knowledge of the woods of commerce, including their habitats, nature, and conversion. Of the seven chapters into which the first part of the book is divided, the second and fifth contain much that will interest and be useful to the timber merchant; while the student of forestry will find the opening pages, which contain a technical résumé of "the origin, structure, and development of wood, and its use to the tree," both instructive and valuable. We think, however, that the cause of "cup-shake," in "Defects of Wood," particularly in the timber of the Spanish Chestnut, will find but few supporters amongst practical foresters and wood merchants. Part II. is devoted to an alphabetically-arranged list of the timber-producing trees of commerce, their sources, characters, and uses, which will be found handy for reference, the descriptions of many being, however, as one would expect, meagre and of little value to those who are directly interested in the many uses to which some of the woods are applied in their native countries. From experiments which have been undertaken in connection with a large number of introduced Conifers we expected our home-grown woods to have received a much greater share of attention, particularly at present, when the supply has fallen short of the demand, and prices are at least one-third higher than was the case less than a quarter of a century ago. The book contains a number of well-executed illustrations, which should go far in elucidating some knotty points regarding the structure and development of wood.

"Easily-grown Hardy Perennials." By G. H. Vos, B.A. (Collingridge, London.) 5*s.*

A book containing a short notice of all (or almost all) the ordinary herbaceous-border plants. It is admirably arranged and planned, and illustrated with 255 really good photographic reproductions of the most typical plants. The Latin and English names are first given, with their derivation and meaning; then the habit of the plant and its use and place in the garden are fully described; and lastly the particular culture (if any) and its propagation are carefully noted, a warning word being given here and there against what must be called garden weeds. The plants are all arranged alphabetically under their Latin names, but an index at the beginning contains all the better known English names, with cross references. It will be a useful book to give to anyone just beginning an herbaceous border of plants, both old and new.

"A University Text-book of Botany." By D. H. Campbell, Ph.D. With many illustrations. (Macmillan, London.) 17*s.*

The author describes it as "an outline of the essentials of modern botany . . . prepared for the use of students in America." The paragraphs are necessarily exceedingly short, for the author has succeeded in condensing his matter to the smallest compass. As it is not a laboratory manual, all practical work is excluded. Some little inequalities are observable: thus he gives 56 pages to Algæ, 80 to *Pteridophyta*, and only 60 to Dicotyledons. Some omissions occur, as of special light-rays for transpiration, heat for respiration, phenomena of colouring and of osmose, &c. The heading of pages 369–399 should be *Monocotyledons*, not *Angiospermæ*.

"Round the Year." By Professor L. C. Miall, F.R.S. (Macmillan, London.)

A most delightful little book of real Nature-studies, though the word "study" is suggestive of something harder than these charming notes of all sorts of subjects, from "The Moon" to a "falling leaf." "Nature-treats" would really convey a better idea of Professor Miall's book, for even children would regard a chapter from it as a treat. The following will give an idea of the spirit and tone of the book: "If you have boys and girls about you, whether your own or other people's, take them into the woods and fields. Try to answer their questions; try to put better questions than they can think of. Never mind the technical names; leave all your Latin and Greek at home. . . . Never shrink from saying 'I don't know.' These words are always on the lips of a well-trained naturalist." From beginning to end the reader feels insensibly that he is being spoken to by a master-mind, who knows what he is speaking of so thoroughly and well that he is able to explain all that he can explain with perfect ease, so that the simplest can understand, and who at the same time has no scruple in confessing when anything passes his understanding and his explanation.

"Forestry in Minnesota." By Samuel B. Green. (Geological and Natural History Survey of Minnesota.) 1902.

A book of this kind, the first edition of which has exhausted 10,000 copies, requires little to be said in its favour. One thing is evident, that forestry abroad is receiving a far greater share of attention than has ever before been the case, the present work being used as a text-book in no less than fourteen of the agricultural colleges in Minnesota and the neighbouring States. Primarily intended as a text-book, there is much in the fourteen chapters into which the work has been subdivided that appeals directly to the practical forester in this country, and from which he may gather many useful hints and valuable information. The chapters on the "Rate of Increase of Timber," "Propagation," and "Regeneration" are of particular interest; while "Forest Protection" gives excellent advice regarding injurious insect and animal life, and calls to mind much of what has to be guarded against in our own country. "Street Trees," too, will be found to contain much of a thoroughly practical nature, as, for instance, the notes on mulching and pruning. There are a few minor mistakes, such as advising cuttings "to be pushed into the land"—a pernicious practice, unless in the freest of soils. The book is well and plentifully illustrated, and must rank amongst the most useful of the works dealing with forestry generally.

"Types of British Plants." By C. S. Colman. (Sands, London.) 6*s.*

This is an attempt to simplify the beginning of the study of the physiology of plants, and we think it is rather well carried out; yet we fear it may be a little too difficult for quite beginners, and not sufficiently advanced for more mature scholars; but for the small class in between it will be very welcome. The woodcuts are good, clear, and helpful, but the "16 full-page plates"—well, the kindest thing that can be said is, what a pity the money spent on them was not devoted to more woodcuts.

"Villa Gardens." By W. S. Rogers. (Grant Richards, London.) 2*s.* 6*d.*

We opened this little book reluctantly, having a somewhat pronounced dislike to the word "villa," but we very quickly forgot our dislike of the name in our real interest in the book. It contains an immense amount of excellent advice for the owner of only a tiny plot of ground behind his little suburban house, advice which is sorely needed—how to make the best of, and how to really enjoy, even only a few square yards of garden. It is concerned chiefly with how to lay out the plot to the greatest advantage, and some typical examples, with detailed plans, are excellent; but the plants to grow are by no means forgotten, and we are glad to note that the author is not too ambitious—unless it be in the way of sundials, which, much as we admire them and their associations, we should not care to see in quite every little garden.

"On the Amazon and Rio Negro." By Dr. A. R. Wallace. (Ward, Lock, London.) 2*s.*

The issue of so cheap an edition of Dr. Wallace's intensely interesting book is a distinct gain. The whole story of his travels and adventures is very simply and naturally told, and though of course a great part is concerned with the fauna of the countries he explored, still there is ample concerning the flora also to claim the attention of plant-lovers, to say nothing of the exceeding interest from a scientific point of view of the whole narrative.

"Foresters' Diary, 1903." By A. D. Webster. (Rider, Aldersgate Street, London.) 2*s.* 6*d.*

Of diaries and pocket-books suited to special purposes, we know of none that fulfils its object more thoroughly than this. In the first place it is very portable, and, though bound in red morocco, very light. It contains a regular diary for every day in the year, and in addition to all the usual information of pocket-books it gives a really detailed scheme of work in woods and forests for every month in the year, and over and above all this, notes on such general matters as "Woodland Roads," "Profit and Loss on Oak Barking," "Comparative Value of Timbers," lists of trees and shrubs suited for seaside, for towns, for peat soils, for chalk, for gravel, sand, ironstone, &c., "Injurious Insects" and how to deal with them. In fact, it is exactly the *multum in parvo* which any forester would be glad to have always in his pocket.

NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

JUDGING by the number of appreciative letters received, the endeavour commenced in our last volume, to enlarge the usefulness of the Society's Journal, by giving an abstract of current Horticultural and Botanical periodical literature, has met with success. It has certainly entailed vastly more labour than was anticipated, and should therefore make the Fellows' thanks to all who have helped in the work all the more hearty.

That anything approaching perfection either in method or execution should have been achieved as yet is not to be expected, but the Editor desires to express his most grateful thanks to all who co-operate in this work for the very large measure of success already attained, and he ventures to express the hope that they will all strictly adhere to the general order and scheme of working, as the observance of an identical *order* can alone enable the Editor to continue to cope with the work. The order agreed on was as follows :—

1. To place first the name of the plant, disease, pest, &c., being noticed; and in this, the prominent governing or index word should always have precedence.

2. To place next the name, when given, of the author of the original article.

3. Then, the abbreviated form of the name of the journal, &c., in which the original article appears, taking care to use the abbreviation which will be found on pp. 680, 681.

4. After this, a reference to the number, date, and page of the journal in question.

5. If an illustration be given, to note the fact next, as "fig.," "tab.," or "plate."

6. After these preliminary necessities for making reference to the original possible for the reader, the abstract or digest should follow, ending up with the initials of the contributor affixed at the close of each Abstract or Note.

Names of those who have kindly consented to help in this Work.

Boulger, Professor G. S., F.L.S., F.R.H.S.
Bowles, E. A., F.R.H.S.
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Hooper, Cecil, M.R.A.C., F.R.H.S.
Houston, D., F.L.S., F.R.H.S.
Hurst, Captain C. C., F.L.S., F.R.H.S.
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Reuthe, G., F.R.H.S.
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Scott-Elliot, G. F., M.A., B.Sc., F.L.S., F.R.H.S., F.R.G.S.
Shea, Charles E., F.R.H.S.
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Ward, Professor Marshall, Sc.D., F.R.S., F.R.H.S.
Webster, A. D., F.R.H.S.
Wilks, Rev. W., M.A., F.R.H.S.
Worsdell, W. C., F.R.H.S.

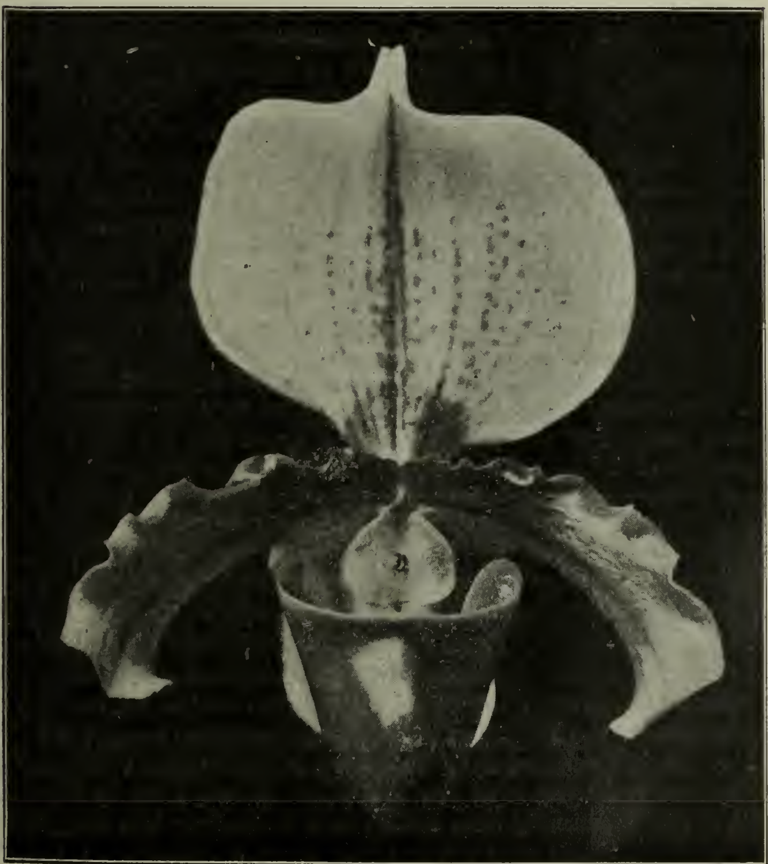
JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales de la Soc. Nantaise	Ann. Soc. Nant.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Hort. de Loiret	Bull. Soc. Hort. Loiret.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletin of Bot. Dep. Trinidad	Bull. Bot. Dep. Trin.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt für Bacteriologie	Cent. f. Bact.
Chronique Orchidéenne	Chron. Orch.
Comptes Rendus	Comp. Rend.
Contributions from the Botanical Laboratory, University of Pennsylvania, Philadelphia	Contr. Bot. Lab. Phil.
Department of Agriculture, Victoria	Dep. Agr. Vict.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Dictionnaire Iconographique des Orchidées	Dict. Icon. Orch.
Die Gartenwelt	Die Gart.
Engler's Botanische Jahrbücher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Hamburger Garten- und Blumenzeitung	Hamb. Gart. Blum.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal Dep. Agricult. Victoria	Jour. Dep. Agr. Vict.
Journal Imperial Department Agriculture, West Indies	Jour. Imp. Dep. Agr. W.I.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R.A.S.
Journal S.E. Agricultural College, Wye	Jour. S.E. Agr. Coll.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundheitsamte	Kais. Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Notizblatt des Königl. Bot. Gart. und Museums zu Berlin	Not. König. Bot. Berlin.
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Queensland Agricultural Journal	Qu. Agr. Journ.

Journals, &c.	Abbreviated title.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gén. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions Bot. Soc. Edinburgh	Trans. Bot. Soc. Edin.
Transactions of the British Mycological Soc.	Trans. Brit. Myc. Soc.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.*
U.S.A. Experimental Station Reports	U.S.A. Exp. Stn.†
U.S.A. Horticultural Societies' publications	U.S.A. Hort. Soc.†
U.S.A. State Boards of Agriculture and Horticulture	U.S.A. St. Bd.†
Wiener Illustrirte Garten-Zeitung	Wien. Ill. Gart.-Zeit.
Woburn Experiment Farm Report	Woburn.
Zeitschrift für Pflanzenkrankheiten	Zeit. f. Pflanz.

* The divisions in which the U.S.A. Government publish Bulletins will be added when necessary.
† The name of the Station or State will in each case be added in full or in its abbreviated form.



NOTES ON RECENT RESEARCH.

Effect of Poison on Roots.

Absorption as influenced by Cold, Poisons, &c. (*Beih. Bot. Cent.* bd. xii. ht. 3, pp. 293–303).—Dr. P. Kosaroff has tested the effect of poisons in hindering the absorption of water both with roots at ordinary temperatures and also after they had been cooled down to 0° C., or treated with small quantities of poisons. The result is to show that with such cooled or slightly poisoned roots the difference in absorption when strong poisons are applied is not nearly so great as with roots in the ordinary healthy condition. When the water was at 0°, the absorption was at the rate of 33 mm. and 34 mm. at intervals of twenty minutes. The application of 0·1 per cent. chloroform solution reduced it to 31 mm., 32 mm., and 32 mm. In the control experiment with water at 20° C., the absorption, at first 15 mm., was brought down to 12 mm., 11 mm., and 12 mm. by the same chloroform solution. The absorption of roots already slightly poisoned is unchanged by the application of poisonous solutions. Thus, in the tenth experiment, the absorption of roots poisoned with 0·2 per cent. chloroform solution was 17 mm. and 18 mm. at intervals of twenty-five minutes. After the application of 4 per cent. sublimate solution the absorption was 17 mm., 18 mm., and 14 mm., showing no marked difference in the rate of absorption.

It is shown that the reaction of plants is thus similar to that of animals under external environmental conditions.—*G. F. S.-E.*

Anatomy of Anonaceæ.

Anonaceæ, Anatomy of. By H. Beyer (*Engl. Bot. Jahrb.* vol. xxxi. 1902, pp. 516–555, with figures in text; 2/9/1902).—A general account of the anatomy of the vegetative and floral organs, especially of African species of this family. The author also gives a short anatomical description of the leaves of all the African species studied.—*A. B. R.*

Embryology of Araliaceæ.

Araliaceæ, Embryology of. By L. Ducamp (*Ann. Sc. Nat. Bot*, xv. 1902, pp. 311–402; plates 8).—After a brief review of the literature, the author describes the development of the ovule, embryo-sac, and embryo of species of *Araliaceæ*. Two ovules appear in each loculus, but only one attains maturity. The origin and development of the parts of the ovule are traced in detail and fully illustrated in the excellent plates. The embryo-sac is derived from one of a series of two, three, or four sister-cells or nuclei, generally from the lowest of the series. The occurrence of two primordial cells may produce two series of sister-cells: this, the author suggests, supports the homology of the ovule with a macrosporange, the integument representing an indusium. The absorption of the nucellus by the growing embryo-sac is followed out. The nuclei of the embryo-sac form two tetrads, which become arranged as usual; the polar nuclei fuse before fertilisation. The differentiation of sister-cells and the embryo-sac resembles the *Polypetalæ*, but the presence of one ovule integument, the differentiation of an epithelial layer, and the absorption of the nucellus recall similar characters in the *Gamopetalæ*. The development of the tissues of the embryo from the fertilised ovum is described and figured in detail, and summarised in a table.—*W. G. S.*

The Boragoid Cyme.

Boragoid Cyme, Morphology and Development of the: (1) Investigations on the Development of the Inflorescence and Flowers and of the Adnate Axillary Buds of *Symphytum officinale*. By F. Muth (*Flora*, xci. pp. 56–114, t. 9–15; 1902). (2) The Development of the Boragoid. By H. Goebel (vol. cit. pp. 237–263; 6 woodcuts).—Muth finds in the Comfrey transitions between lateral branching and bifurcation of the growing point; on anatomical, comparative, and developmental grounds the inflorescence must be regarded as a true sympodium, close to the true scorpioid cyme. Mechanical effects (pressure) are concerned in the adnations and displacements that characterise it. Such effects occur in connection with the variations of the sequence of appearance of the (properly) quincuncial sepals. Muth rejects Goebel's view that the actual development of the Boragoid is by a wide conical dorsiventral shoot which gives off flowers and leaves alternately on its upper flanks in acropetal succession behind the growing point. Goebel, in a criticism of Muth, says that his description is accurate and supports it with fresh drawings [which, to the abstractor, are hardly convincing either way]. But Goebel explicitly declares, what he has long since admitted, "that he recedes from the revolutionary position he took up in his famous work of 1880 on 'The Branching of Dorsiventral Shoots,' that developmental evidence is only *one* factor in morphological identification, and that the Boragoid of many *Solanaceæ*, as well as of *Boragineæ*, must be regarded as a modified cicinnus, and he goes on to say that comparative studies prove incontestably that the typical cicinnus and the Boragoid are links of one chain. "If this be recognised, it seems to me of minor weight whether one speaks of a Sympode growing in a monopodial fashion, or of a Monopode." It is to be hoped that Goebel's explicit declaration will help to revive the study of comparative phanerogamic morphology in England.—*M. H.*

Manner of Fungus Attack.

Botrytis cinerea. By R. E. Smith (*Bot. Gaz.* xxxiii. No. 6, p. 421).—The author first records the observations of Marshall Ward and others that, in certain fungi, parasitism is brought about by the secretion of a soluble substance by the mycelium which kills and disintegrates the host tissue at a considerable distance from the filaments, thus affording them practically saprophytic nourishment. But, the author observes, still much is to be explained.

The usual conditions under which this organism may affect living plants are: excessive moisture, stagnant air, high temperature, low vitality of the host-plant, parts being young and delicate. In all cases much more active (parasitic) infection took place when saprophytic nourishment was used as a starter for the conidia.

When the mycelium penetrates a soft tissue, this becomes darkened, the cells separate with a loss of turgidity, &c., the tissue being affected considerably remote from the filaments, due, according to Ward, to the fact "that these secrete a cellulose-dissolving enzyme which transforms the cell-substances into available food-material for the fungus."

When a Lettuce-leaf was placed in a watery extract of mycelium, all the tissue in contact with the liquid became softened and discoloured and soon disintegrated, just as in a leaf with the fungus actually growing in the petiole.

Hence the toxic principle of this fungus is a soluble substance given off by the mycelium. The effects are—first, the death of the cells; and secondly, the disintegration of their walls and contents. The poisonous substance is not an enzyme; but the second result is caused by a variety of enzymes, not necessarily always the same, each affecting its particular substance.

The author then gives results of experiments, which established this last-mentioned conclusion, with some twenty-four vegetable substances, of which sugars and many others were capable of supporting the fungus. The results in each case are described in detail.

The toxic substance which first kills the cells is probably oxalic acid formed as a by-product.—*G. H.*

Calcium-oxalate in Leaves.

Calcium-oxalate Crystals in Seedlings of Alsike (*Trifolium hybridum*). By J. Percival (*Journ. Linn. Soc. Bot.* vol. xxxv. p. 396, with 5 figures, July 21, 1902).—The author says: "The very definite and characteristic position in which the crystals of calcium-oxalate occur in the leaves of most leguminous plants led me to consider that a detailed study of their first appearance and distribution in young seedlings would be of interest, and might possibly throw some light on their formation." "The seeds were germinated upon the purest filter paper, and were moistened with distilled water." Germination soon takes place, and as soon as the plants are six or eight days old the primary leaf can be detected between the cotyledons; the crystals can now be seen in the petioles of the cotyledons. Various experiments were made with the young seedlings to try and ascertain from what source the calcium and the oxalic acid were derived, and it appears that both are produced from the reserve-food of the cotyledon.—*G. S. S.*

Leaf-adaptation to Habitat.

Climatic Adaptation in the Leaves of Seychelles Plants (*Beih. Bot. Cent.* bd. xii. ht. 3, pp. 304–342; tables 7–9).—Herr Max Fabricius has made an anatomical examination of the leaves of twenty-five Seychelles plants, arranged according to the habitat in which they occur (tall trees in woods, shrubs of the undergrowth in woods, soil plants, epiphytes, and small trees growing in the open). The results are full of interest. All these Seychelles plants possess an epidermis with thick and generally smooth outer walls to the cells. The trees have generally small, thick-walled epidermis cells. Almost all the others (undergrowth, epiphytes, and ground plants) have large, thin-walled epidermis cells. Thus the trees may be regarded as protected against the mechanical effect of the wind by the smallness of the cells and thick-walled character of the epidermis. The plants growing within the woods fall into two groups. All those which form the undergrowth are not protected against too great transpiration, because either the soil is wet or the air is saturated with moisture. But all those which are epiphytes have very few stomata and possess water-storage tissues. Only these latter are xerophilous, all the others being, as regards number of stomata, adapted to moist conditions. There is a special anatomical examination of each of the twenty-five species under consideration.—*G. F. S.-E.*

Effect of Copper Fungicides.

Copper on Leaves, The Action of. By S. M. Bain (*U.S.A. Exp. Stn. Tennessee, Bull.* vol. xv., No. 2; Ap. 1902, pp. 1–108; pls. i.–viii.).—The investigations recorded in the chapters of this work are the outcome of some preliminary experiments made at the Tennessee Experiment Station in the year 1895 with a view to gaining some knowledge as to the effect of fungicides on Peach foliage, which might be of some economic value in the treatment of the disease commonly known as the Brown Rot. The lines upon which the work was carried out are suggested in the table of contents. "The rational method of procedure was, in the first place, to select for a comparative study with the Peach plant several others whose foliage is not susceptible to injury by fungicides. For this purpose the Grape and Apple seemed best fitted, for various reasons. . . .

"By a comparison of these plants from various physiological and histological points of view, it was hoped to gain some information that would lead to some practical beneficial result, or at least to a clearer understanding of the real problem underlying the whole investigation. *Why is the foliage of the Peach more susceptible to injury by fungicides than that of other plants?*" The answer to this is given in the summary as follows:—

"Peach foliage is very susceptible to injury by fungicides because:

"(1) *Peach leaves* (*not the whole plant*) *are especially sensitive to poisons in general, and to copper in particular.*

"(2) *They have the power, which may or may not be possessed by the leaves of other plants, of dissolving copper hydroxide.*

"(3) *They have a cuticle which is thinner and more permeable than that of some other leaves.*

"(4) *They have glandular surfaces terminating their marginal teeth, which are especially fitted, by reason of their thin cuticular covering, for the absorption of copper in solution.*

"(5) *They are especially sensitive to the various agencies producing leaf-fall by a normal absciss layer.*

"(6) *They have the power, in common with other leaves of the genus* Prunus, *in a similar manner to exfoliate any injured region, this exfolia-*

tion involving much more than the really injured cells. If this process removes a large portion of the lamina, the whole leaf drops."—R. N.

Cronartium ribicola on Pines.

Cronartium ribicola. By P. Magnus (*Not. König. Bot. Berlin*, Vol. iii. (1902), p. 183).—Klebahn in 1888 showed that *Peridermium Strobi*, Kleb., is the æcidium of this uredine, and that it occurs on *Pinus Lambertiana*, Dougl., as well as on *P. monticola*, Dougl., and in 1890 the same observer suggested that it also lives on *P. Cembra*, L. This has now been confirmed by Tranzschel in Russia, who has infected *Ribes nigrum* with the spores of the *Peridermium* from *P. Cembra*, L.

Magnus remarks that Henning's doubt whether *Pinus Strobus* can have been the means of infecting the species of *Ribes* referred to in *Not. König. Bot. Berlin*, No. 28 (see Journal R.H.S., Vol. xxvii. (1902), p. 236), is unnecessary, since that Pine and its *Peridermium* often occur near Berlin, and re-infect the *Ribes* annually. Magnus regards it as probable that various local races of the *Cronartium* occur.—*H. M. W.*

Vegetation Destroying Ponds.

Development of Vegetation in the Morainal Depressions of the Vicinity of Wood's Hole, Mass. By C. H. Shaw (*Bot. Gaz.* xxxiii. No. 6, p. 437).—The depressions occur in a terminal moraine of clay, sand, and boulders. They are known as "kettle-holes," in which ponds and lakes are formed, each one the first term of a long series ending in its own obliteration.

The author first remarks upon the physical causes of obliteration, the intrusion after severe storms being often very great, while rain-rivulets make small deltas, upon which the yellow-flowered *Gratiola aurea* soon becomes conspicuous and characteristic.

The vegetation is distributed in two zones. *Limnanthemum lacunosum* forms a continuous belt, but never touches the shore. *Lobelia Dortmanna* is in the same zone, growing entirely submerged, its flowering stems being unable to reach the surface. On the shore-line, separated from the above by a zone of clear water, is *Euthamia* (*Solidago*) *graminifolia*. The shoreward limit of the previous zone was set by the action in the shallow water of the wavelets in shifting the silt and burying the bottom-growing vegetation.

Euthamia resists burial by possessing running stems penetrating the sand in all directions. The others have no runners, and so are driven to the deeper zone beyond.

Floating vegetation assists in the destruction of the pool. This is effected by the increase of such plants as Water-lilies in the body of the pool till a footing is afforded for the less anchored forms, and the consequent formation of the floating mat vegetation. Several species of *Utricularia* aid greatly by means of their floating and branching tufts. Then *Sphagnum* and other Mosses, Carices, *Xyris*, and *Drosera* appear. In some *Decodon* (*Nesæa*) *verticillatum* (*Lythrarieæ*) plays a leading part. In others *Hypericum boreale* takes its place. Its submerged stem is an unbranched axis, weak and slender; but on reaching the surface it breaks into a strong branching herb, sustaining masses of aerial foliage from enlarged stems floating horizontally on the surface.

As the floating mat is formed the conditions begin to become xerophilous. Such plants as *Clethra alnifolia*, *Azalea viscosa*, *Vaccinium corymbosum*, *Ilex verticillata*, *Myrica Gale* and *cerifera*, &c., rapidly transform the floating mat into a swamp thicket.

Though these plants belong to different families, they all agree in having alternate, simple, lanceolate, nearly entire and smooth leaves.

Decodon passes away before the shrubs, and in due time seedlings of trees appear.

As these trees grow, often wholly *Chamæcyparis*, the shrubs are overtopped and give place to them, and the series enters a final cycle as a *Chamæcyparis* swamp.

In receding the pond fills up from the circumference to the centre. In other cases it is reversed, an island forms in the middle and leaves a narrow belt of open water about the edge of the pond. The ditches, though well defined, are quite shallow, yet free from vegetation.

It was observed that formations of this character were only found in wooded districts. In treeless districts the ponds fill up from the margin.

The ditch is always widest where the most material is washed in.

The character of the materials gave the clue. Only fallen leaves and other organic matter are washed into the pond, so that young plants which might start around the edge are constantly smothered.

The islands themselves are floating on from 2 to 3 metres of water.

After the island becomes fixed the ditch fills but very slowly. Even after the central area has been occupied by trees, it often may still be plainly traced.—*G. H.*

Dipodascus.

Dipodascus, Cell-contents, Fertilisation and Spore Formation in. By H. O. Juel (*Flora*, xci. pp. 47–55, t. 7, 8; 1902).—*Dipodascus albidus* is a small mould first found on decaying vegetable matter in Ecuador by Lagerheim, and remarkable for its gigantic ascus containing numerous spores supported by two "legs" (whence its name), the basal parts of two unequal conjugating hyphæ, of which the upper coalesced lips have grown up to form it. Juel has rediscovered it on Birch-trunks at Falun, in Sweden, associated with *Fusaria*, obtained pure culture, and studied its cytology by modern methods. The hyphæ are septate; the chambers, of unequal size, are apocytial, with numerous minute nuclei (2 μ) in the cytoplasm, which is mostly parietal. The gametes are short terminal, equal, filled with cytoplasm and multinucleate; on their union the protoplasm from the one ("pollinode") passes into the other ("carpogone"), which grows out into the "ascus." In the fertilised carpogone, among many unchanged nuclei is seen a much larger one (4 μ, from the figures). This is probably derived from the fusion of at least two nuclei. Successive divisions of this zygote nucleus result in the formation of a large number, which for a time become undistinguishable from the vegetative nuclei. However, when the ascus has attained its final size and form it contains two kinds of nuclei, the one homogeneous, more numerous than the others, which are vesicular with a central nucleolus; the latter are the persistent vegetative nuclei, the former presumably the reproductive and descended from the zygote nucleus. The latter are indeed something more, for they appear to be directly transformed into the spores, which are thus imbedded in a nucleated epiplasm.

As the spores mature a minute central nucleus again becomes evident in each. Juel places the genus among *Hemiasceæ*, but notes its relation to *Peronosporeæ* and to *Eremascus* among the true *Ascomycetes*. It will be seen that there are still gaps in our knowledge of the cytological processes of this most interesting form.—*M. H.*

Heredity.

Diseases, Plant, are they Hereditary? By Alfred R. Wallace (*Garden*, No. 1,591, p. 317; 17/5/190).—A carefully thought-out article in which Dr. Wallace says: "In a very interesting and original work, 'The Present Evolution of Man,' by Dr. G. Archdall Reid, this subject is very fully discussed, and it is shown that, with very few exceptions, there is no proof whatever of the inheritance of disease in man, but only of the inheritance of a *tendency* to the special disease of the parent, so that, under similar unhealthy conditions of life or of exposure to infection, the child is likely to contract the same disease, which will thus appear to be hereditary without being really so. This is clearly the case with gout and consumption, which have both been held to be hereditary, but in no case has an infant been born suffering from these diseases."—*E. T. C.*

Doubling caused by Parasites.

Double Flowers and Parasitism. By M. Molliard (*Comp. Rend.*; October 7, 1901).—Certain parasites determine the formation of double flowers in the plants in which they live; as examples the flowers of *Knautia arvensis* attacked by *Peronospora violacea*; those of *Matricaria inodora* infested with *Peronospora radii; Viola sylvestris* shows petalody of the stamens when *Puccinia violæ* is present as a parasite.

The author suspects that the double flowers of our gardens originated owing to the presence of a parasite in their roots. In support of this view the case of *Saponaria officinalis* is cited.

The size of the *Saponaria* with double flowers is obviously different to that of those producing normal single flowers. The internodes are shorter, the nodes more swollen, and the rhizome thicker and its structure less differentiated, the lignification in particular being less pronounced in individuals attacked by *Sorosporium saponariæ*. In such infested individuals the root also shows the presence of tubercles, from which under proper treatment a copious mycelium belonging to a *Fusarium* is developed.

In *Primula officinalis* again the rootlets of plants bearing double flowers are infested with a fungus called *Dematium*. According to Molliard the diœcious forms of *Pulicaria officinalis* are infested in the root by a parasite.

The author produced by experiment petalody of the stamens of *Scabiosa Columbaria*, through the influence of an eelworm called

Heterodera radicicola. A healthy and normal plant was planted in soil in which an infested plant of the same kind and showing petalody had been growing. The following year the healthy plant showed the galls of the eelworm on the roots, also petalody of the stamens or double flowers.

For the formation of double flowers the author considers that the horticulturist should foster the association of parasites with cultivated plants, as double flowers are produced by such an association in nature.

G. M.

ELECTRICITY IN SEEDS.

Electrical Reactions of Plants. By Dr. Arthur Tompa (*Beih. Bot. Cent.* bd. xii. ht. 1, p. 98).—The author has conducted a series of experiments on seeds on similar lines to those of Dr. Augustus Waller. This paper contains a record of his results and a short bibliography. His results may be summarised as follows:—Electric polarisation appearances can be produced with dead as well as with living seeds. The polarisation currents are of considerable intensity, but are of very low tension (*Spannung*). Changes in the inner resistances of the seed alter both the intensity and also the direction of the current. The strength of the current which can be induced by mechanical injury (on the outside) seems to depend on changes in the inner resistances, for they show no measurable electromotive strength. The direction of the current also depends on these resistance changes, and the electrode which lies next the place stimulated becomes the anode. Living seeds produce electromotor strengths of which the potentials are over 0·005 volt. Dead seeds show either no potential, or it is less than 0·005 volt, and generally less than 0·002 volt.

A lesion current with a potential over 0·005 volt is to be taken as a sign of life in seeds. Lesion currents appear to originate in the embryo (especially in the hypocotyledonary part) of living seeds (not germinated). They are of higher potential than the electromotor strengths present in uninjured seeds

In dicotyledons the current is from the embryo to the point stimulated, and in the reverse direction in monocotyledonous (Grass) seeds. (See also ‘ Plant Juices.’)—*G. F. S.-E.*

ELECTRICITY COMPARED IN ANIMAL AND VEGETABLE LIFE.

Electric Response in Ordinary Plants under Mechanical Stimulus. By J. C. Bose (*Journ. Linn. Soc., Bot.* vol. xxxv. p. 275; July 21, 1902.)—An account is given of various experiments which the author made to determine, to use his own words, “If throughout the whole range of response phenomena a parallelism between animal and vegetable could not be detected. That is to say, I desired to know, with regard to plants, what was the relationship between the intensity of stimulus and the corresponding response; what were the effects of superposition of stimuli; whether fatigue was present, and in what manner it affected the response; what were the effects of extremes of temperature on the response; whether chemical reagents could exercise any influence on the plant-response, as anæsthetics and poisonous drugs have been found to do with nerve and muscle; finally, if it could be proved that the electric response served as a faithful index of the physiological activity of plants, it would then be possible successfully to attack problems the solution of which at present offers many experimental difficulties." In conclusion the author says: "I have shown that these electric responses are given by all plants and by their different organs. It has also been shown that in the matters of response by negative variation, of fatigue, of modification of response by high and low temperatures, and even in matters of occasional abnormal variations, such as positive response in a modified tissue, they are strictly correspondent to similar phenomena in muscle and nerve. Judged by the final criterion of the effect produced by anæsthetics and poisons, these electric responses in plants fulfil with animal tissues the test of vital phenomena."—*G. S. S.*

Embryology.

Embryo-sac, Development of, Reduction of Chromosomes, and Fertilisation in *Paris quadrifolia*, L., and *Trillium grandiflorum*, Salisb. By A. Ernst, of Zurich (*Flora*, vol. xci. 1902, pp. 1–46, t. i.–vi.).—The embryo-sac here is the lower of two sister-cells, of which the upper disappears; it is in the division that produces these two that the heterotypic mitosis with chromosome-reduction first appears. The numbers of segments in the vegetative cells are in *Paris* and *Trillium* twenty-four and twelve respectively; the reduced numbers in all subsequent nuclei are twelve and six, the latter being the lowest yet known in flowering plants. A transitory longitudinal splitting of the daughter-chromosomes occurs in the metakinesis of this first division; and in the remaining mitosis the halving of the chromosomes is homœotypic (the figures, however, show heterotypic rings) and always longitudinal. The antipodal cells have the normal reduced number of chromosomes, and appear to degenerate without multiplying or acquiring nutritive functions. In fertilisation the sperm- and oo-nuclei fuse completely; while in the pseudo-fertilisation the second sperm- and polar-nuclei remain distinct till the prophases of their mitosis are advanced.
M. H.

Anatomy of Euphorbiaceæ.

Euphorbiaceæ, Anatomy of. By L. Gaucher (*Ann. Sc. Nat. Bot.* xv., 1902, pp. 161–309; figs. 81).—The results of an investigation on the general and comparative anatomy of 375 species of this order. The author concludes that in spite of the wide distribution of the group and the many variations of external form, there is a collection of anatomical characters constant enough to define the type *Euphorbiaceæ*. The chief characters in the stem are the sub-epidermal origin of the cork, the origin and arrangement of the thickened elements of the cortex and pith, and the distribution and characters of the tannin elements and crystals of calcium oxalate. In the leaf, the characters are the uniform structure of the epidermis and the structure of the stomata. The various types of internal phloëm found in the order are described and figured. The latex-system is also specially investigated; the laticiferous elements are either unicellular or pluricellular in origin, and a table is drawn up to show how modifications of these elements are characteristic of the families and sub-families of the order. In regard to the function of the laticiferous elements, the author regards the latex as composed largely of substances of high nutritive value, similar to, and in communication with, reserve food-materials laid up in other parts of the plant. They also communicate with the leaf-tissue, and are therefore regarded as a conductive system for substances elaborated in the leaves. A classification based on the comparative anatomy and external features of the order is given, and, on the whole, it agrees with the classification already in use.

W. G. S.

Starch in Evergreens.

Evergreen Leaves, Starch of, and its relation to Photosynthesis during the Winter. By Kiichi Miyaké (*Bot. Gaz.* xxxiii., No. 5, p. 321).—The experiments were conducted at Tokyo and elsewhere in winter. The mean temperature of the three winter months is: Dec. 5·1°; Jan. 2·7°; Feb. 3·5°; that of London being 3·5°; so that the coldest month (Jan.) is colder than our metropolis.

Of eighty species examined, seventeen were found to lose their starch from the mesophyll during the winter. It was observed that the starch contents of evergreen leaves are generally greater in April than in August or September.

The experiments sufficed to prove that many of the Evergreen plants in Tokyo can form starch in the leaves by photosynthesis, and translocate it to other parts of the plant-body during the winter. It generally begins to decrease in November, the minimum being in January, and increases again from the end of February.

The quantity of starch is generally very little in winter compared with that of other times of the year. It is formed by photosynthesis.

The majority of evergreen leaves in the northern part of Japan nearly lose the starch from the mesophyll and guard-cells in winter.—*G. H.*

Eutypella prunastri.

Fungoid Disease of Nursery Stock. By G. Massee (*Gard. Chron.* No. 822, p. 235, fig. 80; Sept. 27, 1902).—This disease, which young Apple and Plum trees have suffered from lately in various parts of England, is caused by a minute fungus, known as *Eutypella prunastri.* It attacks the stem of the trees, and the first outward indication of the disease is a slight browning of the bark, which soon becomes hard, dry, and inseparable from the wood. There is no cracking or wrinkling of the bark, which presents a polished surface. The mycelium continues to grow inwards, killing the young wood, and the following season the leaf-buds either do not expand at all or only imperfectly, and during the summer the branches die through lack of food. This fungus is by no means uncommon on Blackthorn, Bullace, Crab, Wild Cherry, Wild Plum, &c. Infection sometimes takes place through the punctures caused by insects, but more commonly by the fungus germinating in the cut ends of twigs. Insects should be kept in check, and it should be ascertained if the fungus be present on any of the wild trees already mentioned. (Fig. 173.)—*G. S. S.*

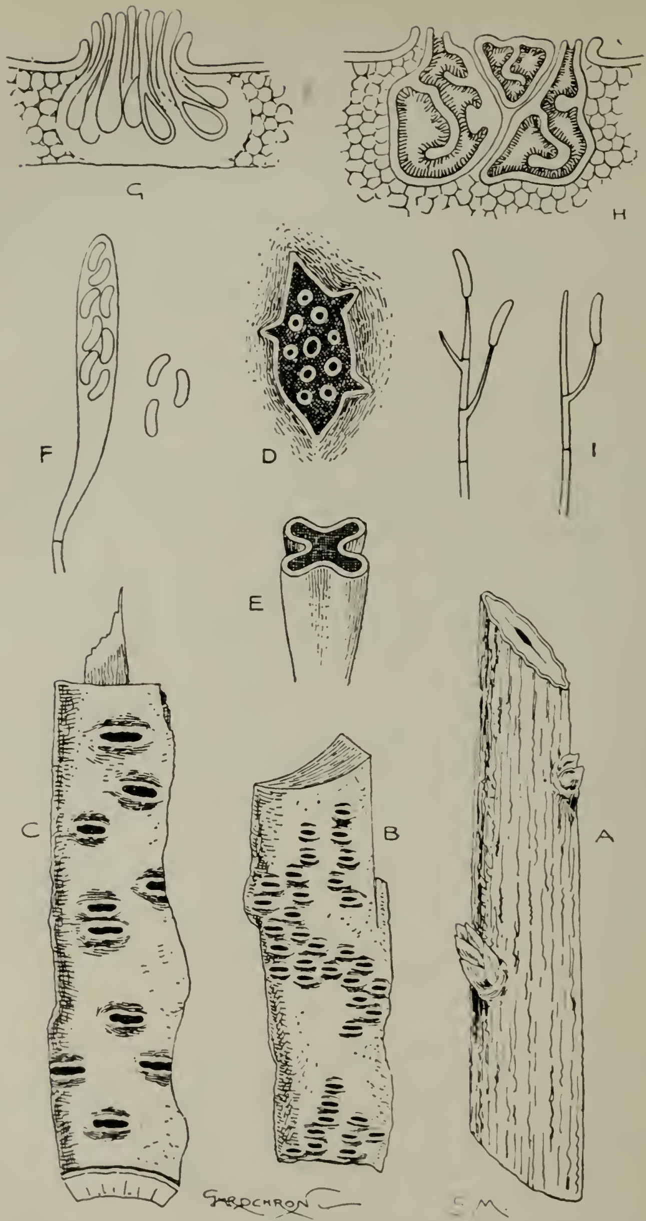


FIG. 173.—EUTYPELLA PRUNASTRI, CAUSING A DISEASE OF NURSERY STOCK. (*Gardeners' Chronicle.*)

A. A young Peach branch becoming shrivelled, indicating that the stock is dying. (Natural size.)
B. The conidial stage of fruit bursting through the bark. (Natural size.)
C. The second or ascigerous condition of fruit, showing at the surface through transverse cracks in the bark. (Natural size.)
D. Surface of view of the second form of fruit, surrounded by the ruptured bark. (× 40.)
E. Cruciate mouth of a perithecium. (× 400.)
F. Ascus and spores. (× 400.)
G. Section through ascigerous form of fruit. (× 80.)
H. Section through conidial form of fruit. (× 50.)
I. Conidia (× 1,000.)

Weather Influence on Fungi.

Fungus Diseases in Relation to Weather. By K. Sajó (*Zeit. f. Pflanz.* xi. 1901, pp. 92–95, and xii. 1902, pp. 151–157).—An interesting attempt to correlate climatic conditions with the prevalence of parasitic fungi in vineyards in Hungary. The most common fungus pest in 1899 was Powdery Mildew (*Oidium Tuckeri*); in 1900 downy mildew (*Peronospora viticola*); in 1901 white rot (*Coniothyrium Diplodiella*). 1899 was distinguished by prevalence of south-west or west winds, low temperature, and low pressure of atmospheric moisture from May to August; 1900 by an absence of south-west and west winds, by high temperature, and high pressure; 1901 by prevalence of easterly winds during the period of vegetation, by great heat (especially in May, June, and July), and by abnormally high rainfall (sometimes hail) in July. The statistics from which these conclusions are drawn are given, viz. temperature, barometric pressure, rainfall, and pressure of atmospheric moisture for the months April to July.—*W. G. S.*

Influence of Graft on Stock.

Graft on Stock, Influence of. By G. T. Grignan (*Rev. Hort.* pp. 414–6; September 1, 1902).—This article is really a *résumé* of results so far obtained by heterogeneous graftings, with special reference to a paper of ninety pages, presented by M. Daniel, on "Les Variations spécifiques dans la Greffe" at the Vine-hybridisation Conference held at Lyons in November 1901. By ordinary grafting, with which M. Daniel has mainly dealt, he has united together Tomatos of different varieties, Aubergine and Tomato, Pimento on Tomato and Aubergine, various Potatos, various Pears, Roses, sundry Composites, especially Sunflowers, Crucifers (Cabbages of various kinds and Turnips &c.), Vines, &c., and has thereby obtained very marked and extremely interesting specific variations. Thus the long violet Aubergine grafted on a ribbed Tomato has yielded round ribbed fruits. New strains have been obtained which are distinct and more or less intermediate as to habit, inflorescence, fruit, and tubers, &c. *Helianthus tuberosus* (perennial Sunflower) grafted on *H. annuus* (annual Sunflower) has yielded particularly interesting results: the annual stock became perennial and assumed to a large degree the character of the scion, adventitious roots appeared on the graft at the bud point, partly penetrated the tissues of the stock, and became completely amalgamated therewith. Allusion is made to the Bronveaux Medlar as a characteristic example. Very interesting variations have been noted also in the variegation of the stock or the scion in precocity of flowering, in fruitfulness (M. Daniel having succeeded in producing Grapes in abundance on infertile varieties—*variétés coulardes*—and seeds of the Cauliflower), in resistance against parasites, cold, &c.

These facts, which can only be briefly touched upon, led M. Daniel to the conclusion that grafting cannot always be relied upon as a means of maintaining varieties, strains, or hybrids intact, but may, on the other hand, be a potent cause of variation itself.

These results would be of minor importance were they limited to the individual, but in many cases the acquired characters can be fixed by cuttings or graftings or preserved by heredity. This part of the memoir is by no means the least interesting. It is thus that M. Edouard Lefort has fixed a graft hybrid Potato which bears his name, which combines the characteristics of two varieties, 'Marjolin' and 'Imperator.' M. Daniel has obtained analogous results, having fixed and reproduced by seed a new variety of hardy forage Cabbage. M. Jurie has fixed the variety 340A of the Vine by cuttings and graftings. Other plants, Roses, for instance, could not be fixed, and the Aubergines and Pimentos have yielded no seeds. In other cases the results were indefinite. M. Daniel grafted the Wild Carrot on the Red Carrot, and the resulting seed gave plants some annual, some biennial, some with three normal cotyledons, others three with one bifid, others two with one bifid, and others only one. In short, asexual hybridisation, according to M. Daniel, is neither constant, regular, nor frequent. It sometimes affects directly the grafted plants and sometimes indirectly their descendants, sometimes the external characters and sometimes the internal; sometimes there is disunion, as in *Cytisus Adami*, and at others the heredity and constancy are perfect, or they may be partial or non-existent. Sometimes also it is possible to predict the results. But the main practical points, which cannot be too strongly impressed on horticulturists, is that in many cases grafting has already served to realise a systematic perfecting of plants. Thus, as M. Daniel remarks, if it be desired to improve a plant in a certain direction it must be grafted on a stock superior in that particular feature; for instance, in order to produce a hardy Cabbage a perfectly hardy stock was chosen, altogether irrespective of inferiority in other points. The danger is also pointed out of degeneration being induced by grafting in lieu of improvement; a risk which is run by prevalent methods of Vine grafting to avoid phylloxera, by which the special qualities (*crus*) are endangered.

M. Lindemuth is another investigator in this direction, who published a paper in the *Gartenflora* of January 1 last, from which we cite a few extracts. He grafted *Solanum erythrocarpon* on *S. Lycopersicum* (developed exceptionally strongly); Yellow Stock on Red Cabbage (flowered exceptionally early); hybrid *Petunia* on *Nicotiana, Abutilon Thompsoni* on *Sida Napæa*, and *Abutilon Thompsoni* on *Althæa narbonensis*. *Vide* Abstracts "Interesting Grafts" for further remarks in this connection.

C. T. D.

Root Gravitation.

Gravitational Sensitiveness of the Root-tip, On a Method of Investigating the. By Francis Darwin, F.R.S. (*Journ. Linn. Soc., Bot.* vol. xxxv. p. 266; July 21, 1902).—Details and figures are given of the experiments made to show the gravitational sensitiveness of the root-tip. The experiments were made with the seeds of *Sorghum* and Beans, in order to confirm some experiments made by Czapek, which some work of Wachtel seemed to contradict, and they were eminently successful. The details of the experiments it is impossible to condense, but the results proved the sensitiveness of the root-tip to the force of gravitation.

G. S. S.

Seeds Unaffected by Alcohol.

Germination and Alcohol (*Beih. Bot. Cent.* bd. xii. ht. 1, p. 137).—Ludmila Sukatscheff (Belgorod) left seeds of *Lupinus mutabilis* for one to five days in 100 per cent. and 90 per cent. alcohol, but these seeds germinated. Seeds of Sunflower and Lupine which had had the skin removed also germinated after lying in alcohol from half an hour to seven hours. Even seeds injured by deep cuts with a penknife were able to germinate after lying for from twelve to thirty-seven hours in 90 per cent. and 100 per cent. alcohol.—*G. F. S.-E.*

Fungus in Fegatella conica.

Hepatic with Thallus occupied by a Filamentous Fungus. By M. Beauverie (*Comp. Rend.* p. 616; 1902).—The author states that *Fegatella conica*, one of the thalloid hepatics, is almost constantly infested to a large extent by a filamentous fungus, which proves to be a species of *Fusarium*. The fungus enters through the rhizoids, and a protuberance is usually formed at the point of entrance of the mycelium. The fungus is absent from the growing point of the rhizoid. The cellulose walls of the cells infested with the fungus assume a deep violet colour.

Reproductive bodies, sometimes in chains, are formed on the mycelium in the rhizoids: these are analogous to the megalospores or chlamydospores described by Warlich and others as produced by phanerogamic endophytes. Finally conidia are also produced in the rhizoids.

The host-plant undoubtedly benefits by the presence of the fungus; in fact the plants most abundantly infected are the most vigorous.

Infection of the host-plants depends on the presence of humus, and is most pronounced when humus is abundant. If humus is wanting the fungus is absent, and the hepatic remains small and ill-nourished. These facts are sufficient to demonstrate that the *Fegatella* is nourished, through the medium of the fungus on the humus.

Finally, the author considers that the *Fegatella* has acquired (as in certain saprophytic Orchids) the means of obtaining nourishment from the carbon contained in the humus, and consequently has lost to a great extent the power of exercising the original function of chlorophyll.

G. M.

Method of Infection by Rust.

Host and Parasite, on the Relations between, in the Bromes and their Brown Rust (*Puccinia dispersa*, Erikss.). By H. Marshall Ward, D.Sc., F.R.S. (*Ann. Bot.* vol. xvi. No. 62, p. 233).—In this paper is recorded one of those thorough and laborious investigations for which the author is so well known. Some years ago, he writes, "I gave a summary of the factors and questions involved in the study of the relations between host and parasite in certain epidemic diseases of plants,* and have at various opportunities since then continued investigations into that subject. In particular I have for some time been occupied with researches planned with the object of ascertaining more concerning the modes of infection and attack of the Uredo-form of certain rust fungi. During the course of this work I had occasion to select a particular genus

* Croonian Lecture, *Proc. R.S.*, vol. xlvii. 1890, p. 393.

of Grasses, viz. the Bromes, with the view of examining their anatomy and histology in detail, in reference to the behaviour of the fungus in their tissue. In course of time a series of phenomena came to light which led me to go further into the conditions of infection, and to make numerous experiments with the Uredo of the Brown Rust (*Puccinia dispersa*), so common on certain species of this genus. These experiments led to some unexpected results, and the purpose of the present paper is to put together these results, since they appear not only of considerable interest and importance by themselves, but promise to throw additional light on some vexed questions of parasitism and immunity, and on the relations between the host-plant and its invading or attacking fungus."

The above may serve to show the general object of the paper, but it must be said at once that it would be impossible by mere abstracts to do justice to the various issues that are dealt with in this extensive work. It falls under sixteen heads or chapters, and there are twenty-eight tables, many of them very elaborate and all of importance in the argument and evidence with which they deal. There are practical bearings, and we shall reach an important one at the end; but let us endeavour first to indicate the nature and great scientific interest of the investigation. The author, in his work on *Hemileia* in 1881–82, the uredine which caused the Coffee-leaf disease in Ceylon, was impressed by the probability, amounting almost to a certainty, that the species *Hemileia vastatrix* on Coffee had originated by the special adaptation of a certain species, *Hemileia Canthii*, wild in the native forests on *Canthium*, to the cultivated Coffee. "Since then Eriksson has elaborated a theory of adapted parasitism in connection with the rusts of our cereal Grasses, which has assumed a degree of importance so grave, and so full of consequence for the understanding of the epidemic diseases of cereals, that any investigations throwing further light on the matter are welcome. Eriksson found, in fact, that the so-called Rust of Wheat (*Puccinia graminis*) is a collective species the morphological characters of which are now very thoroughly known, which behaves differently according to the particular host to which it has adapted itself as a parasite. For instance, if we take the uredospores growing on Wheat and sow them on Rye, Barley, or Oats, the results are negative. Nevertheless *P. graminis* occurs on these plants and forms uredospores on them. If, similarly, the uredospores from Rye be sown on Oats, the results are negative, whereas if sown on Barley they infect it."

"In other words, *Puccinia graminis*, while it infects all the above-mentioned plants and preserves its morphological characters on all of them, is so closely adapted to the particular host it happens to be on at the time that the uredospores from this host can only attack successfully and directly either this particular host or a limited number of its immediate allies; and the same specialised parasitism occurs in the case of other species of Rusts growing on different hosts."

"It thus becomes evident that we must modify our ideas considerably as to the danger of infection of Wheat by the uredospores of *P. graminis* growing in its neighbourhood on some other Grass. Further research showed, for instance, that the uredospores of the fungus on the Weed Grass, *Agropyron repens*, will infect Rye but not Wheat, and similarly with that on *Elymus arenarius*. On the other hand, the uredospores—of the same *Puccinia*—growing on *Dactylis* will attack Oats but not Rye, and similarly in other cases."

One of the interesting ideas which arose out of these results was "that the different specialised forms—which, though not morphologically distinct, are physiologically different from one another—are incipient species; that the particular specialised race adapted to grow on Wheat, but not on Rye or Barley, is in course of becoming a species, and may during the lapse of time actually become a species of *Puccinia*, which will eventually show morphological differences in addition to the physiological ones it already shows. Various names have been proposed for these physiologically but as yet not morphologically different varieties of the *Puccinia graminis*. Eriksson termed them 'special forms' (*formæ speciales*), Rostrup names them 'biological species' (*biologische Arten*), Schroeter chose the term *species sorores*, and Magnus calls them adapted races (*Gewohnheitstrassen*). . . . It is, of course, a matter of pure hypothesis as to whether these intangible physiological differences will ever bring about morphological changes of so obvious and relatively permanent a nature that we should then recognise the differences as specific."

The author gives an account of the Rusts that are found on the Bromes and also a descriptive account of the species of *Bromus* used in the experiments, all carried on with *Puccinia dispersa*. It should be mentioned here for clearness that this Rust has its physiological forms, which are adapted to species or groups, in a similar way to the case of *Puccinia graminis*, and that the main object of these extensive investigations was to find out what the various factors might be, in host or parasite, which governs infection, and so the association of the several physiological forms with particular kinds of *Bromus*. The numerous experiments themselves, though of great interest and importance, must necessarily, on considerations of space, be almost entirely passed over. Valuable ones, among others, were undertaken on the germination of uredospores, the conditions attending which had been astonishingly little attended to. It appears to have been generally taken for granted that uredospores would germinate at almost any summer temperature; but this is not the case, the minimum required being about 10–12° C. (50–53° F.), the maximum limit being not far from 26–27·5° C. (78–81·5° F.), while the optimum temperature is about 20° C. (68° F.). New light is thrown on some of Eriksson's results by cardinal points here brought forward. Elsewhere it is interesting to note that the author finds no evidence to support the remarkable hypothesis of Eriksson, that at certain seasons the Rust fungus attacks the Grass—*e.g.* Wheat—and passes the protoplasm of its spores into the embryo or some other part of the plant, where it mingles with the protoplasm of its host and lives a common life of *symbiosis* with the living cell contents, to break out suddenly at a favourable opportunity as Rust. The last chapter is in answer to its heading, "Is there any relation between infection and the visible structural features?" The answer given to this important question may perhaps be sufficiently shown as follows:—"Or, again, spores from *B. sterilis* readily infect *B. madritensis*, which has larger but fewer stomata than the former species. How is it that *B. maximus* is almost immune to these spores, although its stomata are far larger? Is it because they are also fewer? If so, it seems strange that *B. tectorum* should also have proved immune, because its stomata are more numerous than those of *B. madritensis*, and hardly smaller than those of *B. sterilis*. And the results are similar with other factors. . . . We are hence driven to conclude that the factors which govern predisposition on the one hand and immunity on the other are similar to those which govern fertility and sterility of stigmas to pollen, and I have elsewhere * shown that parallels between the behaviour of pollen (which is, after all, a kind of spore) towards the stigma of the receptive plant in cross-breeding and of these uredospores towards their host-plants multiply as we examine them. The importance of all this is, I think, that it justifies the hopes of those who believe that the constitution of plants can be so modified by breeding and selection that disease-resisting varieties should be no more difficult to evolve than varieties which refuse to cross with certain other forms. Only we must not forget that the fungus is also capable of being bred or selected, and prepotent varieties of spores are just as much realities as prepotent pollen."

R. I. L.

Hybridisation.

Hybrids, Preliminary Account of Variation in Bean. By R. A. Emerson (*U.S.A. Exp. Stn., Nebraska*).—The author here deals only with racial hybrids of Kidney Beans. The characters chosen were yellow, green, and blue-green pods; stringy and stringless pods; long and short pods; round and flat pods; white, red, brown, black, and variously mottled seeds; oblong and nearly round seeds, &c.

After describing the precautions taken, and methods of artificial pollination, the author proceeds:—"When ripe, the hybridised seed is gathered and compared with self-fertilised seed from the two parents to determine whether any tendency toward xenia exists."

The seeds are sown in the garden and protected against crossing by wire netting.

All racial hybrids of beans yet produced by the author showed little variation in the first generation, but pronounced variation in the second and third generations. Three photo-plates illustrate many instances of such variations.

With regard to the "common characters," *i.e.* of both parents, such are usually reproduced in the hybrids with little variation.

When both parents have yellow or green pods, such are reproduced; so also with other features, as stringy pods, dwarf habit, &c.

"Differentiating characters' usually unite and form "intermediate characters."

Blending of colours occurs, as when a blue-podded variety is crossed with a white one: the result is brown. The white seeds of 'Navy' unite with the black seeds of 'Challenge Black' to form spotted seeds, the light spots being grey.

Similarly intermediate results followed between stringy and stringless pods, and Beans of different shapes.

"Mosaics" occur when the two colours remain distinct. Then a

* *Proc. Cambridge Phil. Soc.* vol. xi. pp. 326–328.

white and red seed give rise to a spotted white and red in varying degrees from minute specks to patches.

Hybrids may produce seeds which take all their characters (colour, shape, size, &c.) from one parent, and pods having the characters (colour, shape, stringiness, &c.) of the other parent.

A hybrid may closely resemble one parent in the habit of plant and in all characters of pods, and the other parent in seed characters.

"Mosaics" may also be formed of characters of one or both parents united with the blended characters of both parents.

There may be an entire return to one parent. Then, in the second and third generation of a certain Bean hybrid, numerous individuals were so nearly like the male parent, and several so nearly like the female, that they could scarcely be distinguished from those races by any character of plant, pod, flower, or seed. When hybrid forms of second and later generations return to a parent race in any character, the reversion seems to be in accord with no law unless there be a definite numerical relation, not yet established, between the various hybrid types.

The writer confirmed Mendel's law (in which *dominant* characters are those which are transmitted entirely or almost unchanged, and *recessive*, those which become latent in the first-generation forms, but reappear in later generations). Thus, when semi-dwarf races were crossed with dwarf races, the first generation were *all* semi-dwarf. The recessive character (*i.e.* strictly dwarf plants) appeared in the second generation. Similarly, when green-podded and yellow-podded races are crossed, the green colour of the pod is dominant, occurring alone in the first generation, the recessive colour appearing, together with intermediate forms, in the second and later generations.

New or atavistic characters may appear, which neither parent race possesses. In 'Davis' × 'Blue Pod,' the dark blue-green colour of the pods of the latter race is dominant in the first generation hybrid forms. On this blue-green ground colour appear numerous spots and splashes of red.

In the second-generation forms the recessive pod colour, yellow, appears sometimes alone, but often nearly covered with red or purple spots, which were prominent in the first generation. This coloration likewise appears in hybrids of certain other races.

An even more peculiar circumstance is the coloration of hybrid seeds corresponding to that of the pods. In 'Davis' × 'Blue Pod' the ground colour of the seeds of the first-generation hybrids is apparently a blend of brown and white, but on this ground-colour are spots and stripes of red which fade to bluish purple.

As this yellow or brown colour striped or spotted with red or purple is common in the seeds of several races of Beans, such as 'Horticultural,' 'Dwarf Do.,' 'Goddard,' &c., it seems, therefore, that such races as 'Davis' and 'Mohawk' came originally either directly or indirectly from races similar to the last-named.—*G. H.*

Embryology of Juglans.

Juglandaceæ, Embryology of. By G. Karsten ("Ueber die Entwicklung der weiblichen Blüthen bei einigen Juglandaceen," *Flora*, 90: 316–333, pl. 12, 1902. Review by C. J. Chamberlain, *Bot. Gaz.*

xxxiv., No. 1, p. 75).—Karsten emphasises features resembling Gymnosperms, expressing his belief that the Angiosperms are derived from the latter, *Gnetum* being the point of contact. At the time of fertilisation in *Juglans*, the union of the carpels is delayed, thus leaving the ovules exposed, resembling *Gnetum*. He bases his argument upon embryological characters, and the most important points are summed up in the following comparison of the embryo-sacs of *Gnetum* and the Angiosperms :—

Gnetum.	*Angiosperms.*
Prothallium in lower part . . .	Antipodals.
Egg-cells	Egg-cell and synergids.
Endosperm nuclei	Polar nuclei.
The stimulus to development of embryo and endosperm by fertilisation of at least two egg-cells . . .	The stimulus to development of the embryo by fertilisation of the egg ; and development of endosperm by vegetative reproduction.

G. H.

CONTRACTILE ROOT-POWER.

Liliaceæ, Californian, Physiological Observations on the Subterranean Organs of. By A. Rimbach (*Bot. Gaz.* xxxiii. No. 6, p. 401 ; 1 pl.).—The subject of this paper is the contractile power of the roots, by means of which the bulb or rhizome is carried downwards. The author arranges the ten plants described as follows :—The first group includes *Clintonia*, *Prosartes* and *Fritillaria*. In these the rhizome alone, by its movement of growth, determines the location of the plant in the earth. It develops horizontally, and is not influenced in a mechanical way by the roots, which are not contractile.

The second group is formed by *Lilium*, *Scoliopus*, and *Trillium*. Here the growth of the horizontally developing rhizome determines in a much smaller degree the location of the plant. In general, the influence of the contractile roots prevails in fixing the position of the rhizome.

The third group contains *Zygadenus*, *Chlorogalum*, *Calochortus*, and *Brodiæa*. In these the rhizome develops vertically, and the contractile roots determine almost exclusively the position of the plant.

Lastly, in *Clintonia*, *Prosartes*, *Fritillaria*, *Lilium*, *Scoliopus*, *Trillium*, and *Zygadenus*, the roots are all of the same kind ; whereas in *Chlorogalum*, *Calochortus*, and *Brodiæa* there takes place a division of labour between nutritive and contractile roots.—*G. H.*

LINNEAN SPECIES.

Linnean Specific Names, The Use of. By Henry & James Groves (*Journ. Linn. Soc.*, *Bot.* vol. xxxv. p. 368 ; July 21, 1902.)—The authors say that "the Linnean species fall roughly into three groups : those applied to distinct species fairly well understood in Linnæus's time and still generally accepted ; those which are now considered to include two or more species combined by Linnæus ; and those about which there is more or less doubt as to the proper application." As to the first group there is little to be said. In regard to the second group, after taking the arguments on both sides into consideration, the conclusion is come to that the most satisfactory plan is to apply the name to the species which, "from being the most distinct and usually also the most widely distributed," may fairly be accepted as his type. In the case of names included in the third group, after stating what is said in favour of other views, the authors say, "We are of opinion that it is the better course to retain the names when, although the descriptions are imperfect and of themselves inadequate, there are reasonable grounds for inferring that they belong to certain plants."—*G. S. S.*

Anatomy of Lotus, &c.

Loteæ, Leaf and Seed Anatomy in (*Beih. Bot. Cent.* bd. xii. ht. 3, pp. 425–482).—Herr Walter Schmidt has investigated anatomically ninety-six species belonging to the genera *Lotus*, *Anthyllis*, *Hosackia*, and others of the Lotus family. The leaf seems not to differ in any marked way from the majority of the *Leguminosæ*. It is remarkable for the absence of external glands and mucilage-cells which are very common in other tribes The frequent presence of idioblasts containing tannin and probably also albuminoid substances is characteristic. Stomata are generally found on both the upper and lower surface of the leaf. The seed consists of three distinct parts: the seed-coat, a more or less developed endosperm, and the embryo. The seed-coat consists of the following layers: first, prismatic cells (*Stabzellen*) greatly thickened and with only about $\frac{1}{2}$ or $\frac{1}{3}$ of the cell-cavity remaining. They have a polygonal outline on the surface of the seed, and at times show a "lightline," probably through unequal thickening of the cell-wall and the different chemical nature of the different parts of the wall. Next comes a layer of hourglass-shaped cells more or less compressed and pretty strongly thickened. The innermost layer of the seed-coat consists of several rows of thin-walled, strongly-compressed cells. The endosperm consists of an outer portion covered by a cuticle and consisting of four-sided cells (polygonal as seen from the surface) and containing a little fat, a great quantity of proteal substances, and occasional starch grains. Then follows the horny or mucilaginous layer of endosperm, which swells greatly in water. The paper contains a tabular view of the characteristics of sixteen seeds, and both genera and species are treated in considerable detail.—*G. F. S.-E.*

Rust on Willow.

Melampsoræ that attack Willows. By C. B. Plowright, M.D. (*Gard. Chron.* No. 813, p. 55; July 26, 1902).—A synoptic table is given of fourteen species belonging to this genus, which infests Willows. The *Uredineæ* or Rust fungi, the family to which this genus belongs, is remarkable for the majority of its species being heterœcious. Out of the fourteen species of the genus *Melampsora* which attack Willows, only two are autœcious. The forms which appear on other hosts were formerly classed in another genus (*Cæoma*). These alternate hosts belong to various orders of plants, Larches, Orchids, Alliums, Ribes, Saxifrages, and Euonymus.—*G. S. S.*

Plant-Movement.

Movements of Plants (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 248–278). —Professor Dr. Anton Hansgirg gives many new instances of movements of the stalk in flowers, in ripening fruits, and in those that are ready to distribute their seeds. It is not possible to mention more than a very few of these. Several new examples are given of movements of the stalk in fruit similar to the *Avena*, *Oxalis*, and *Primula* types, but it is shown that species of the same genus often behave differently. This is well shown in *Trifolium*, where, in some species, the stalk moves downwards in fruit and in others is quite unchanged. In the *Veronica* type the stalk is close to the stem before flowering, moves outwards whilst flowering proceeds, and again draws close to the stem whilst the fruit is ripening. Many new examples are given of the Strawberry type, in which the stalk of the fruit turns towards the earth or under the leaves. Many Orchids and others turn the stalk of the *flower* downwards as soon as it blooms, but show no movement in fruit. Other cases are given of *Ranunculaceæ*, &c., in which the stalk is, in flower, upright, but turns below water to allow the fruit to ripen. *Euphorbia Peplis* and other prostrate plants bury their ripening fruits in the sand under the plant. A very large number of examples are given of sepals, calyx-tubes, and bracts which shut closely over the ripening fruit, as in many *Caryophyllaceæ*, *Labiatæ*, and *Acanthaceæ*. Other tropical plants show similar movements to keep out injurious insects, such as the turned-back sepal teeth or turned-down bracts of some African *Labiatæ*. A sort of cleistogamy is shown to be produced, not only by dry weather, but also by insufficient light or temperature during cold, wet weather. New examples are given of "sleeping" leaves and paraheliotropic leaves. A great number of *Leguminosæ* possess sensitive leaves. The filaments of *Amberboa*, of *Opuntia* spp., and of *Grewia* sp., and the styles of *Tecoma* spp. and *Arctotis* spp., are also sensitive to contact. Colour change is also mentioned in the flowers of several orders. The knotted swellings at the base of the internode in some *Umbelliferæ*, Grasses, *Polygonaceæ*, *Labiatæ*, &c., are to be explained by various adaptations. They may be intended to give mechanical support to the stem, which is often weak, or protection against wind and rain, or to act as stores of water or food-material, or to uplift the stem by geotropic sensitiveness after it has been thrown down.—*G. F. S.-E.*

Malay Polypodies.

Myrmecophilous Ferns, two Malayan: *Polypodium* (*Lecanopteris*) *carnosum* (Blume), **and** *Polypodium sinuosum*, Wall. By R. H. Yapp, B.A. (*Ann. Bot.* vol. xvi. No. lxii. p. 185; pls. 10, 11, 12, figs. 1–51).—This paper is an interesting result of the author's visit to the Siamese Malay States as a member of the Cambridge expedition of 1899–1900, under the leadership of Mr. W. W. Skeat. The anatomy, biology, and systematic position of these Ferns are fully dealt with. They are found to be specifically distinct and differing widely in external appearance, "yet an examination of their internal structure reveals the fact that, after all, their resemblances are more remarkable than their differences, and that, instead of being placed in separate genera, they must be recognised as closely allied species." Both are epiphytes of the Malay region, *P. carnosum* growing at an elevation of 600 feet and above, while *P. sinuosum* is often found almost at sea-level. Their thick fleshy rhizomes are tunnelled by a system of galleries, similar to those of *Myrmecodia* and *Hydnophytum*, and which are, like them, invariably inhabited by colonies of ants. "In both Ferns a tissue consisting of large cells with thin walls and no intercellular spaces is formed in certain definite areas near the apex of the stem. This tissue breaks down at an early period, its place being taken by the ant-galleries, which are thus of lysigenous origin. The gallery system consists in both cases of a main ventral gallery which runs longitudinally through the stem, giving off two lateral series to the branches and two series of vertical ones leading to the swollen leaf-cushions. Soon after leaving the main gallery the vertical ones branch so as to form two longitudinal series of dorsal chambers." Differences between the two species, with regard to these chambers, are then described. Continuing, the author says that "communication between the galleries and the external air is effected by means of short passages excavated by the ants themselves in the soft tissues of the younger parts of the stem. The character and topographical position of the large-celled tissue seem to indicate that it was developed in the first instance as a special water reservoir; but the fact that it is soon disintegrated may perhaps point to some degree of change of function, *i.e.* that the galleries which replace it have some important function to fulfil. There is no evidence that the galleries are an adaptation on behalf of the ants, and indeed their meaning is still somewhat obscure. Perhaps they serve as organs for the aeration of the stem, which is in both cases almost devoid of intercellular spaces. It is also possible that they assist to a slight extent in the absorption of water." The species of ant is not the same in both species of *Polypodium*, *P. sinuosum* being inhabited by *Technomyrmex albipes*, and *P. carnosum* by a new species of *Cremastogaster*, *C. Yappi* of Forel. Although the possibility of the existence of a true adaptation between the ants and the Ferns cannot be denied, yet available evidence, the author says, seems to point to Goebel's view as being the correct one, *i.e.* that the ants are merely "Raumparasiten," or dwellers in cavities formed without reference to their future inhabitants, more particularly so because no attraction in the form of food appears to be offered to the ants. Pteridologists are indebted to the author for his careful examination of these Ferns, especially in the case of *P. carnosum*, the position of which has been debatable. Reinwardt originally placed it in the genus *Onychium*, while a few years later Blume described it as the type of a new genus with the name *Lecanopteris*. The majority of writers have maintained this genus, and in 1892 Baker wrote, "I now think that *Lecanopteris* will have to stand as a distinct genus in the neighbourhood of *Dicksonia*, from which it differs in having an indusium formed of only a single valve and in the curious rootstock." The author shows, however, that the supposed indusium is in reality part of the ordinary leaf-lamina, and, resting on this, it is easy to agree with him in his determination. He says that "the only reason that remains for retaining *Lecanopteris* as a distinct genus is the curious reflexed position of the sori." The sorus-cups are brought to face skywards, and what this means in the economy of the plant is of much interest. The plants grow on the upper branches of trees, in one locality never at less than

80 feet from the ground, and the author thinks that the object is to preserve the spores from falling to the ground in still weather. The majority would be scattered only on windy days, and obviously with the advantage of easily reaching the higher branches of other trees. In a footnote the suggestion of Mr. F. Darwin is recorded that this may be compared with the "Censer" mechanism found in the fruits of Poppy and other flowering plants. The numerous figures which accompany this paper are all of much interest, and no important point appears to be without an illustration.—*R. I. L.*

HONEY IN POLLEN.

Nectaries, Chemical Proof of Sugar in Pollen-flowers (*Beih. Bot. Cent.* bd. xii. ht. 1, pp. 34–43).—Dr. Rob. Stäger gives a series of observations with Hoppe-Seyler's sugar test. He finds that many so-called pollen-flowers, such as the *Helianthemum vulgare, Hypericum perforatum, Parnassia palustris, Papaver Rhœas, Lysimachia vulgaris, Cyclamen persicum, C. europæum, Spiræa Ulmaria, Chenopodium album, Plantago lanceolata*, Hop, Hemp, Nettle, and various Grasses, secrete honey. He also mentions that numbers of insects regularly visit the flowers of Grasses.—*G. F. S.-E.*

PILOSTYLES INGÆ.

Pilostyles Ingæ (= *P. Ulei*, Solms Laub.), **Monograph of.** By W. Endriss (*Flora*, vol. xci. pp. 209–236; 29 figs.; t. xx.).—This is one of the parasitic Phanerogams, whose vegetative body is represented by a fungoid thallus in the tissues of the host-plant; its mycelium is truly cellular, the chambers of the hyphæ being 1-nucleate; intracellluar hyphæ act as haustoria, while the larger strands are intercellular, sometimes from the breakdown of the tissues they traverse. Unlike *Rafflesia*, it develops its flowers exogenously at the end of a short leafy stem. The fibrovascular bundles are much reduced, and the phloëm has no true sieve-tubes. The anatropous ovule has two coats, a micropyle closed by the adnation of an outgrowth from the funicle to the exostome, and a typically-constituted embryo-sac. Fertilisation was not observed in cases where the pollen had penetrated; on the other hand, the oosphere had developed in cases where no pollen-tube was traceable, from which parthenogenesis is conjectured. Endosperm is of limited amount, and forms a layer of large cells around the embryo, which remains small. Germination was not observed. The actual point of the outgrowth of the thallus, which pierces the surface to give rise to the floral axis, becomes its growing point.—*M. H.*

THE PITCHERS OF DISCHIDIA.

Pitchers in *Dischidia Rafflesiana*, **Evolution of.** Morphological note by Sir W. T. Thiselton-Dyer, K.C.M.G., C.I.E., F.R.S. (*Ann. Bot.* vol. xvi. No. lxii. p. 365; plates xiv. and xv.).—These interesting pitchers, so entirely different from those of *Nepenthes, Sarracenia*, and other insectivorous plants, have long been known to botanists, but the plant itself had not been seen alive in Europe until introduced to Kew from the Botanic Gardens of Java in 1890. Having pointed out the improbability at first sight of any addition to our knowledge of the morphology of the pitchers, in consequence of the exhaustive monograph by Dr. Scott and Miss Sargent (*Ann. Bot.* 1893, 243–262, tt. xi. xii.), the author writes: "It is, however, one of the results of the change of conditions effected by cultivation to rouse latent tendencies and to develop atavistic forms which are often extremely instructive. Such deviations from specific stability are usually the result of seminal reproduction. In the case I am about to describe it is purely vegetative, and therefore of even greater theoretical interest. The structure of the pitcher in *Dischidia Rafflesiana* is well known. . . . As demonstrated by Treub, it is 'a modified leaf in which the inner surface corresponds to the lower surface of the normal foliage leaf' . . . and it is important to observe that normally the form of the future pitcher is, as it were, laid down from the first, and there is no indication of any passage from the form of the normal foliar leaf to that of the pitcher. Such intermediate stages have, however, made their appearance after some ten years' cultivation of the Kew plants. . . . These indicate a complete transition from the ordinary leaf by an increasing concavity of its under surface to a pitcher, which, however, still differs, in its open mouth, uninflexed margins, and small size, from the fully-developed organ. It can hardly be doubted that these indicate the path by which the latter has been arrived at from the ordinary leaf." The author points out that "the production of pitchers is only characteristic of a small part of the genus. From this the inference may be fairly drawn that the property of producing pitchers is rather an individual adaptation than bound up with a particular generic type, as it is apparently in *Sarracenia* and *Nepenthes*." Discussing the teleological object attained by the plant in forming these pitchers, and referring to the views of Carpenter, Beccari, and Delpino, the author says: "Treub's view that the pitchers are water-economisers appears most nearly to correspond with the facts. As he points out, it is only in certain, and by no means inevitable, positions that the pitchers collect rain-water. I can only conclude that on the average they pay. But under all circumstances they serve to preserve water lost by transpiration, which is one of the severest taxes the plant has to meet. As is well known, the pitchers of *Dischidia Rafflesiana* contain a copious root system. This is derived from one or more of a pair of aërial roots, which are either derived from the petiole or from the stem in close adjacence. The whole root system of the plant is adventitious. And I venture to hazard the theory that, in so far as adventitious roots are not merely organs of support, their production is in response to the demand for water. In plate xv. fig. 1, it will be noticed that each petiolar root is applied to the concavity of its corresponding leaf, and in fig. 3 it will be seen that as soon as the concavity becomes a pitcher the roots are included within it. The whole, if I may say so, evolutionary data tend to prove then that the primary object of the pitchers is the supply or, at any rate, economy of water. But the copious development of the enclosed root system, which is often matted with organic débris, seems to go beyond this. The researches of Groom (*Ann. Bot.* 1893, 223, 242), I think, leave no doubt that the roots utilise this as if it were ordinary soil (*l. c.* 227). From whence is the organic matter derived? There can be no doubt that, except when in the erect position, the pitchers are usually almost dry. We are driven then to accept the suggestion of Groom, based on the observations of Mr. H. N. Ridley, that the organic matter is carried in by ants (*l. c.* 229). We have, therefore, to deal with an adaptation of a singularly complex kind. Originally destined to store and economise water, the pitchers often imperfectly perform that function, and are then taken possession of by ants, which supply solid in the place of liquid nutriment. Having begun as 'water-cans,' they, by a change of function and by the aid of ants, become 'flower-pots.' And there is a sequel to the story scarcely less interesting. Looking through the descriptions of *Dischidia* in the *Flora of British India*, I came on that of *D. complexa*, based on a note of Griffith, which no one seems to have taken the trouble to investigate or confirm. What excited my curiosity was that in this species a second pitcher is described internal to the primary one. This seemed to me so extraordinary that, finding Griffith's solitary and imperfect specimen in the Kew Herbarium, I ventured to take some liberties with it. The result seemed to me so surprising that I have asked Mr. H. H. W. Pearson to work out the promising problem which it presents." An account of this investigation appears in the *Journal of the Linnean Society*, vol. xxxv. p. 375, and will be found of great interest.—*R. I. L.*

Plant-Breeding.

Plant-breeding. By Prof. Homer C. Price (*U.S.A. Hort. Soc. Iowa*, 1901, p. 429).—A very valuable article is given here by a competent authority. The writer opens by comparing stock-breeding with plant-breeding. The term "plant-breeding" is of comparatively recent origin. We have long used the term "stock-breeding" to indicate that man possessed the power to regulate, to some extent at least, the character of the offspring of his animals; but in the plant kingdom we did not recognise the plasticity of reproduction so soon. The writer contends that what we can do with animals we can do with plants. After setting forth the rudimentary laws of breeding, the writer classifies the methods as (1) selection; (2) natural crossing; and (3) artificial or hand pollination. Sufficient care and attention are not given to selection. Large numbers of good seedlings should be used and just a few selected, following the dog-breeder's advice "to have lots of dogs and to hang lots of them." Hand pollination is the highest development of the art of plant-breeding. The work is difficult, tedious, and exacting. The parents should be carefully chosen, and cross pollination secured by emasculating or removing the stamens from the blossom of the variety chosen for the mother; and after carefully guarding it from any other pollen, the pollen that is chosen for the other parent of the cross is placed on the pistil when in a proper condition to receive it.

The choice of parents is of vital importance, for if the cross is too violent there will be very few matured seeds, and the ones that do develop are likely to be sterile. Improvement by plant-breeding, however, should be accompanied by improvement in environment. In order to succeed we must have an ideal, and that ideal must remain constant.—*V. J. M.*

Plants and Electricity.

Plant Juices, Electrical Conductivity of. By F. D. Heald (*Bot. Gaz.* xxxiv., No. 2, p. 81).—The experiments described and illustrated were made with *Beta vulgaris*, *Solanum tuberosum*, *Allium Cepa*, *Raphanus sativus*, *Nuphar advena*, *Cucumis sativus*, *Portulaca*, and *Amaranthus*, and led to the following results:—

1. Plant juices are good conductors, and the conductivity is due in large measure to the dissolved mineral substances, while the organic compounds play a minor part.

2. The specific conductivity of the juice obtained from the roots of plants is always considerably less than that of the juice obtained from sub-aërial parts.

3. The specific conductivity generally increases progressively from the root upward, although in some cases the sap from the stem has a higher conductivity than that from the leaves.

4. In the majority of cases the specific conductivity is a rough measure of the relative amounts of ash present in different parts of the plant. (See also "Electrical.")—*G. H.*

Anatomy of Podalyriæ and Genisteæ.

Podalyriæ and Genisteæ, Leaf-anatomy of (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 279-288).—Dr. H. Solereder gives a short account of the anatomy of these two tribes. The *Podalyriæ* possess the characteristic hairs of *Papilionaceæ*; they have no glands. The epidermis cells do not possess strongly undulated sidewalls. There is no special type of stoma. The intercellular spaces in the leaf are generally reduced. Both centric and bifacial types occur. Generally sclerenchyma accompanies the bundles. Idioblasts are found frequently and contain tannin. The *Genisteæ* possess the usual leguminous hairs. Glandular hairs occur in *Melolobium*. Tannin-idioblasts and calcium-oxalate crystals are generally absent, but saponin-like substances, sphærocrystalline masses, indigo, and indican-like bodies are found.

A key is given to the chief anatomical peculiarities of the genera in both groups.—*G. F. S.-E.*

Submerged Foliage.

Proserpinaca palustris, On the nature of the stimulus causing the change of form and structure in. By W. B. McCallum ((*Bot. Gaz.* xxxiv. No. 2, p. 93).—The object of this paper is to discover the actual cause which produces the finely-dissected foliage when submerged, the aerial leaves being narrowly lanceolate and serrate. After showing that light, nutrition, temperature, salts, relations to carbon-dioxide and O_2, and contact stimulus must be eliminated as direct influences, experiments proved that it was the excessively hydrated condition of the protoplasm. "The essential feature common to the water and the moist air (in which the submerged type was also produced) is the inhibition of transpiration and the consequent choking of the cells and diluting of the protoplasm with water." By means of hygrometric salts the protoplasm was restored to its proper state, and the air type of leaf was developed under water.

Another fact was observed, that when plants had been kept submerged for some months they started to produce the air type of foliage. "It would seem as if some of the plants after a time became accustomed to the stimulus and refused to respond. Or it may be that, as only the air form is capable of fruiting, in the effort to produce flowers the plant has the ability of self-adjustment to its conditions and develops the air form in spite of its environment."—*G. H.*

Protoplasm.

Protoplasmic Continuity (*Beih. Bot. Cent.* bd. xii. ht. 3, p. 343, plates 10 and 11).—F. G. Kohl (Marburg) describes and figures protoplasmic connections in various algæ (*Chætopeltis*), in Fern prothallia, in the leaf of Mosses, and in the guard-cells of the stomata. A critical discussion of the observations of others is also included in his paper.

G. F. S.-E.

Red Spider.

Red Spider, Biology of. By R. V. Hanstein (*Zeit. f. Pflanz.* xii. 1902; pp. 1–7).—Two species of red spinning mite or spider are distinguished: (1) *Tetranychus telarius*, the mite so common on the Lime tree, is green or greenish-yellow, with one pair of red eye-spots, and orange in the winter condition. (2) *T. Althææ* (on Hollyhock, Hop, French Bean, &c.) is greenish-brown, slightly larger than the other, with two pairs of eye-spots, and the female is red in colour from August till the following spring. The Lime mite causes the leaves to shrivel and fall, while the webs spun all over the tree are unsightly. The damage does not seem to injure the trees much, as the author has observed them badly attacked several years, yet each spring they produced healthy new foliage and, later, fruit. The Hop red mite, according to Miss Ormerod and other observers, is more destructive; the author has never found this species on the Lime. Eggs of the Lime mite were seen from May to November. After five or six days, six-legged larvæ hatch out, and these after three feeding periods and three resting periods, each from one to two days' duration, become the eight-legged adult. During each resting period the structure is altered. From deposition of the eggs to the mature egg-laying female the life-history is completed in fourteen to eighteen days, so that four or five generations may be produced in a season. Towards autumn, the females change colour, and probably only these survive the winter. No males were observed in spring. The winter is passed in clefts of the bark or in the earth beneath. Sheltered by a dead leaf they were observed to have considerable resistance to cold, although it is probable that many perish in winter. Dry seasons favour their increase, but it was found that a certain degree of moisture was necessary for vigorous growth. Prevention: The author does not appear to have tried remedies himself, but discusses various methods which are much the same as given by Miss Ormerod (*Manual of Injurious Insects*). The ladybird and other larvæ are natural enemies of the red mites.

W. G. S.

Anatomy of Rhamnaceæ.

Rhamnaceæ, Leaf-anatomy of (*Beih. Bot. Cent.* bd. xii. ht. 3, pp. 351–424; 45 figs.). Dr. Kurt Gemoll has examined 120 species belonging to twenty-four genera of the tribes *Rhamneæ*, *Colletiæ*, and *Gouaniæ*. There is a short account of the special characters of each species. The leaves show great variation in size and general character. In most of them there is no clear differentiation of the mesophyll into palisade and spongy parenchyma. The entire mesophyll consists of several layers of cells elongated like palisade cells. Very often the inner walls of the epidermis cells become mucilaginous. There are characteristic mucilage-containing cells in the collenchyma below the bundles. The leaf is generally bifacial. Some species of *Ceanothus* show deep grooves between the nerves on the under side, in which lie the stomata, protected by hairs. These sunken parts of the leaf have only one layer of palisade-like cells, while the rest may have seven to eight layers. The crystals show great variety as regards both character and position. Small stellate crystal cells are common in the spongy and bast parenchyma. Long crystals found in special thin-walled cells characterise the *Gouaniæ*. These "styloids" often reach from upper to lower epidermis, and produce the transparent points in the leaf. Short clinorhombic crystals also occur, as well as small hendyoëdic and aggregates of crystals. The hairs vary from long unicellular trichomes to stellate and stalked forms.—*G. F. S.-E.*

RUSTS.

Rust Fungi, Experiments with. By H. Klebahn (*Zeit. f. Pflanz.* xii. 1902; pp. 17–44, and 132–151; 5 figs.).—The tenth annual report of the author on his experiments with the cultivation of heterœcious *Uredineæ* with incomplete life-histories. While generally notes on progress of his work, each year brings some problem solved. Parts I. to VI. deal with the *Melampsoreæ* of Willows and Poplars. An excellent summary of results on the species occurring on Willows is given by Plowright (*Gard. Chron.* July 1902, p. 55). In regard to Poplars the investigations confirm that *M. populina* includes two forms: (1) *M. allii-populina*, cæoma on *Allium ascalonicum*, uredo on *Populus nigra*, *canadensis*, and *balsamifera*; (2) *M. laricis-populina*, cæoma on Larch, uredo on various Poplars. Other Poplar *Melampsoreæ* are noticed. Part VII. Experiments with needle-rusts of Pines: (1) *Coleosporium Pulsatillæ*, Lév., æcidia on Scots Pine, uredo on *Pulsatilla pratensis* and *P. vulgaris*. (2) *Col. Inulæ*, Fischer, connection with æcidia on Scots Pine confirmed. VIII. Rind-rust of Pines: (1) Identity of the three species *Cronartium asclepiadeum*, *flaccidum*, and *Nemesiæ* confirmed. (2) *Peridermium pini*, negative results with species of *Galium*, &c. IX. *Æcidium elatinum*; confirms Fischer's results (see R.H.S. JOURNAL, vol. xxvii. p. 272). X. *Chrysomyxa Ledi*. Successful infection of *Ledum palustre* with æcidia from *Coniferæ*. XI. *Æcidium Pastinacæ* Rostr.; confirms connection with a *Uromyces* on *Scirpus*. XII. A *Puccinia* on Bistort gave æcidia on *Angelica sylvestris* and *Carum Carvi*, the name *P. Angelicæ-bistortæ*, Kleb., is suggested; this confirms and extends Soppitt's experiments. XIII. Rusts on *Ribes* and *Carex* spp.; reports new experiments. XIV. An æcidium on *Ranunculus acris*, L., infected Meadow Foxtail (*Alopecurus*), hence belongs to *Puccinia perplexans*, Plowr. XV. Confirms connection of *Æcidium graveolens*, Shutt., on Barberry with *Puccinia Arrhenatheri*, Erikss., on Tall Oat-grass. XVI. Experiments with *Pucciniæ* on *Phalaris*; reports new observations on the connection between these and æcidia on *Liliaceæ* and *Orchideæ*. XVII. *Gymnosporangium* experiments; notes on infection of *Rosaceæ*.

W. G. S.

Rusts.

Rusts of Cereal Crops: Origin and Propagation. By J. Eriksson (*Ann. Sc. Nat. Bot.* xiv. 1901, pp. 1–124; xv. 1902, pp. 1–160; figs. 10, plates 5).—For twelve years the author has carried on an important research on the rust fungi which damage Corn crops. Many papers and a book have been issued on his work. Reviews of the earlier work have appeared in English periodicals, *e.g.* Plowright (*Gard. Chron.*, 1898), Massee (*Natural Science*, 1898), Smith (*Nature*, August 1898). The chief object of the present paper is to furnish evidence in favour of the author's view that rusts of cereals are propagated by a germ which inhabits the grain. The paper is diffuse, and only a brief outline can be attempted.

Part I.—Observations and investigations which suggest an internal origin of rust. *A.* Observations in the open field (xiv. pp. 1–124). The following are noteworthy. On autumn-sown Wheat, uredo patches were never seen by Eriksson earlier than thirty to thirty-four days after sowing the grain; yet uredospores under observation cause infection in ten to twelve days. Although the teleutospores germinate in April or May, the first appearance of uredo patches in the years 1891 to 1897 was: (*a*) autumn-sown Rye, last week of June to first and second weeks of July; (*b*) autumn-sown Wheat and Barley, second or third week of July; (*c*) spring Wheat, Oats, and Barley, second week of July to beginning of August. Again, autumn Wheat and Rye, 100 metres distant from the nearest Barberry bushes, showed uredo patches before spring Wheat and Barley only fifty metres off. The same variety of Wheat was sown at intervals of fourteen days from April to June; in each case the first trace of rust appeared in eighty-one to ninety-six days. Varieties of Oats, Barley, and Wheat are unequally disposed to rust. These and other results are given, and Eriksson says they can only be explained by assuming an internal germ as the cause. The remainder of Part I. deals with the different species and forms of rust recognised by Eriksson, and with the course of their development.

I. *B.* (xv. pp. 1–50.) Experiments with isolated cultures. Cereals liable to rust were grown in closed chambers and protected from outside infection. At first the results were negative, because healthy plants could not be obtained in the chambers, but as technical details were improved normal plants were obtained. The majority of the experiments showed that plants protected from external infection can develop rust, of which the only source is an internal germ in the seed. The different methods of protecting the plants are shown in figs. 1–8, and plates 1 and 2.

Part II. (pp. 51–129). Morphology and biology of the internal germ of rust. This is the crux of Eriksson's work, since it is the source to which he ascribes the propagation of rusts in epidemic form year after year. He criticises the opinion that the rust may be propagated by an intercellular mycelium produced by spore-infection and living for some time in the host-plant before it gives rise to spores. Eriksson shows that no one has traced such a mycelium except near the spore-sori, and just prior to their formation; his own observations confirm this. Another opinion is that the rust may arise from spores adherent to the husk of the grain or enclosed inside it. Eriksson says that adherent spores have been rarely recorded, while examination on his part shows only occasional cases, too few to account for the general appearance of rust throughout a whole field. Spores have never been observed in or near the embryo of the grain; they are always on or just below the husk. Experiments with grains with adherent spores show that these are not more liable to rust than clean grains, or those treated with fungicides. Current theories thus disposed of, Eriksson describes his "mycoplasmic intracellular condition as a source of the disease." The germ could not be discovered by any known methods of microtechnique till just before the appearance of the uredo-sori. At this time, by using 3·5 per cent. alcoholic hæmatoxylin, then 2 per cent. alum solution, and examining in glycerine, one can detect certain corpuscles floating in the cytoplasm, either isolated or in groups, irregular in outline and sometimes branched (plate 3). These are said to perforate the cell-wall and emit an intercellular mycelium, the corpuscles themselves remaining in the cell as suckers. (It seems yet not quite clear whether the corpuscles produce the mycelium, or whether they are the suckers produced by the mycelium.) Eriksson's view is that the corpuscles are the visible product of a peculiar form of mycoplasm unrevealable by existing methods, and living in an intimate symbiosis with the cell-contents of the host-plant. The presence of the mycoplasm does not appear to affect the host-plant much. In the grain it lives almost as long as the embryo plant itself, so that seed-grain several years old is as likely to produce rusted plants as that grown last year. Grain deformed and shrivelled by rust may give a good crop, and *vice versa*. Plate 4 shows a variety of Wheat rusted in 1890 and 1892, healthy in 1891 and 1893. Rust epidemics appear to depend on the weather in April, but the exact conditions have not been elucidated.

Part III. (pp. 130–152). Recent work in other countries. Since the mycoplasm theory introduces into plant pathology a new mode of propagation of fungi, it has naturally led other workers to make observations; generally, it must be said, with results antagonistic to Eriksson. This chapter gives a critical review of recent work, and an attempt is made to read the results into a confirmation of the mycoplasm theory.

Part IV. (pp. 153–155). What is to be done in the suppression of grain-rust? If Eriksson's views be accepted, then the destruction of Barberry, treatment of seed by fungicides, and other such measures are useless. Eriksson suggests a special experimental station in each country where rusts of cereals are epidemic. The work of the stations is to find out (*a*) which varieties are liable to rust, and therefore should not be cultivated; (*b*) which are rust-proof; (*c*) to determine how far soil, situation, manure, season, &c. are responsible for epidemics; (*d*) to obtain new varieties of rust-proof cereals. The investigators should hold periodic international conferences.—*W. G. S.*

Anatomy of Rutaceæ.

Rutaceæ, Leaf-anatomy of. By Hilmar Schulze (*Beih. Bot. Cent.* bd. xii. ht. 1, pp. 55–98; 2 plates).—This is an important paper on the anatomy of the leaf in *Rutaceæ.* The most important points are connected with the secretion of mucilage by the inner walls of the epidermis cells (of the upper surface). In the simplest cases the inner wall (palisade side) has a mucilaginous layer deposited upon it; in other cases this latter becomes covered by a subsequent cellulose lamella; sometimes also a second deposit of mucilage and a second cellulose lamella are laid down. Secretion glands were found in all the species investigated with one exception, in which only oil-cells were present. An arrangement for emptying these glands was proved on the living plant in the case of seven species, and in many others the anatomy pointed to some similar structure. Peculiar circular groups of small cells were found on the lower side of the leaves of two species of *Boronia*; they are enclosed by a ring of the usual epidermal cells, and are perhaps secretory in function. In *Murraya exotica* the epidermal cells are often pressed together, sometimes to such an extent that the lumina vanish. Stone-cells were found in the parenchyma of the main nerves in *Almeidea.* Idioblasts were present in the mesophyll of the four species of *Boronia* examined, and were at the extremities of the spiral vessels. Crystals of calcium oxalate are found in the epidermis of *Flindersia*, and the walls of the cells containing them are thickened. The large epidermis cells are often divided into many small cells, of which each contains a crystal. Hesperidin has been proved to exist in numerous other genera besides *Boronia.* Seventy-six species, belonging to thirty-five genera, are discussed in this paper.—*G. F. S.-E.*

Spore Development.

Selaginella, Spore Development of (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 182–199; 1 plate).—Dr. P. Denke (Krefeld) has followed the development of the spores. He fixed the material in $\frac{1}{3}$ glacial acetic and $\frac{2}{3}$ absolute alcohol, then hardened in 50–60 per cent., 70 per cent., 80 per cent., 95 per cent., and absolute alcohol; then in chloroform and paraffin. The sections were 5–7·5 μ thick, and Meyer's Eiweiss glycerin was employed. Stained hæmatoxylin and Congo red.

The epidermal cells of the stem at a point just above the leaf divide, and the sporangia are formed by them and the hypodermal tissue. The author did not find that one special cell, characterised by great size, became the spore mother-cell. The macro- and microsporangia develop in the same manner until the separation of the cells of the central tissue in the sporangium; this suggests that they are phylogenetically of the same origin. An extranuclear spindle initiates the division of both macro- and microspore mother-cells. The nucleus is drawn into the spindle by fibrils passing from the spindle poles to the nuclear membrane. Exo- and mesospore of the macrospore are close together, and are both formed one after the other by the protoplasm of the mother cell. During this process the membrane of the mother-cell becomes dissolved. After mesospore formation, there is only a small sphere of plasma remaining at the apex of the spore. The projections on the outer side of the exospore are formed in *S. emiliana* before the separation of the two layers. This separation is due to the more rapid growth of the exospore. The figures are excellent.—*G. F. S.-E.*

Silver-leaf Disease.

Silver-leaf Disease. By J. Percival (*Journ. Linn. Soc., Bot.* vol. xxxv. p. 390, pl. 10 and 5 figures; July 21, 1902).—This disease, which frequently attacks the Plum and the Peach, less often the Apricot, and only occasionally the Sloe, has hitherto been a complete puzzle to all investigators. There is nothing unusual about the leaves of affected trees, except that, instead of their being green, they are of a peculiar ashy-grey colour; this peculiar colour is due to the presence of certain spaces filled with air between the cells of the epidermis, and not to any alteration of the colouring matter of the leaf. The affected trees may live for many years in this diseased condition, but they bear little or no fruit. When first noticed the disease is found often to only attack some of the branches on one side of the tree, but later the entire tree becomes affected. The author says: "In advanced cases a discoloration of the central parts of the wood is observable when the stems are cut across, and this sometimes extends to the wood of the finer branches, and into the wood of the leaf-petioles. In milder attacks, where the disease is of recent origin, the wood of the stem and branches is not discoloured as far as the naked eye can determine." After careful examination of the roots, it was found that the roots of affected trees when cut across were always discoloured in the centre, and that between that portion and the healthier part surrounding it there were always the hyphæ of a fungus, which, on being kept in a moist place for some time, grew and produced the sporophores of a fungus known as *Stereum purpureum*. To prove whether this fungus was the cause of the disease or not, some healthy young Plum-trees of various kinds were inoculated with it on one- and two-year old branches early in March, and in the first week in May the leaves on these branches exhibited the characteristic silvery appearance, "thus showing conclusively that this fungus is the cause of the disease."—*G. S. S.*

Anatomy of Plants.

Sperguleæ, Polycarpeæ, Paronychiæ, Sclerantheæ, and Pterantheæ, Anatomy of (*Beih. Bot. Cent.* bd. xii. pp. 139–181, pls. 3 and 4).—Herr Friedrich Joesting has written an important paper on this group of plants. The general anatomical characters are as follows:—

The root is primarily diarch, and the phloëm is without hard-bast elements. Development of the periderm begins at an early date. It may be formed from the pericambium, from the inner layers of the cortex, or from the sub-epidermal layer. The cambium, in a great number of genera, ceases at certain points to form wood. Only parenchyma is developed at these places, hence the wood is divided into many radiating wedges. Secondary cambiums were found in nine of the thirty-three genera investigated. They arise either in the cortex, in the phelloderm, or in the phloëm parenchyma. Papillary outgrowths of the epidermis are common. An endodermis separated the cortex from the mechanical cylinder, which latter consists of from one to five layers of close-set, strongly-thickened, rounded cells. This mechanical cylinder is nearly continuous, and is only interrupted at the nodes.

The vascular bundles (probably collateral) are usually united to form a ring. The perennial species show distinct annual rings in the wood, which in these cases is interrupted (see above). The leaves are very primitive in structure. There is no distinct difference in the shapes of palisade and spongy cells respectively; there is a mass of collenchyma or sclerenchyma above the collateral bundles, which is enclosed with them in a bundle-sheath. The stipules develop from a very small, many-layered, basal part, and eventally become dry, silvery-white, and one-layered. The following specific differences are noted :—

(1) Isolated vascular bundles in *Spergula*, *Corrigiola*, and *Pycnophyllum*. (2) No mechanical ring in *Drymaria* and *Pycnophyllum*. (3) Hard-bast only in *Lœflingia*. (4) Lignified cork-cells in *Spergula* root. (5) Lignified cortex-cells in *Drymaria*. (6) Lignified pith-cells in *Sphærocoma*, *Pollichia*, and *Gymnocarpos*. (7) Companion-cells to stomata, *Siphonychia*. (8) Gland in place of stipules, *Ortega*.—*G. F. S.-E.*

Starch and Inulin.

Starch and Inulin (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 226–242).—This paper has been written by Hugo Fischer in reply to a reference by Correns on the author's well-known article on Inulin. It is mainly a criticism of Nägeli's theory. The author has repeated Arthur Meyer's experiments on the effect of light and darkness in producing the layers of starch grains with different results. Starch grains may be permanently coloured by staining with a drop of alcoholic iodine solution and mounting in Canada balsam. A short criticism of assimilation, of Haberlandt and Nemec's gravitation theory as regards the starch sheath, of an enzyme as being the possible inulin-forming body, and of the absence of wound cork in certain tubers concludes the paper.—*G. F. S.-E.*

Stomata.

Stomata, Mechanism of. By Edwin Bingham Copeland, Stamford University, California (*Ann. Bot.* xvi. No. lxii. pp. 327–364, pl. 13).—For the last hundred years, perhaps, the student of botany has found a special point of interest in stomata, and yet, as shown by this paper, there still remains an extensive field for observation. "From all points of view, anatomical and physiological, the stomata have received more constant and lasting attention probably than any other single vegetative structure in the plant, and yet recent literature on the subject is most contradictory, not only as to the mechanism of their movements, but even as to the conditions which influence their opening and closing." The relation between the structure of stomata and their movements forms the theme proper of this interesting paper. "But as this takes for granted the occurrence of movement under certain conditions, we must first determine what these conditions are, and how, aside from the structure of the stomata, the conditions are met." Having thus shown the scope of this paper from its first paragraph, we may be content to take the convenient summary (of part of the work) which is given at the end, in the following table :—

The pore opens by—

1. A change of shape, rather than by stretching the walls, in which the change is—

(*a*) An increase in the depth of the guard cell, in which there is chiefly concerned—

The entire wall (except the dorsal)	. *Medeola* (*Equisetum*).
The inner half	. *Mnium*.
The outer half	. *Funaria*.
The dorsal half	. *Lycopodium*.
The ends	. *Osmunda*.

(*b*) An increase in the width of the slender stoma	. *Sagittaria*.
2. Stretching the thin dorsal wall .	. *Amaryllis*.

3. A change in shape, with or without much stretching, at the ends of the guard-cells which forces the dorsal wall, with the passive middle part of the cell—

Directly backward	. The *Gramineæ*.
Upward and backward . . .	. The *Coniferæ*.

4. Combinations of the types of—

Amaryllis and *Mnium* . . .	. *Helleborus*.
Amaryllis and the *Gramineæ* .	. *Achillea*.

It should be added that in the fifty-seven figures of the plate we have a valuable exposition of stomata structure.—*R. I. L.*

Decay of Timber.

Timber, The Decay of. By Hermann von Schrenk (*U.S.A. Dep. Agr., Bur. Pl. Ind. Bull.* No. 14 : 1902 ; numerous photos and figures in text).—The investigations into this subject were set on foot in consequence of the annual destruction by decay of forest timber and of timber used for construction purposes, such as railroad ties, posts, bridge timber, &c., being almost beyond computation. The treatise deals with the following matters :—After the introduction, giving the scope of the report, there follow the structure of timber, the factors which cause the decay of wood, timber preservation, results of timber impregnation, ties, poles, &c., ballast, tie-plates, fastening, methods of impregnation and creosoting. It concludes with a summary.

In the introduction the author speaks of the marvellous amount of timber consumed annually, with the corresponding drain upon the forest supply. For thirty years there has been a constant appreciation in the prices of timber in certain classes.

Timber removed from the forests decays sooner or later. By increasing the length of service of timber, not only does it become cheaper, but less is used. The object, therefore, is to increase the length of life of timber.

Longer life may be attained in two ways—by placing wood under such natural conditions that decay becomes impossible, or by preserving the wood in one way or another.

After describing the anatomical structure of timber, the factors which cause the decay of wood are considered. Though insects of various sorts can do much harm, it is fungi which cause the greatest amount of destruction in timber—bacteria and some hymenomycetous fungi being described and figured, and the process of decay by means of enzymes explained.

The next section deals with timber preservation. The first method was charring, the next was the use of preservative paints. Finally, the injection of preservative substances into the wood was adopted. The second was found ineffectual because the evaporation of water was prevented, and gave access to any fungus-spores to grow.

The materials for injection are copper sulphate ($CuSO_4$), zinc sulphate ($ZnSO_4$), zinc chloride ($ZnCl_2$), mercuric chloride ($HgCl_2$), aluminium sulphate ($Al_2(SO_4)_3$), and the products of coal-tar distillation.

The object of the salts is to prevent decay by destroying fungi, and the solution must be of a certain strength, as below a certain per cent. the fungus can begin to grow, as bacteria and other destroying agents.

The preservative must be of easy injection, and ought to remain permanently in the wood. It must penetrate all parts of the timber, and it must be cheap.

Then follow accounts of the results of timber impregnation in Texas and in Europe, with technical details and figures on the structure of railway ties, poles, &c., as well as on stacking.

With regard to the methods of impregnation, the one used in England Belgium, and France—the creosoting process—is the most costly, but at the same time the most effective in preserving the wood.

Tables show the final results as to ties which had to be removed within twelve years, according to their being seasoned or not seasoned, and treated with the various salts mentioned above. Thus zinc chloride increased the length of life of Beech, which decays the most rapidly, more than three times. After eleven years 82 per cent. of those treated with zinc chloride are still in service. Of Spruce only 49 per cent. were in service. With Pine, copper sulphate gave better results than zinc chloride, as the former had 16·5 per cent. and the latter 19·8 removal.

Other comparisons are given for timbers used in Austria. Thus unimpregnated Oak ties lasted on an average eleven years, while those treated with zinc chloride were, for the most part, still in position after twelve years, and of those treated with tar oil still more.

With regard to creosoting in England, Scotch Fir will last twenty-five or more years. The Bethell process is used, the injection resulting in a complete impregnation of the sap-wood, with a small penetration of the heart-wood. This total impregnation of that part of the wood from which decay usually starts retards the destruction of the timber for many years. Such timbers as can be wholly impregnated with creosote will never rot.

The various merits of the other salts used as injections are further discussed, as well as new processes, as the "senilisation by electric action," "emulsion treatment," &c., but they have not yet been sufficiently tried.

G. H.

Vaccination applied to Plants.

Vaccination of Vegetables. By Raymond Roger (*Rev. Hort.* pp. 340–342; July 16, 1902).—In lieu of attacking contagious plant diseases by means of disinfectant solutions or vapours with a view to the destruction of existing organic germs, it is suggested as possible to anticipate the attacks of the more destructive types of these by prior infection by less harmful ones on the antitoxin principle. It is pointed out that disinfectants of the class named are powerless where the pest has already invaded the internal tissues, and that hence the remedy is only partial, while such a remedy as the one in view would render the plants immune from such internal disintegration by weakening the force of the invading and disease-producing micro-organisms. The questions are raised, Do the parasitic micro-organisms secrete toxines in vegetable tissues as their co-generic fellows do in animals? Is the damage caused by their presence in the body of the plant due simply to the exhaustion by these foreign intruders of a part of the elementary matter destined for the plant itself, and hence causing an anæmia, or is the matter complicated by a veritable poisoning by toxines or noxious secretions of the parasite? As little evidence has been gathered on this point we can only argue by analogy, which teaches us that the success of vaccination depends in most cases on the production in the parasitic micro-organism of elements noxious to the parasite itself which render the subject immune. Observation so far tends to confirm this idea as regards plants. It is well known that the yeasts of fermented liquors, for instance, belonging to fungi of the *Saccharomyces* or *Mucor* genera sown in media rich in saccharine matter, have their vitality suspended so soon as the alcoholic contents attain a certain degree, although a large quantity of the sugar may not yet have suffered decomposition. Their activity is annihilated by the presence of the alcohol, a true toxine secreted by themselves.

More precise facts resulting from recent experiments by M. J. Beauverie permit of the assumption in other cases, not only of the production of toxines, but also of the possibility of attenuating the virulence, and thus lead up to the hope that at length vegetable pathology may benefit by Pasteurian methods of imparting immunity.

The marvellous results of his researches into the life history of the microbe of plant rot (*la toile*), *Botrytis cinerea*, by turning attention to this branch of investigation, will form beyond doubt the starting-point of a new therapeutical method as applied to vegetable diseases.

We set forth briefly the facts as presented by M. Gaston Bonnier to the Academy of Science at the meeting of July 8, 1901. According to M. J. Beauverie, *Botrytis cinerea*, or the plant-rot microbe, presents itself under three different forms, according to the conditions of the medium in which it is developed.

(*a*) Under its normal form it is saprophytic, *i.e.* it lives at the expense of organic matter in decomposition. This condition, under which it is absolutely harmless to living vegetation, is characterised by the appearance of conidia as reproductive organs.

(*b*) When *Botrytis cinerea* is developed under conditions of saturated humidity at a temperature of about 30° C. it becomes sterile, does not produce conidia, and is reduced to its purely vegetative stage of a filamentous mycelium. It is this new form which is particularly dangerous, and which in propagating houses produces the rot which causes such ravages among young seedlings and cuttings by inducing decay.

(c) Between the conidia stage and the sterile or filamentous one there is a transitional phase, an intermediate form characterised by the simultaneous presence of mycelium filaments and a very few conidia. In this condition the *Botrytis* is not quite harmless, but many plants can be affected by it without serious damage.

When the temperature is high and the air very humid this form appears rapidly in vineries accompanied by the conidial type, which produces the noble rot (*pourriture noble*). It is frequent in damp temperate houses where the atmosphere is not confined.

In a general way, according to M. Beauverie, this intermediate form is produced in a very humid atmosphere at a temperature of 15° to 20° C. If the thermometer rises to 30° C. the fungus assumes the barren filamentous form unless the substratum be rich in nutritious matter for the fungus.

It is this intermediate form which has served M. Beauverie for his immunising experiments.

He obtained it by sowing *B. cinerea* spores on sterilised soil in Petri boxes of large superficies. Maintaining these boxes at from 15° to 18° C. the development of the attenuated type of *Botrytis* was very rapid, and the soil was soon infected throughout.

The contaminated soil was placed in ordinary pots which were then filled with sowings and cuttings, especially Begonia cuttings. These plants adapted themselves rapidly to the action of the attenuated form of *Botrytis*, and being subsequently placed under conditions favourable to the development of the filamentous or rot form this was abundantly produced, but all the plants resisted its action. They were immune.

It was necessary, however, to ascertain whether this immunity was really the result of the treatment, or whether the resistance of the vegetables under trial was simply due to a reduced virulence of the rot developed under such conditions.

The counter experiment was made, the " rot " form produced during the trial was sown on the soil of plants not treated as above, and these succumbed straightway.

Doubt was no longer possible ; the immunity was certainly induced by the treatment.

It only remained now to determine a practical method of utilising the discovery for the benefit of horticulture, and this M. Beauverie indicates in a few words in the paper above cited, as presented by M. Gaston Bonnier. According to this, in order to preserve seedlings and cuttings from this form of rot it is sufficient to use soil infected by the intermediate form of *Botrytis cinerea*. To do this the soil of a temperate house sufficiently aired is sown with spores obtained from the conidial form. The intermediate type develops very speedily. The sowings are then made and cuttings are inserted in this soil, and then after a few days' growth they can be carried into warm houses and submitted to forcing, when, although the rot will develop abundantly, it will involve no serious risk to the young growths.

These experiments do not stand alone. Subsequently, in a paper read at the Academy on July 29, 1901, M. Julien Roy demonstrated the possibility of attenuating the virulence of other parasitic micro-organisms, such as the rusts and smuts of cereals &c. In another direction, according to Dr. Charron, outside the specific toxines of pathogenic microbes there are a number of other applications, organic serums or mineral saline solutions, which may modify the nutrition of the plants, and in this way produce a more or less complete immunity against contagious diseases.—*C. T. D.*

Anatomy of Viciæ.

Viciæ, Anatomy of. By Otto Streicher (*Beih. Bot. Cent.* bd. xii. ht. 3, pp. 483–538).—Herr Otto Streicher has examined 105 species belonging to the six genera of this tribe of *Leguminosæ*. Like other leguminous tribes, there are characteristic stalked hairs. Calcium oxalate occurs only in the form of large single crystals and their derivatives, or sometimes as small prisms or granules. The multicellular stalked external glands are characteristic; so also is the presence of mechanical tissue in the nerves. Tannin-idioblasts, and mucilaginous modifications in the epidermal cells, do not occur. There is no special or peculiar arrangement of the cells next the stomata. The pericycle in *Cicer* contains isolated bast fibres; in *Abrus* there is a continuous ring of sclerenchyma. Cork develops from the inner part of the primary rind in *Cicer*, but from the "rind-epidermis" in *Abrus*. The author concludes that *Abrus* differs decidedly from the other *Viciæ* in anatomical structure, and appears to doubt if it should remain in this family.—*G. F. S.-E.*

ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

Acacia arabica, on the Medical Value of. By Gaston Thierry (*Not. König. Bot. Berlin*, vol. iii. (1902), p. 197).—Gaston Thierry gives a short note recording the use of *Acacia arabica*, Willd., as a specific in dysentery.—*H. M. W.*

Acanthaceæ from Tropical Africa. By S. Le M. Moore (*Journ. Bot.* 477, pp. 305–309; 9/1902).—Description of *Petalidium Gossweileri* and *P. tomentosum*, new species, collected at Mossamedes by John Gossweiler; *P. cirrhiferum* from the Cunene-Zambesi region; *Barleria buddleioides* and *Justicia linarioides* from South-West Africa, collected by H. Baum, from specimens in the British Museum Herbarium.

G. S. B.

African Flora XXIII. By A. Engler (*Engl. Bot. Jahrb.* vol. xxxii. 1902, pp. 53–189; 13/5/1902).—Includes the following papers:—A description by R. Pilger of a new genus of Grasses, *Acritochæte*, from Mt. Kilimanjaro. The genus is allied to *Panicum*. A systematic account of the Algæ, especially those constituting the plankton, from Lake Nyassa and neighbourhood, by W. Schmidle. The collections were made by Dr. Fülleborn. A number of new forms are described, and the paper is illustrated by two plates. The description of new genera and species in the orders *Liliaceæ*, *Cruciferæ*, *Scytopetalaceæ*, *Linaceæ*, *Pedaliaceæ*, *Campanulaceæ*, *Rutaceæ*, and *Simarubaceæ*, by Engler, and *Bignoniaceæ* by E. Hallier; a description by various authors of new species from Benguella from the collections of Antunes and Dekindt; a conspectus of the species of the section *Eustrophanthus* of the genus *Strophanthus*, by E. Gilg; an account of the East African species of *Landolphia*, by Walter Busse (with plate); an account of the species of *Strychnos* collected by W. Busse in German East Africa, by E. Gilg and W. Busse; and a description of the cultivated forms of *Andropogon Sorghum* from German East Africa and Togo, by W. Busse and R. Pilger.

A. B. R.

Agaricus campestris: Germination of the Spores &c. By Margaret C. Ferguson (*U.S.A. Dep. Agri.* (*Bur. Pl. Ind.*) *Bull.* 16; 3 plates).—States that there is a large and growing consumption of Mushrooms for food in the States; and that last year about 3,000,000 lb. of canned Mushrooms were imported, as well as all the spawn used. In order that all spawn should be produced at home, and the Mushrooms grown, the production of pure spawn of high vitality is essential. To this end many difficult problems required to be solved, to which this paper is dedicated as a basis for future work, having for its object the growing of pure virgin spawn. It records what has been done as an introduction, the methods employed, followed by records of experimental study on spore germination, extremes of temperature, action of an artificial digestive fluid, effects of acids on germination, effect of light on germination, age of the spores relative to their power of germination, a new factor in germination, effect of mycelium on germination, concluding that it has been determined that "if a few spores are able to germinate under the cultural conditions, or if a bit of the mycelium of *Agaricus campestris* be introduced into the culture, the growth resulting will in either case cause or make possible the germination of nearly all the spores of the culture, provided, of course, that the other conditions are not such as to inhibit germination." This is followed by an historical review. The above to be considered as preliminary to work which must follow before the secrets are revealed.—*M. C. C.*

Agave americana. By W. Dallimore (*Garden*, No. 1,589, p. 283; 3/5/1902).—The writer calls attention to the old notion that the Giant Agave (or American Aloe, as this plant is popularly but erroneously called) flowered but once in a hundred years, which is still believed by some people, who, when told that it is a myth appear quite disappointed, and their interest in the plant is gone. To the enthusiastic gardener, however, the plant can never be without interest; for its noble appearance, large, fleshy,and bold foliage, and, when it flowers, its tall stately inflorescence, terminated with hundreds of small tubular flowers, stamp it as one of the most distinct plants in the garden.—*E. T. C.*

Agave Bakeri. By W. W. (*Garden*, No. 1,586, p. 240; 12/4/1902).—Nothing is known of the origin of this plant beyond the fact that it was purchased in 1889 at the sale of the collection of succulents formed by the late J. T. Peacock at Sudley House, Hammersmith. It belongs to the *Littæa* section of the genus, the members of which have innumerable flowers in pairs, forming a dense cylindrical subspicate inflorescence. The flower-spike is 8½ feet high. It flowered at Kew this year for the first time. Illustrated by a photograph of the plant in the Mexican House at Kew.—*E. T. C.*

Agricultural Conference in Queensland in 1902 (*Qu. Agr. Journ.* xi.; July 1902).—Reports of this conference occupy the entire July part of this journal, which cannot be satisfactorily abstracted.

M. C. C.

Agricultural Returns for 1901 [*Cd.* 1,121]. Anon. (*Journ. Bd. Agr.* vol. ix. pp. 118–120).—This paper is a review of the Parliamentary publications of the statistics collected by the Board of Agriculture of the acreage and produce of crops and the number of live stock in Great Britain in 1901, references to portions of which have already appeared in the pages of the Society's JOURNAL. It may be interesting in this connection to add that the total area of land and water in Great Britain is given as 56,786,000 acres, of which 13,000,000 represent mountain and heath-land, used for grazing stock; 2,726,000 were occupied by woods and plantations, and 32,417,000 were under cultivation. The land under the plough is shown to have fallen in Great Britain from 59 per cent. in the period 1867–71 to 49 per cent. in the period 1897–1901.

The returns of the estimated yield of crops in 1901 show that, although Wheat was stated to be nearly a bushel per acre over average, the results of the corn harvest generally were unsatisfactory. A deficiency in the Turnip crop was only partially redeemed by a good yield of Mangolds, while the Hay crop, both from clover and meadows, was unusually short. There was, however, a heavy crop of Potatos, and a large yield of Hops.
R. N.

Alaska, Suggestions to Pioneer Farmers in. By C. C. Georgeson (*U.S.A. Dep. Agr. Alaska Exp. Stn., Bull.* 1; 7 plates; 1902).—A helpful body of instructions to intending settlers in Alaska, describing all the various processes to be gone through before the farm is in a condition to produce crops. Clearing the land, draining, building silos, and fertilising are all described with a view to the scarcity of available appliances and the cost of introducing them.

Freshly cleared land in Alaska is not capable of producing a paying crop without a good deal of preliminary fertilisation, and there is a red subsoil, said to be of volcanic origin, which is almost wholly sterile in itself.—*M. L. H.*

Alkali on Citrus-trees, Effect of. By R. H. Loughridge (*U.S.A. Exp. Stn. California, Report for* 1897–8, p. 99; plates and tabs.).—The effect produced by the presence of alkali in the soil is both direct and indirect: direct in its action upon the trees through their roots, and indirect in its action upon the physical nature of the soil, and hence through the soil upon the tree. The direct action, of course, varies with the nature and amount of the alkali in the soil. Carbonate of soda is regarded as the most dangerous of the alkali salts, because of its intense alkalinity and corrosive action on the rootlets. The chief injurious effect of chloride of sodium upon plant-life is that of an antiseptic whose action seems to be in the arrested development or killing of the nitrifying organisms in the soil. Sulphate of soda is injurious when in large amounts, and its action would seem to be chiefly that of preventing osmosis of the soil solution inward into the cells of the roots. This must ultimately produce death. In many affected orchards relief can be had by bringing the soil back to its orginal tilth by proper tillage, by deep ploughing of the soil to break up the compact hardpan condition caused by the alkali. As an aid to the loosening of the soil a green-manure crop should be grown and turned under to decay and give needed humus, which is an active agent in maintaining good tilth. Alkali that has accumulated to a large extent in the soils must be removed by thorough leaching of the soil around the trees to depths of five or six feet; the leaching, of course, being done by water free from alkali. Reproductions of photographs are given showing the difference in Orange trees grown in soils containing much and little alkali, and valuable tables of the results of various analyses of soils showing the percentages of alkali at various depths.—*V. J. M.*

Algæ, Destruction of. By L. Graebener (*Die Gart.* p. 520; 2/8/1902).—The author mentions how he destroyed the Algæ in a tank where various typical aquatics—among others *Victoria regia*—grew, containing also goldfishes and young brood. Not being able to clear the pest away, he threw in the tank a little copper vitriol, which at once killed the Algæ, without injury to other plants and fishes.—*G. R.*

Algæ in the Malayan Archipelago. By A. Weber van Bosse (*Ann. Jard. Bot. Buit.* ser. ii. vol. ii. pt. ii. 1901, p. 126, with 3 plates). Preliminary notes on the results of an expedition.—*P. G.*

Almond, Late-flowering Varieties of. By G. Rossati (*Bull. R. Soc. Tosc. Ort.* ix. p. 277; September 1902).—The Almond is cultivated on a large scale in California only, although also in the States of Arizona, New Mexico, Texas, Utah, and Oregon. The Californian produce varies annually from 500,000 to 2,500,000 pounds, and the quality compares well with that of European varieties. The importation by the States from other countries depends on the success or otherwise of the Californian crops. A table is given showing the importation of the product from Italy, France, Spain, and other countries for the past five years. The liability of the tree to damage from frosts is the cause of its cultivation being confined to certain "Almond belts." From data afforded by the Experimental Station at Berkeley, Cal., the variety most resistent to frost is 'Drake's Seedling'; it is therefore not the best for quality. According to the Department of Agriculture at Washington, the best varieties for quality are 'I X L,' 'Ne Plus Ultra,' and 'Nonpareil,' which flower in February, and along with all the others mentioned in the report can be obtained from the California Nursery Company at Niles, Cal. Then follows a table compiled from the station at Berkeley, giving the times of flowering, germination and ripening, and the quantity of fruit going to make a pound for fourteen varieties grown at the sub-station of Foothill. According to Thomas Beck, a Watsonville grower, the varieties 'Commercial' and 'Languedoc' are the most resistent and productive. Mr. J. A. Sladky, another grower, recommends further the variety 'Jordan,' which originally sprang from Malaga, as resistent to frost and of excellent quality. He advises planting Bitter or Wild Almonds amongst the others, so as to facilitate fertilisation of the latter, which yield better fruit as a result of crossing. The cryptogamic disease known as "leaf-blight" seriously attacks the foliage, so as often to leave the trees quite bare in the middle of summer, for which it is necessary to syringe the trees every fortnight with a copper solution. "Red Spider" is treated in the same way.—*W. C. W.*

Aloe oligospila. By J. G. Baker (*Bot. Mag.* tab. 7834).—Nat. ord. *Liliaceæ*, tribe *Aloineæ*. Native of Abyssinia. It was raised from seed by Mr. Lynch at Cambridge. Its nearest ally is *A. obscura* of the Cape. The perianth is pale red, tipped with green, less than 1 inch in length.
G. H.

Aloe pendens. By A. Berger (*Bot. Mag.* tab. 7837).—Nat. ord. *Liliaceæ*, tribe *Aloineæ*. Native of Arabia. It bears a long raceme of pale rose-coloured flowers.—*G. H.*

American Blight or Apple Plant-louse on Roots of Apple-trees. By C. Ritter (*Zeit. f. Pflanz.* xii. 1902, pp. 7–10; pl. 1).—The life-history of *Schizoneura lanigera*, Hausm., is known. The author, however, directs attention to obscure points. In spite of many remedies the damage goes on. The occurrence of the blight on the roots causes swellings, which are shown on pl. 1, and it is suggested that the source of fresh infection of aërial parts may be the young insects developed on the roots. The paper is suggestive, but contains few original observations.—*W. G. S.*

Amphoranthus spinosus. By S. Le M. Moore (*Journ. Bot.* 477, p. 305; tab. 441; 9/1902).—Description and figure of a new monotypic genus of the sub-order *Cæsalpinieæ* from Damaraland, collected by T. G. Een, and now in the British Museum Herbarium. It is a leafless spinous shrub or undershrub, with sub-sessile fascicled axillary apetalous flowers.—*G. S. B.*

Anemone cernua. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,858).—Nat. ord. *Ranunculaceæ*, tribe *Anemoneæ*. Native of Manchuria and Japan. A tall flowering species, remarkable for the inner surface of the sepals being red-brown, the anthers yellow, and the styles blue. The flower is nearly two inches across. It flowered at Kew in 1902.—*G. H.*

Anthospermum Randii. By Spencer Le M. Moore (*Journ. Bot.* 475, p. 253; 7/1902).—Description of a new species collected by Dr. Rand at Salisbury, Rhodesia, from specimens in the National Herbarium.

G. S. B.

Apple, Black Spot, and Spraying for Fungus Diseases. By D. McAlpine (*Bull. Dep. Agr. Melb.* No. 3; 1902; with 11 plates).—After an introduction combating the theory that plant diseases are "blights" caused by the weather, it proceeds to record the earliest appearance of this disease, caused by *Fusicladium dendriticum* in Europe and Australia. This is succeeded by an enumeration of the varieties of Apple and Pear most and least affected by the disease. Then follows the symptoms and effects of the disease, with an estimate of losses caused by it. This is said to be £10 per acre, on an average, for all kinds liable or not liable to attack. Hence the total annual loss for Victoria in Apples alone is estimated at £40,000.

Afterwards follows a statement of the conditions favouring the disease, the nature of the fungus, and its life history; and it is suggested that the winter condition of the fungus is passed on fallen leaves under a new phase, that of *Venturia inæqualis* and *Venturia pyrina*, both of which have been found in Victoria. But the evidence connecting the sporidia of these sphæriaceous fungi with the spring infection is not forthcoming, and the conclusion arrived at is that the summer spores of the mould are able to survive the winter, and start to germinate afresh on the return of spring. The residue of the "Bulletin" is occupied with details of the experiments which have been made in treating the disease.

It is shown by tables that one formula for composing Bordeaux mixture has been more successful than any other, and is termed "Grant's mixture." This is said to be composed of "bluestone and lime, with some added ingredient, and made in the same way as Bordeaux." Unfortunately the "added ingredient" is not given, whether sal ammoniac, sulphate of ammonia, or common salt. It certainly is rather peculiar that the "Bulletin" of a Department of Agriculture should so strongly commend one particular form of Bordeaux mixture—and retain as a secret the third ingredient—and give no clue to its composition.—*M. C. C.*

Apples, Cause of Failure in trees. By E. Walker (*U.S.A. Exp. Stn. Arkansas, Bull.* 71, 1902; 16 figs.).—This bulletin points out the various causes of death among the Apple-trees in the orchards of Arkansas:—(1) Unsuitable soil, especially insufficient drainage or depth of soil; (2) Planting too closely—from 25 feet to 30 feet apart is recommended; (3) Neglect of trees when young; (4) Planting of diseased stock, trees attacked by woolly aphis or "crown-gall," the latter being due to the presence in the roots of a slime fungus (*Dendrophagus globosus*); (5) Planting of poor stock; (6) Sun-scald on exposed trees, caused by the direct rays of the sun falling upon the frozen trunks in winter; (7) Insufficient cultivation of the soil; (8) The Apple "rust" caused by one of the *Uredineæ*, e.g. *Roestelia pirata*, having its teleutospore stage on *Juniperus virginiana*, forming the fungus known as *Gymnosporangium macropum*, Lk.; (9) Borers: the beetles *Chrysobothris femorata* and *Saperda candida* are noted as the two worst; (10) Fruit-tree bark beetle (*Scolytus rugulosus*); (11) Bad and untimely pruning; (12) Over-bearing; (13) Root-rot caused by the fungi *Clytocybe parasitica* and *Armillaria mellia*, which live on decaying wood, invading the roots of Apple and other trees growing near their habitat.—*F. J. C.*

Apple Diseases, Systematic Prevention of. By H. E. Summers, State Entomologist (*U.S.A. Hort. Soc. Iowa*, 1901, pp. 49–58).—The writer estimates that fully one-fourth or one-third of the value of the Apple crop is annually lost in Iowa from preventable injuries of insects and fungus diseases. Continual foresight is necessary, and should begin with the choice of nursery from which young trees are purchased. Each tree should be examined before planting in order to make sure that no sign of disease is present. In particular it should be seen that the *roots* are free from—(1) woolly aphis (*Schizoneura lanigera*), (2) brown gall, (3) nematode worms. These three principally affect roots, and may be readily recognised by the nodular swellings that they produce upon the roots. For the woolly aphis a thorough fumigation with hydrocyanic acid is recommended.

The entire bark of the tree should also be examined in search of any trace of a scale insect—*e.g.* (1) San José Scale, (2) Oyster-shell Scale, (3) Scurfy Scale. The following description is given of these three:—San José Scale (*Aspidiotus perniciosus*), round, gray, with reddish centre; different sizes ranging from $\frac{1}{20}$ inch in diameter. Oyster-shell Scale (*Mytilaspis pomorum*), oval, smaller at one end, dark gray or blackish, with well-defined margin, about $\frac{1}{8}$ inch in length. Scurfy Scale (*Chionaspis furfureus*), round, white shading to a dirty grayish-white when old, margins poorly defined, about $\frac{1}{10}$ inch in diameter.

The preventive treatment of borers is best accomplished by coating the trunks of the trees with some application which deters the adult insect from depositing its eggs thereon.

The worming of trees is also referred to, but spraying is particularly recommended. The writer advocates as many as five sprayings with copper sulphate, Bordeaux and arsenite, and gives full directions as to same.—*V. J. M.*

Apple-trees Injured by "Palmer-worm." By E. V. Lowe (*U.S.A. Exp. Stn. N. York, Bull.* 212; 4/1902; pp. 16–22; pl. 5–7).—The caterpillar of *Ypsolopus pometellus*, Harr., caused extensive damage to Apple-trees by eating the softer parts of leaves and gnawing the fruit. Spraying with arsenical poisons was recommended.—*F. J. C.*

Apples, Descriptions of Varieties. By W. K. Wonders (*U.S.A. Hort. Soc. Rep., Michigan,* 1902, pp. 116–118).—Advocates the addition of description of flower—colour before and after opening, shape of petals, average length and width, average length of claw, average length of styles and stigmas, length of external and internal pedicels, average number of flowers in an inflorescence, average diameter of flower, number of stamens, and texture of petals—in the descriptions of varieties of Apples, but finds that the flowers in any variety of Pear vary too much to be used in classification.—*F. J. C.*

Aristolochia pontica. By C. Sprenger (*Gard. Chron.* No. 804, p. 333; fig. 113; May 24, 1902).—This fine species is a native of Batoum, where it grows vigorously in shady woods. The flowers are much curved, and vary in colour from olive-green to pure purple, and have a powerful scent. At Naples it is cultivated in the open ground near a wall in the deepest shade, and it is expected will soon become a favourite with amateurs.—*G. S. S.*

Arnica montana. Anon. (*Journ. Hort.* p. 185; August 21, 1902) An illustration of this handsome yellow composite from the Alps is given, with a description on p. 171. It is a durable perennial, requiring no attention.—*C. W. D.*

Asclepias Randii. By Spencer Le M. Moore (*Journ. Bot.* 475, p. 255; 7/1902).—Description of a new species resembling *A. gibba*, collected at Salisbury, Rhodesia, with an enumeration of other species, from Dr. Rand's specimens in the National Herbarium.—*G. S. B.*

Asparagus Sprengeri (*Rev. Hort.* p. 351; August 1, 1902).—M. Ch. Grosdemange of Soissons reports beautiful effect by planting out in May in half shady position, when it flowers abundantly and elegantly in July.—*C. T. D.*

Asters Injured by May-bug. By E. V. Lowe (*U.S.A. Exp. Stn. N. York, Bull.* 212; 4/1902; pl. 8).—Extensive damage was done by the grub of this beetle (*Lachnosterna fusca*, Fröh.), which caused the wilting of the young plants by nibbling the roots. The plants were pulled up and the grubs destroyed.—*F. J. C.*

Astilbe chinensis var. **Davidii** (*Garden*, p. 179; 13/9/1902).—A note and illustration about this beautiful new *Astilbe*, which is fully 6 feet high, with tall pyramidal spikes of rose-purple flowers. It is one of the most handsome perennials introduced of recent years, and is one of Mr. Wilson's finds in China. It was introduced by Messrs. J. Veitch & Sons.—*E. T. C.*

Astilbe, The Genus. By A. Henry (*Gard. Chron.* No. 815, p. 95, fig. 34, Aug. 9; p. 154, Aug. 30; p. 171, Sept. 6, 1902).—The first part of a paper on this genus deals with only one species, *Astilbe chinensis* and its varieties, of which the most notable is *Davidii*, which is quite new in cultivation, having recently been sent home by one of Messrs. Veitch's collectors from Central China, and attracted much attention when exhibited at the Royal Horticultural Society's meeting at the Drill Hall on August 5. It is a perfectly hardy plant in this country, and attains the height of 6 feet. It bears a panicle of flowers 2 feet in length, of a beautiful violet-purple colour; the petals are bluish violet, the calyx pink. The stamens are violet, and the anthers blue.

In the second part of the article on this genus the affinities and nature of this genus are given, and the ten species which it contains described. A list is given of synonyms and various species which, according to the author, have wrongly been included in this genus. The third and con cluding part of this paper describes another species (the eleventh) recently discovered in Japan.—*G. S. S.*

Astragaleæ, Three new. By E. Ulbrich (*Not. König]. Bot. Berl.* vol. iii. (1902), p. 192).—Ulbrich describes three new species of *Astragaleæ*, viz. *A. erythrostachys*, Ulbr., from Mexico; *Oxytropis leucocephala*, Ulbr., from Central Asia; and *O. Holdereri*, Ulbr., from N.E. Thibet.

H. M. W.

Bamboos, Hardy. By W. J. Bean (*Garden*, No. 1,600, p. 44; 19/7/1902).—A valuable article, giving the names of the most beautiful and hardy Bamboos, with instructions as to soil, position, &c.—*E. T. C.*

Banana Anthracnose. "Sur le Mode de Développement du Champignon du 'Noir des Bananes.'" Par M. le Dr. G. Delacroix (*Bull. Soc. Myc. Fr.* xviii. p. 285; 1902; with fig.).—A detailed description of the development of the conidia of *Glœosporium musarum* (Cooke and Massee) on fruits of Banana in France and Algeria. The conidia are considered to vary very much in their dimensions according to their maturity between 10–12 × 4 μ (Cooke), 16–18 × 4 μ (Stoneman), and 21–23 × 8 μ (Delacroix). On germination there is the appearance of a central septum and the production of a germinating filament, at the extremity of which one or more polyhedric chlamydospores are developed, with a thick and slightly coloured membrane, 7–7½ μ diam. (fig. on p. 286).—*M. C. C.*

Banana, Disease of. By Dr. Axel Preyer, including a report by Dr. Looss and G. P. Foaden (*Bull. Bot. Dep. Jam.* ix., pt. 7, p. 100) The disease is due to the presence of nematodes (*Tylenchus*) and occurs near Alexandria, where no results have followed experiments. Gas-lime is suggested for proposed experiments. (See R.H.S. JOURNAL, vol. xxvi. p. ccxxii; also p. 844.)—*G. H.*

Bean, Velvet. By H. K. Miller (*U.S.A. Exp. Stn. Florida, Bull.* 60; January 1902).—This work deals entirely with the Velvet Bean *Mucuna utilis*, which is apparently a coming plant for culture in this State. As a member of the natural order *Leguminosæ*, it possesses the power of enriching the soil in nitrogen, acting in the same manner as our own Clovers, and, being of free growth, may be looked upon as a valuable means of renovating the soil from the free nitrogen of the atmosphere. It is also an excellent forage plant, on which stock seem to thrive well after it is made into hay in the usual manner. It can also be used as green pasturage, and in addition gives capital cover. An analysis is also appended showing the value of the Bean itself as an article of food. Five plates are given illustrating the seeds, leaf, and flower, the root nodules, and a field of the Bean in full growth.—*E. F. H.*

Bee Flowers of the West Indies. A list of. Extract from "Bee-keeping in the West Indies" (*Bull. Bot. Dep. Trin.* No. 33, p. 429; April 1902).—*E. A. B.*

Beet Army-worm (*Laphygma exigua*, Hbn.). By F. H. Chittenden (*U.S.A. Dep. Agr., Div. of Entom., Bull.* 33, pp. 37–46.)—This insect, which is identical with the British *Caradrina* (*Spodoptera*) *exigua*, Hbn., is described, and the serious injury which it does to both garden and sugar Beets by eating off not only the leaves but the crown of the root as well is noted. The caterpillar feeds also on *Chenopodium album*, *Amaranthus*, *Atriplex*, Corn, Potato, Pea, Onion, Sunflower, leaves of Apple, Mallow, *Nicotiana glauca*, *Cleome*, and Plantain. A single natural enemy, a Tachine fly (*Frontina archippivora*, Will.), is known in America. Spraying with kerosene emulsion or Paris green seem the most effectual remedies.—*F. J. C.*

Beet Sugar in England, The Growth of. By A. D. Hall (*Journ. S.E. Agr. Coll. Wye*, No. 10, pp. 3–15; February 1901).—Gives the following conclusions: "In dry and warm seasons Sugar Beet may be grown in England of average quality, on land suited to the cultivation of Mangolds, &c. At the present price of sugar, no factory could afford to pay for Sugar Beet a price that would be remunerative to the farmer."

Further trials in the use of Sugar Beet as fodder conclusively prove that it cannot profitably replace Mangolds.

Manurial experiments upon Hops show that on the typical Hop lands of East Kent, or the "Rag" soil of Mid Kent, general manuring is required, but on clay and sandy soils, &c., specific treatment is needed, as, for instance, phosphates for Marden, potash for Frant, and lime for Farnham soil.—*J. C. E. K.*

Beet-Sugar Industry in the United States, Progress of the. By C. F. Saylor and B. T. Galloway (*U.S.A. Dep. Agr. Report* 72; illustrated).—An exhaustive pamphlet, of which the first part concerns the operations of the various Beet-sugar factories in the United States, and the proper methods of growing Beet; while the second part deals with the insect enemies and fungous diseases attacking Sugar-beet, with the remedies to be applied.

This latter part also contains a report on the production of Sugar-beet *seed*.

This industry is not yet fully developed in the States, but shows every prospect of rapidly increasing. The present tonnage of 9·6 per acre would be increased by thorough cultivation, proper crop rotation, and by fertilising where necessary.

At present, what the Beet-growing industry lacks is a proper disposal of its by-products.

In most European countries (Germany especially) the pulp has been found to be a valuable food for domestic animals.

When Beet cultivation was begun in Utah it was found necessary to adopt a system of irrigation, which, with no possibility of obtaining data from other countries with regard to this particular crop, has proved completely successful, and opens up new prospects for agriculture and the people of the arid regions generally.

The States hope eventually to produce enough sugar for their own consumption (as Spain, Italy, the Balkan States, and even Egypt do now), and are striving to emulate the example of Germany, where, in 1878, the sugar content of the Beet averaged 9·24 per cent., and in 1898 it was 13·15 per cent., owing to gradual improvement.

The cost per acre to produce Sugar-beets and market them is about $30 where rain is plentiful. This does not include the rent of the land. Where irrigation is necessary the cost is about $40 per acre.

Besides the question of by-products, the incidental benefits resulting from the growing of Sugar Beets must be taken into consideration.

The high cultivation given to the land through deep ploughing, thorough harrowing, and constant weeding, finally makes the land of superior quality for any purpose (Wheat, Corn, or any other crop).

Both in Europe and in America, owing to the immense importance of good quality, a farm superintendent is attached to certain farms on behalf of the factory that is to take their Beets. He is a trained agriculturist and thoroughly scientific. The employment of such an official has been found to be a very necessary precaution, as the cultivation of the Beet is beset with difficulties, and the success of the growers means everything to the factories. The comparatively recent introduction of the industry, and the dislike of the conservative farming class to innovation, render the superintendent's advice, guidance, and directions very valuable.

Amongst by-products, the pulp is estimated by the author as second in value only to the chief product—sugar. It is a most valuable feeding-stuff for cattle, but as yet is little appreciated by stockmen and cattle-raisers. It can either be fed fresh or pressed and made into cakes, which sell at $2 per cwt. In one case, at Waverly, 300 head of three- and four-year-olds consumed about 100 lbs. of pulp per day, in addition to hay, and were putting on over 3 lbs. of flesh a day.

Beet leaves, with a portion of the crown, are a valuable forage, but should preferably be fed on the ground or ploughed under as green manure, for if carted away fertilisers will be required to take their place.

Syrup manufacture comes next on the list. It is much used in making jams of different fruits.

The molasses resulting from the Beet-sugar industry is unpalatable in its raw state, owing to the condensed salts which are extracted along with with the sugar; refining is necessary before it can be used, and even then it has an acrid taste. It is worked up into shoe-blacking, vinegar, and alcohol, but the greater part is mixed with the pulp or the leaves, for feeding purposes, or as a fertiliser.

The establishment of a sugar factory is important from many points of view. It disposes of the Beets; it employs capital, also labour. Much coal is consumed (about 17 per cent. by weight) or else other fuel, such as petroleum or wood, and a large amount of lime rock is required (about 10 per cent.).

The necessary supply of labour for the various operations of bunching, thinning, hoeing, harvesting, &c., has sometimes been difficult to obtain. It is now being met, in many cases, by the emigration from towns to the fields, at certain seasons, of adults and boys, many of whom are foreigners already well versed in the industry.

At present most of the seed used is imported from Europe (largely from Germany). It is supplied by the factory, and costs the farmer about $3 per acre (at the rate of 20 lbs.).

Some of the factories are beginning to produce their own seed.

It has been found that in different States Beet does best after different crops, in one after corn, in another after alfalfa.

The subject of irrigation is being seriously considered, for Beet has shown a remarkable adaptability for growth under these conditions and at present much water, from excessive rainfall and from melting snows, is wasted.

The best methods for combating insect pests (so far not numerous) and fungous diseases have yet to be discovered, the crops at present being practically at their mercy when attacks occur.

The above considerations come chiefly within the province of the grower.

The manufacturer is also confronted with problems, which are perhaps less easy to solve.

Water-supply, fuel, the market for the products, transportation, the supply of lime, skilled labour, all have to be thought of and provided for.

Public opinion and the influence of the press have much to do with the success of the Beet-growing industry. There is a certain prejudice against Beet sugar at present, which time will remove, for experts have decided that properly-made Beet sugar is not inferior to cane-sugar.

The Report is profusely illustrated; it contains numbers of statistical tables of much interest, and it should do much to increase the popularity of this important industry.—*C. H. C.*

Begonia angularis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7842).—Nat. ord. *Begoniaceæ.* Native of Brazil. A magnificent species, of shrubby habit, growing 8 feet high. Flowers freely at Kew throughout the year. The leaves are 6–8 inches long, very dark green. Flowers in large panicles, white, $\frac{2}{3}$ in. diam.—*G. H.*

Begonia Mite. By A. D. Michael (*Gard. Chron.* No. 806, p. 376; June 7, 1902).—This pest does not confine its attentions only to Begonias, although they are the chief sufferers. It belongs to the genus *Tarsonemus*, and is probably *T. floricolus*; but these mites are difficult to identify. They usually feed on the undersides of the leaves, when they may be destroyed by paraffin emulsion, sulphur, soap, &c. But they often burrow into the leaves and feed upon the parenchyma. In this position no external application of insecticides is of any use, and the affected plant had better be burnt. They are extremely small, and for that reason often escape detection, and were not noticed until a few years ago.

G. S. S.

Begonias, Lemoine's New; B. Buisson rose and B. Perle Lorraine, By L. Wittmack (*Gartenflora*, p. 291; 2 figs.; 1/6/02).—B. Buisson rose is a cross between *B. gracilis* var. *diversifolia*, flowering ordinarily during summer, and the winter-blooming *B. polyantha*. The rose-carmine flowers are produced from August to January.

Begonia Perle Lorraine originated from *B. polyantha* crossed with the winter-flowering *B. dædalea*. It blossoms from January to April; flowers white or pale rose.—*J. P.*

Berberis dictyophylla. By Sir J. D. Hooker (*Bot. Mag.* tab. 7833).—Nat. ord. *Berberideæ*, tribe *Berbereæ*. Native of Yunnan. It has very small leaves, single yellow flowers nearly $\frac{1}{2}$ inch in diameter, and elliptical crimson berries. It flowered at Kew in 1901, ripening its fruit in September.—*G. H.*

Bignonias. By W. Dallimore (*Garden*, No. 1,596, p. 412; 21/6/1902).—A description of "the best species in cultivation, together with a few belonging to other genera, which are in gardens usually spoken of as Bignonias." Cultural directions are given.—*E. T. C.*

Bitter-rot of Apples. By J. T. Burrill and J. C. Blair (*U.S.A. Exp. Stn. Illinois, Bull.* 77; July 1902; 12 figs.).—The authors supply the additional information regarding this rot (see *Journ. R.H.S.* xxvii. pp. 227, 281, 287) that, besides spreading from "mummy" Apples remaining on the trees, the disease is carried over the winter on the branches where a "canker" spot, where perithecia similar to those on "mummy" Apples were produced, was found, in many cases just above the infected Apples. Spores from these spots produced the characteristic rot on the fruit in four days, and each spot formed the apex of a conical area of infection. This canker is totally distinct from that caused by *Nummularia discreta*, Tul. (*U.S.A. Exp. Stn. Illinois, Bull.* 70), which usually attacks the trunk and larger branches, generally appearing on branches from one inch to a half-inch in diameter.

Infected limbs and fruit should be removed from the orchards, taking care not to scatter the spores during the removal, and burnt; Bordeaux mixture sprayed on the fruits is a means of holding the disease absolutely in check.—*F. J. C.*

Bougainvillæa spectabilis var. **lateritia** (*Bull. Bot. Dep. Trin.* No. 32, p. 409; January 1902).—Records the production of flowers, identical in every way with those of the typical form, by a seedling raised from this, the brick-red-flowered variety.—*E. A. B.*

Broom, Common, Varieties of the. By W. Goldring (*Garden*, No. 1,590, p. 299 ; 10/5/1902).—Description of the four varieties, with an illustration of the "Moonlight Broom" (*Cytisus scoparius* var. *pallidus*). This shrub, beautiful as it is and brighter than any other native flower, by its abundance as a wildling in some places, is seldom considered worthy of cultivation in the sense that it should be in a garden. Yet no shrub produces such a glowing effect of rich yellow, and is so valuable to the planter in districts where it is not abundant in a wild state. People often ask how Brooms are to be pruned when the plants get "leggy," as in a few years they do. The answer is that nothing can be done to make dwarf bushy plants from "leggy" plants. The better plan is to start afresh with new plants, as "leggy" ones, if cut hard back to the old wood, do not break afresh in a satisfactory way. The pruning of Brooms must be continually carried out while the plants are still dwarf, and the cutting away of straggling branches must take place so as to leave vigorous green-barked growth below the cut-away parts. By doing this, shapely bushes may be kept for years.—*E. T C.*

Bryophyllum crenatum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,856).—Nat. ord. *Crassulaceæ*. Native of Central Madagascar. A plant at Kew is now 5 feet high. Flowers orange-red.—*G. H.*

Bulb Mite. By G. Abbey (*Journ. Hort.* p. 272 ; September 18, 1902).—An illustration of a bulb attacked by the mite is given. Soft soap and paraffin or fir-tree oil are recommended as the best remedies.
C. W. D.

Burmannia Dalzieli. By A. B. Rendle (*Journ. Bot.* 477, p. 311 ; tab. 441 ; 9/1902).—Description of a new species resembling *B. tuberosa*, a Malayan species, found by Mr. John M. Dalziel ; parasitic on roots in damp woods in China, from specimens in the British Museum Herbarium.
G. S. B.

Byblis gigantea Lindl. By Dr. Hermann Ross (*Gartenflora*, p. 337 ; pl. 1500 ; 1/7/02).—Plate and description of this Australian insectivorous plant belonging to the *Lentibulariaceæ*.—*J. P.*

Byblis gigantea. By Sir J. D. Hooker (*Bot. Mag.* tab. 7846).—Nat. ord. (?). Native of West Australia. Leaves 6–12 inches long, very narrowly linear, terete. Flowers solitary, red-purple, nearly $1\frac{1}{2}$ inch in diameter. Whole plant covered with glandular hairs.—*G. H.*

Calanthe Masuca var. **sinensis.** By A. B. Rendle (*Journ. Bot.* 477, p. 310 ; 9/1902).—Description of a new variety, collected in China by Mr. John M. Dalziel, of an Orchid described by Lindley from India and Java, growing in wet woods at an altitude of 2,000 feet, from a specimen in the British Museum Herbarium.—*G. S. B.*

Calla, A New (*Rev. Hort.* p. 374; August 16, 1902).—*C. Elliottiana* × *C. albo-maculata*, raised by Mr. J. Tailby, Wellesley, Mass. More floriferous than either parent; spathes primrose-yellow; foliage white spotted. Very robust and easy of culture; planted out end of May, it flowers until the frosts; the tubers are then lifted, dried, and stored like Potatos. Comes quite true from seed sown in the open in April.

C. T. D.

Calla, New Yellow (E. O. Orpet in *Amer. Gard.* xxiii. p. 463, fig. 101; 19/7/1902).—The result of crossing *Richardia* (*Calla*) *Elliottiana* with *R. albo-maculata*. It was raised by Mr. J. Tailby, of Wellesley, Mass. Foliage vigorous and prettily spotted; spathes primrose-yellow, produced in great profusion; altogether a marked improvement on both parents. The cross is said to have reproduced itself true to seed from the first.—*C. C. H.*

Californian Fruit-growing. By C. H. Shinn (*U.S.A. Exp. Stn. California, Bull.* 141; June 1902; 18 figs.).—An account of experiments with deciduous fruit-trees at Paso Robles, near the Southern Coast Range Sub-station. The report, which points out the best fruits for growing in the district, has, among others, some interesting illustrations of root-systems of Almond, Apricot, and Olive trees.—*F. J. C.*

Calochorti and their Culture. By G. B. Mallett (*Garden*, No. 1,585, p. 220; 5/4/1902).—Deals with the unclassed species.

E. T. C.

Camassias. By George B. Mallett (*Garden*, No. 1,603, p. 94; 9/2/1902).—The value of Camassias for grouping in the border, shrubbery, and woodland, or in any situation where it is desirable that the plants should be able to take care of themselves and thrive, is slowly but surely gaining recognition, despite the drawback of a singularly confused nomenclature, and the dearth of authoritative information about them. The genus contains five well-marked species, of which very full descriptions are given.—*E. T. C.*

Cameroons, Economic Plants in the (*Not. König. Bot. Berlin*, vol. iii. (1902), p. 198).—Preuss writes an account of the culture of economic plants introduced from the Central Botanic Station in Berlin into the Botanic Garden at Victoria, Cameroons. The paper refers to Cacao, Cola, Coffee, Tea, Sugar-cane, Vanilla, Cinnamon, Nutmeg, Cardamoms, Pimenta, Pepper, Ginger, and species of *Garcinia*, *Anona*, *Papaya*, *Cinchona*, *Quassia*, *Smilax*, &c. The list of India-rubber plants includes species of *Castilloa*, *Sapium*, *Mascarenhasia*, *Hevea*, *Ficus*, *Forsteronia*, *Cryptostegia*, and two unknown species of *Apocynaceæ* and *Asclepediaceæ*. As Gutta-percha plants species of *Mimusops*, *Tabernæmontana*, and *Galactrodendron* are enumerated. The plants are grouped under headings denoting their uses, *e.g.*, fibre-plants, shade-trees, food-plants, medicines, &c., and some interesting short notes are appended, though the list embraces chiefly such as are well known in our colonial gardens.—*H. M. W.*

Canker in Apple-trees. By H. Hasselbring, B.S. (*U.S.A. Exp. Stn. Illinois, Bull.* 70; 4/1902; 4 plates).—In America "canker" includes all diseases involving more or less extended areas of the bark. Mention is made of the cankers caused by *Nectria ditissima*, by *Sphæropsis Malorum*, Peck, and by *Glœosporium malicorticis*, Cordley; but the most serious bark disease in Illinois at present is caused by *Nummularia discreta*, Tul., which appears usually to be a saprophytic fungus. In Illinois it has assumed the character of a wound parasite, the mycelium finally growing into the wood and causing the death of the branch. If found in its first stages, the diseased portion should be cut away and the wound covered with Bordeaux mixture or paint. All diseased branches should be removed and burnt. The fungus is described and figured (see also Tulasne in "Sel. Fung. Carp." ii. plate v.)
F. J. C.

Canker in Fruit-trees, Cure of. By G. D. Huet (*Rev. Hort.* p. 212; May 1, 1902).—Has succeeded in curing this by removing the rough surface or knots infested and brushing over the bared surfaces with undiluted hydrochloric acid, *i.e.* the common spirits of salts of commerce. Care as regards clothes and flesh is naturally recommended in using such a corrosive, which, however, while destroying the fungus leaves the tree unharmed.—*C. T. D.*

Canker-fungus on Pinus excelsa. By A. C. Forbes (*Gard. Chron.* No. 817, p. 135; Aug. 23, 1902).—This fungus known as *Dasyscypha resinaria*, is a well-known fungus in the United States, it has now been found attacking specimens of *Pinus excelsa*. It is said that the branches in the early stages of the attack exhibit gouty swellings under the bark, upon which the "cup-shaped fructification appears later on." The blisters much resemble the Larch blisters, which are caused by a very nearly allied fungus. On badly attacked branches the blisters occur at intervals of two or three inches; the exudation of resin from the affected parts congeals in large masses, and later on completely covers the tree by flowing down its entire length. Cutting down and burning the infested trees seems to be the only practical way of dealing with this pest.—*G. S. S.*

Canker, Larch and Spruce (*Dasyscypha calycina*, Fuckel, and *D. resinaria*, Rehm). By Geo. Massee (*Journ. Bd. Agr.* vol. ix. pp. 176–188; pls. i.–iii.).—This very valuable article on these destructive diseases is the outcome of observations and experiments extending over a period of sixteen years, and conducted in various parts of England from Yorkshire to Hampshire.

In this country *D. calycina* has also been found on *Pinus sylvestris*, L., and *Abies pectinata*, DC. In Southern Europe it has been found on the *Pinus Pumilio*, Haenke, and in the United States on *Abies balsamea*, Miller. It has been proved by researches to be a wound-parasite; "in other words, it cannot gain entrance into the tissues of a living tree except through a wound."

D. resinaria is apparently more local in its distribution in this country, and is recorded from Shropshire, Yorkshire, Surrey, and Hants. It has been most frequently met with on *Picea excelsa*, Link, but is also not uncommon on *Larix europæa*, DC., and has recently been found in Wiltshire on *Pinus excelsa*, Wall. It is said also to occur either alone or in company with *D. calycina*.

In his summary, the author states :—" The Larch is most susceptible to canker when quite young, and as the fungus spores in the majority of instances gain an entrance to the living tissues through injuries caused by the Larch aphis (*Chermes laricis*, Hedwig), it follows that seedlings and young trees should be protected against this pest. This can be accomplished by spraying in the spring with paraffin emulsion, prepared as follows :—Dissolve half a pound of soft soap in two gallons of hot water, then add two gallons of paraffin, and mix thoroughly until the ingredients do not separate on standing. One gallon of the emulsion thus prepared should be diluted with fourteen gallons of water, when it is ready for use."

" Recent investigations tend to show that the Spruce-gall aphis (*Chermes abietis*, L.) and the Larch aphis (*Chermes laricis*) are alternating stages of one species. The sexual generation occurs only on the Spruce, the agamic generations, consisting entirely of females, then migrating to the Larch. Under the circumstances, a mixture of Spruce and Larch is not to be recommended, as it furnishes the aphis with its two necessary host-plants.

" As a safeguard against inoculation taking place through bark fissures caused by late frosts, it is advisable not to form seed-beds nor to plant Larch in low-lying, damp localities, where not only are the plants most exposed to frost, but such situations also favour the presence of aphis.

" In the case of larger trees there is no cure. If the trunk is not seriously injured the tree may continue to grow and make wood for many years after being cankered. However, it is very important to remember that the toleration of canker-bearing ascophores is a serious menace to surrounding trees. As the spore is the only known means of transmitting the disease from one tree to another in a state of nature, therefore, when ever practicable, all canker wounds should be cut away, and the removed portions burnt. Protect the cut surface with a coating of gas-tar."

The author also gives details of his experiments with the fungi, and the work is embellished with beautiful coloured and plain figures representing the disease in its various phases.—*R. N.*

Cantaloupe Blight. By H. H. Griffin (*U.S.A. Exp. Stn. Colorado, Press Bull.* No. 4 ; June 1900).—A fungus, *Macrosporium cucumerium*, Ellis & Everh, attacks the leaves of Cantaloupes, causing a number of brown spots to appear on the leaves ; these spread until the whole leaf is destroyed. The result of the attack is to cause the fruit to ripen prematurely and to become insipid. Spraying with Bordeaux mixture (6 lbs. copper sulphate, 4 lbs. fresh lime, 40 galls. water), and ammoniacal copper carbonate were both tried, and the Bordeaux mixture was found to be most satisfactory. The spray checked the progress of the disease and, by prolonging the life of the plant, enabled the fruit to develop properly.

F. J. C.

Carnations from Seed. By W. A. Watts (*Garden*, p. 211; 27/9/1902).—An article showing the valuable experience of an amateur in Carnation-growing. The following note is interesting:—"This raising of plants from seed may seem a long process, but patience is everything in gardening, and the reward will come when you see your plants showing a mass of buds, and you eagerly scan them every morning and criticise the flowers as they open. Now, one word of warning—you must not expect too much; there will be many that are not worth keeping, owing to the flowers being badly formed, and there will be a certain percentage of singles; but amongst the rest there should be, if the seed has been good, a nice lot of plants that you can layer for producing plants to bloom the next season, and these layers you will find are mostly stronger, and naturally more likely to suit your climate and soil, than plants you can procure elsewhere."—*E. T. C.*

Carrot Fly. By F. H. Chittenden (*U.S.A. Dep. Agr.*, *Div. of Entom.*, *Bull.* 33, pp. 26–32; one figure).—This well-known insect (*Psila rosæ*, Fab.) is fully described and the injuries done to the Carrot noted. As means of controlling the attacks the following are recommended:—(1) kerosene emulsion (one part to ten of water) sprayed along the rows weekly, from the time the roots begin to form and especially after thinning, until the end of June; (2) late sowing; (3) rotation of crops; (4) destruction of insects in stored crops.

The fly is reported to have attacked Celery as well as Carrot, a fact which must taken into account in planning rotations.—*F. J. C.*

Cassava, Report on. By R. Thomson (*Bull. Bot. Dep. Jam.* ix., Pt. 6, p. 81, and Pt. 7, p. 97).—Deals with culture, expenses, chemical analysis (72 per cent. being starch of dry root and 3 per cent. sugar), and comparisons with other roots and the manufacture of starch sugar. Cassava, its cultivation in Florida and advantages in Jamaica.—*G. H.*

Cattleya hybrida picta. (A. Péricat in *Amer. Gard.* xxiii. pp. 306, 307, fig. 70; 10/5/1902).—It is interesting to know that this plant is still in the land of the living, as it has been "lost to sight" for many years, though it has always been "to memory dear" as the first hybrid *Cattleya* raised by hand. It was raised by Dominy as far back as 1859, and was probably a hybrid between *C. guttata* and *C. Loddigesii.* Its sepals and petals are light green, spotted with purple; petals margined with rose; lip violet-purple, with white margin and yellow throat. It is now in the collection of Mrs. G. B. Wilson, of Philadelphia.—*C. C. H.*

Cattleya × Leucothoe (E. O. Orpet in *Amer. Gard.* xxiii. p. 513; 9/8/1902).—A new hybrid raised at S. Lancaster, Mass., out of *C. granulosa* by *C. Walkeriana.* Flowers light rosy-lilac, dotted with crimson; lip crimson, with white lines.—*C. C. H.*

Cattleya × Nepthys (E. O. Orpet in *Amer. Gard.* xxiii. p. 483, 26/7/1902).—A new hybrid raised at S. Lancaster, Mass., between *C. granulosa Schofieldiana* ♀ and *C. superba*, the former being dominant in the flowers and the latter in the habit of growth. Flowers yellow, shaded with crimson.—*C. C. H.*

Cattleya Roezlii. By R. A. R. (*Orch. Rev.* p. 222; July 1902).—Interesting particulars of this Orchid as to its origin, and possibilities of being a natural hybrid, are given.—*H. J. C.*

Celery Culture. By W. R. Beattie (*U.S.A. Dep. Agr. Farm. Bull.* 148, illustrated).—Celery is much grown in the Northern and Eastern States, and supplies the market from early June till January 1, that from Florida and California being ready from December until March or April. This paper, however, is chiefly devoted to the production of Celery for home use, growing and storing in small quantities, also to assist beginners who wish to grow for commerce. Celery seems to prefer a rich mellow sandy loam, but even clay is better than the peat bogs which abound in some regions. Sowing and transplanting are carried out in the same way as practised in all gardens; but, as Celery is apt to suffer from drought many systems of watering have been tried, amongst others the "deluge sprinkler," which, involving a system of pipes, is costly to install, and interferes with cultivation; another, a sprinkler travelling on wires which has attained fair success; and sub-irrigation, which is not satisfactory, owing to the warmth induced in the sub soil by the current of air following the water.

The simplest and best, where the surface of the soil is even, is to run water along the rows by means of small furrows. Mulching is, of course, recommended, as obviating the necessity of much watering.

Blanching, for early use, can be done either by banking up with earth (which imparts the best flavour) or by the use of boards, drain-tiles, paper-wrappings (not recommended) &c.

For winter use it is better not to blanch at all, as the Celery keeps longer unblanched. and this process takes place naturally when stored, in trenches, pits, or otherwise. But on the whole, except by growers who wish to control and supply a special trade, it is found unprofitable to store for late keeping. Diseases, marketing, profits, and varieties are also dealt with.—*C. H. C.*

Chayote: a Tropical Vegetable. By O. F. Cook (*U.S.A. Dep Agr. Div. Bot. Bull.* No. 28).—Belongs to the Gourd family, and suggests the Cucumber more than any other of the cultivated plants of the same family. The leaves are concave, of a deep, fresh green, with a rough surface. The fruit is pear-shaped. There are several varieties. It is known throughout tropical America, has long been established in Madeira, also in gardens in Southern Europe and North Africa. In Australia, where it has been introduced, it bids fair to become of recognised commercial importance. The Chayote (*Sechium edule*) thrives best in a loose sandy or loamy soil; its other requirements are a sheltered position and something to climb on. To secure new plants it is the universal practice to plant the entire fruit. As a food it has been compared to a Vegetable Marrow, and pronounced by some superior.—*J. C. E. K.*

Cherries in Pots. By Owen Thomas (*Garden*, No. 1,589, p. 287;

3/5/1902).—The method of culture is fully described in this article, which is accompanied by an illustration showing the beauty of the trees in flower.—*E. T. C.*

Cherries, Weeping. By W. J. Bean (*Garden*, p. 180; 13/9/1902).—A capital descriptive list of the many beautiful Weeping Cherries. The list comprises *Prunus acida semperflorens* (All Saints' Cherry), *P. Avium pendula, P. Chamæcerasus pendula* (the Siberian Cherry), *P. Mahaleb pendula* (the Weeping Mahaleb Cherry), *P. Padus pendula* (the Weeping Bird Cherry), *P. pendula, P. puddum* (Himalayan Cherry), and *P. serotina pendula* (the Rum or Wild Black Cherry), with an illustration of *Prunus Mahaleb* var. *chrysocarpa* at Kew.—*E. T. C.*

Chestnut, Yellow-flowered. By Ch. Grosdemange (*Rev. Hort.* p. 403; September 1, 1902).—*Æsculus intermedia.* On trial it has been found to come true from seed, and is very distinct from all other Chestnuts.—*C. T. D.*

China Proper, &c., An Enumeration of all the Plants known from. By F. B. Forbes and W. B. Hemsley (*Journ. Linn. Soc. Bot.*, vol. xxvi. p. 537, 13th pt.; October 21, 1902).—This paper is a continuation of the flora of China Proper, Formosa, Hainan, Corea, the Luchu Archipelago, and the Island of Hongkong by the above authors.—*G. S. S.*

Chroolepus or Trentepohlia (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 200–225; 1 plate).—Herr F. Brand gives a description of two new species and one new variety of this alga. The paper contains a full discussion of the mode of growth, formation of sporangia, and adaptations of these algæ to their habitat. The cell-wall is shown to have, in some forms, special grooves on the outer surface, probably to retain rainwater. The thickening of the walls in dry weather and the peculiar hat-like terminations (probably the stumps of fallen branches) are fully described. There is a good bibliography.—*G. F. S.-E.*

Chrysanthemums, Wild Forms of. By Aug. Henry (*Gard. Chron.* No. 802, p. 301, figs. 93, 94; May 10, 1902).—At one time all the cultivated plants introduced into Europe were supposed to be derived from one species, *C. indicum*, but now a second species, generally known as *C. sinense*, but more correctly as *C. morifolium*, is supposed to share the honour with the former species. Figures and descriptions are given of both species, also descriptions of the varieties of *C. morifolium* and the localities in which they are found.—*G. S. S.*

Cicada septendecim. By V. H. Lowe (*U.S.A. Exp. Stn. N. York, Bull.* 212; 4/1902, pp. 3–16, pl. 1–5).—Gives an account of the locust or periodical cicada which appears every seventeen years in the Northern and every thirteen years in the Southern States.—*F. J. C.*

Cineraria Hamiltoni. By Spencer Le M. Moore (*Journ. Bot.* 479, p. 382; 11/1902).—Description of a new species, allied to *C. aspera*, collected in the Orange River Colony by Captain Barrett-Hamilton, from specimens in the British Museum Herbarium.—*G. S. B.*

Citrus medica var. digitata. By A. Berger (*Gard. Chron.* No. 814, p. 71, fig. 26; Aug. 2, 1902).—One of the most curious varieties belonging to this genus is here figured and described. It grows chiefly in the Chinese province of Fokien. The photograph was taken in Mr. Hanbury's garden at La Mortola, where various species of *Citrus* grow freely. This variety is more a bush than a tree. The peculiarity of this variety is that the carpels of the fruit are not united at the top, but are developed separately like a number of fingers. The Chinese call the fruit "The fingers of Buddha." Similar digitate fruits occur in other species of *Citrus*.—*G. S. S.*

Clover Anthracnose. By O. Kirchner (*Zeit. f. Pflanz.* xii. 1902, pp. 10–14; 2 figs.).—The author examined more completely this disease described by Mehner in 1901 (see Abstracts, vol. xxvi. p. 916). In two sets of clover plots the disease was worst on a red clover from Northern France, and this seed is regarded as the carrier of the fungus, which spread more or less to other varieties. Fig. 1 shows a plant attacked; fig. 2 the spore-production. The author considers it distinct from the North American *Glœosoporium trifolii*, Peck, and proposes the name *G. caulivorum* because it causes characteristic depressed spots on the stem, light brown in colour with a black edge, and the conidia are slightly curved.—*W. G. S.*

Coffee Culture in Queensland. By Howard Newport (*Qu. Agr. Journ.* x. p. 389; May 1902).—This is the tenth communication upon the subject, and is restricted to topping and suckering, and is therefore strictly cultural as applied to local requirements, by the "Instructor in Coffee Culture."—*M. C. C.*

Coloured Glass, Effect on Vegetation of. By G. T. Grignan (*Rev. Hort.* pp. 388–90; August 16, 1902).—Observations regarding the utility of red and blue glass for respectively hastening or retarding growth. He alludes especially to M. Camille Flammarion's experiments and emphasises his warning that much of the effect depends upon the spectroscopic quality of the colour of the glass, which cannot be detected visually with certainty. Hence many reputed failures. Further, it is not suggested that it is beneficial to keep plants permanently under coloured glass: this should only be used temporarily for hastening or retarding, natural white light being essential to continued health. Blue glass keeps vegetation at an absolute standstill as if asleep, even Strawberries remaining thus from May to October. Red or orange, on the other hand, stimulates growth remarkably.—*C. T. D.*

Compositæ, Numerical Variation of the Ray-flowers of. By E. M. Wilcox (*Bot. Gaz.* xxxiii. No. 6, p. 462).—The present paper deals with *Helianthus annuus*. 1,103 heads were examined, and the number of ray-florets classified and tabulated with a curve between 12 and 28; 20 gave 80·25 per cent., and 21 70·08 per cent. None of the others were higher than 7·25 per cent. Again, from 29 to 45 there were only three above 34.

[The author does not allude to phyllotaxis; but this appears to be the obvious interpretation. The typical number corresponds to the fraction $\frac{8}{21}$, and the last terminates with $\frac{13}{34}$; precisely what might be anticipated on *a priori* grounds.]—*G. H.*

Composite Flora of Africa, A Contribution to the. By S. Le M. Moore (*Journ. Linn. Soc., Bot.* vol. xxxv. p. 305, pl. 8; July 21, 1902).—This paper consists entirely of descriptions of Composite plants collected by various travellers in Africa, which are now preserved in the Herbarium of the British Museum, and a few notes as to the differences between certain genera and some species. Between 170 and 180 different species and varieties are enumerated. The paper occupies 63 pages, and is illustrated by one plate.—*G. S. S.*

Conifers, The Natural History of. By W. C. W. (*Gard. Chron.* No. 811, p. 13; July 12, 1902).—In this the first article on the subject, various general characteristics of this family are given; attention is called to the fact that all the members are evergreen, with the exception of the Larch, the deciduous Cyprus, and the Maidenhair Tree, which, however, is scarcely a true Conifer, and that owing to the positions in which they are usually found they are exposed to high dry winds, so that were their leaves of the normal character (flat, with an extended surface) the amount of evaporation from them would be very detrimental to the trees. The needle-like forms of the leaves of most species offer a very small surface to the wind, so that the evaporation from them is reduced to a minimum, as well as the chance of injury in a violent gale. The various methods by which the seeds are distributed are pointed out. (*Continued July* 19, *p.* 33.)
G. S. S.

Convolvulaceæ, African. By A. B. Rendle (*Journ. Bot.* 473, pp. 189-191; 5/1902).—Descriptions of *Convolvulus Randii*, collected in Rhodesia by Dr. R. F. Rand; *Ipomœa Ommannei*, collected at Johannesburg by Mr. H. T. Ommanney; and *I. Barretti*, collected in the Orange River Colony by Captain G. C. H. Barrett-Hamilton, from specimens in the National Herbarium.—*G. S. B.*

Cottage-garden Shows (*Garden*, p. 173; 13/9/1902).—An article advocating cottage shows, and expressing regret that they are not more popular. The writer would fain galvanise them into new life, more especially so because, so far from their usefulness being diminished, it is likely to be augmented in the future. It occurs to him that the electric touch which is needed will be found in corporate management and control.
E. T. C.

Cotton. The Cotton industry. By Daniel Jones (*Qu. Agr. Journ.* x. p. 376; May 1902).—On varieties and crops; value of the crop; healthfulness of Cotton-seed oil. In 1871 the value of Cotton exported to England was £79·317—and in that year the area under cultivation was 12,962 acres.—*M. C. C.*

Cotton Growing. An old industry reviving. By A. J. Boyd (*Qu. Agr. Journ.* x., p. 463; June 1902).—The substance of a lecture on the general features of the subject delivered to the farmers in North Queensland.—*M. C. C.*

Cow-pea, Diseases of. By W. A. Orton (*U.S.A. Dep. Agr. Bull.* No. 17; with four plates).—The wilt disease of the Cow-pea is caused by a fungus, *Neocomospora vasinfecta*, var. *tracheiphila*, Er. Sm., and enters the plants from the soil through the smaller roots. Microconidia produced inside the vessels of the living stem. Macroconidia (*Fusarium* stage) borne on the outer surface of the dead stems. Ascomycetous stage on the roots of dead plants. As a preventive measure the rotation of crops is recommended.—*M. C. C.*

Cow-pea resistent to Root-knot. By Herbert J. Webber. (*U.S.A. Dep. Agr.* (*Bur. Pl. Ind.*) *Bull.* No. 17, pp. 23–36; 1902; with two plates).—Root-knot or root-gall is caused by the attacks of a nematode (*Heterodera radicicola*, Gr.), and affects some 64 species of plants, including Violet, Rose, Cucumber, and Tomato. The possibility of controlling nematode diseases by the use of resistent varieties and stocks being admitted, the Iron Cowpea variety is recommended as resistent to the attacks of the nematode.—*M. C. C.*

Crassula congesta. By N. E. Brown (*Gard. Chron.* No. 819, p. 171, Sept. 6, 1902).—A very distinct species from South Africa, received at Kew from the Cape Town Botanic Gardens in 1901. It is of botanic rather than horticultural interest. The plants are not more than 3 or 3½ inches in height; the flowers are arranged in a large dense terminal head, and would prove effective if several plants were grown together in a pot.
G. S. S.

Crassulas, New, from South Africa. By S. Schönland and E. G. Baker (*Journ. Bot.* 476, pp. 282–291; 8/1902).—Descriptions of *C. rudis*, *Ernesti*, *mesembrianthoides*, *deceptor*, *cornuta*, *elegans*, *tenuipedicellata*, *minutiflora*, *Leipoldtii*, *Tysoni*, *loriformis*, *Rattrayi*, and allied forms previously named, mostly from Namaqualand.—*G. S. B.*

Crinum, Hybridisation of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* ix. p. 271; September 1902).—The author possesses one of the finest collections in existence of this plant. Baker's monograph of 1888 gives seventy-nine species; the author has in his garden to-day over a hundred species. He gives a long list of the hybrids obtained by himself since 1897. The plants are grown in the open all the year round, and are only transplanted about once in seven or eight years, as this process disturbs their powers of flowering. He has succeeded in fertilising not only Asiatic species with American and African, but also species of the sub-genus *Stenaster* with those of the sub-genus *Platyaster*, as, e.g., *C. pedunculatum* × *C. pratense*, and also species of the former sub-genus with those of the sub-genus *Codocrinum*, as, e.g., *C. pedunculatum* × *C. jemense*. As a rule the flowers of *Crinum* open at night; some in the evening, some at midnight, others towards dawn, and still others when daylight arrives. Several can stand the full sunlight: these are aquatic or bog species, or those coming from tropical woods. The pollen of all is hardy except that of the woodland species, which easily perishes and is the cause of the infertility of this or that *Crinum*. The time at which the pollen must be transported to the stigma will depend on the species, the ripening of the stigma, the weather, the sun, and the amount of moisture in the air. The author prefers to pollinate towards evening, after the greatest heat is over, and the flower has passed the first day of its life. The stigma is then mature, and fertilisation is almost always guaranteed. Pollination must be performed with very fine brushes, which are to be carried in glass or porcelain cases, not in those of wood or metal. He has also succeeded in the fertilisation of the sub-genus *Codocrinum* × *Stenaster*, e.g., *C. jemense* × *C. pedunculatum*. The seeds appear like ready-formed bulbils, and germinate of their own accord on falling to the ground, even under the most burning sun. The hardly ripe seeds are placed at once in small pots and treated as if they were bulbils. They germinate in a few weeks, spend the first winter under glass, and in the following spring are placed in the open ground, where they reach during the first year of their life, if treated with plenty of manure and water, a considerable development, and flower profusely in the third, fourth, or at latest in the fifth year.—*W. C. W.*

Cucumber and Melon Leaf-blotch (*Cercospora melonis*, Cke.). Anon. (*Jour. Bd. Agr.* vol. ix, pp. 196–198, pl. iv.).—"The disease under consideration can only assume the proportion of a destructive epidemic when attacking plants grown under glass, and when a high temperature and an excess of moisture are present. Such conditions, accompanied by a deficiency of light, result in the production of 'soft' foliage, and it is only such foliage that the fungus can attack. Experiments carried out at Kew prove that the fungus cannot develop under 'lights' or in the open air. Plants that are badly diseased, if removed to the open air, produce new foliage which remains perfectly healthy.

"The disease is entirely an artificial creation, rendered possible by the rushing mode of cultivation."

The preventive measures given are as follows:—If the foliage is fairly hard, the disease cannot assume the dimensions of an epidemic, and even if it appears it can be kept well in hand by spraying. To accomplish this end a fair supply of air should be admitted, so that the atmosphere is not constantly saturated with moisture. It is wise to spray in anticipation of the disease, using a solution of potassium sulphide—two ounces to three gallons of water, adding two ounces of soft soap.

It is very important that the under sides of the leaves be thoroughly wetted with the solution.

If the disease is present the soil should be drenched with the solution.

Diseased leaves should be removed and burnt before they decay and fall to the ground.

After a diseased crop has been removed, the soil should be thoroughly drenched with a solution of "Jeyes' Fluid," in the proportion of an ounce to a gallon of water.

Copies of this valuable paper may be obtained free on application to the Secretary, the Board of Agriculture. 4 Whitehall Place, London, S.W.

R. N.

Currant Rust, Observations on. By P. Hennings (*Zeit. f. Pflanz.* xii. 1902, pp. 129–132).—*Cronartium ribicola*, Dietr., was observed on twenty-five species, as well as varieties and hybrids of *Ribes*. An opinion previously expressed by the author is confirmed, that the appearance and development of spores and sori of the fungus, and the spots on the leaves are to be traced to the physical and chemical nature of the substratum. On this account the author protests against the recent tendency to create and multiply biological species which cannot be distinguished by morphological characters. Such species only differ because they are adapted to different host-plants.—*W. G. S.*

Cycas circinalis, L., Monstrous Fronds of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* viii. p. 242 ; August 1902).—The plant came from Pfister, of Naples. The monstrous frond was otherwise in a perfect condition of health. The lowermost leaflets are perfect, but not always opposite, falcate, and, save a few, regular. Some on the right side of the rachis are strangely turned over either to the lower or the upper side, crisped and undulate, as if they had been interfered with before expansion. The right side possesses sixteen leaflets, the left only thirteen. Higher up the rachis is devoid of these leaflets, and there a union of great numbers of associated leaflets, both on the right and left sides, forms a kind of boat which from the opposite side looks like a monstrous shell, fringed and incised at the apex and strangely coloured, as if it had all been varnished below. In another case the terminal leaflet was trifid, as if formed of three united together.—*W. C. W.*

Cyclamen colchicum. By H. Gebhardt (*Die Gart.* p. 474 ; 5/7/1902).—A new species or form from the Caucasus, resembling our *C. europæum* ; in colour variable, it has the delicate scent of *C. europæum*, and is autumn-flowering, the same as the former.—*G. R.*

Cymbidium rhodochilum. By R. A. Rolfe (*Orch. Rev.* p. 184 ; June 1902).—Interesting and historical particulars of this rare species are given.—*H. J. C.*

Cynanchum præcox, Schlechter. By Spencer Le M. Moore (*Journ. Bot.* 475, p. 256 ; 7/1902).—Description of a new species of Asclepiad collected by Dr. Rand in the district of Salisbury, Rhodesia, and provisionally named by Mr. Schlechter, from specimens in the National Herbarium.—*G. S. B.*

Cynometra and Maniltoa, New Species of. By H. Harms (*Not. König. Bot. Berlin*, vol. iii. (1902), p. 186).—Harms describes a number of new species of the genera *Cynometra*, L., and *Maniltoa*, Scheff., viz. *C. Schumanniana*, Harms, from New Guinea ; *C. simplicifolia*, Harms, from the Philippines ; *C. Warburgii*, Harms, from N. Luzon ; *M. Schefferi*, K. Schum, from New Guinea ; *M. Hollrungii*, Harms, from New Guinea ; *M. browneoides*, Harms, from S.E. Java (?), &c.—*H. M. W.*

Cynorchis purpurascens. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,852).—Nat. ord. *Orchideæ*, tribe *Ophrydeæ*. Native of the Mascarene Islands. Flowers many in a globose head ; perianth $1\frac{1}{2}$ inch broad ; rose-coloured labellum and paler petals.—*G. H.*

Cynorchis villosa. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,845).—Nat. ord. *Orchideæ*, tribe *Ophrydeæ*. Native of Madagascar. The raceme is spiciform, 3–4 inches long; perianth of rose-purple colour, with an inflated spur.—*G. H.*

Cypripedium × Eucharis Fournierianum (Cogniaux in *Dict. Icon. Orch., Cyp.* × pl. 53; 6/1902).—A pretty form of this hybrid raised from *C. insigne Maulei* and *C. Lawrenceanum*. Dorsal sepal green, with large white outer area almost covered with purple spots arranged in lines.—*C. C. H.*

Cypripedium, Hybrid. By O. Froebel (*Die Gart.* p. 426; 7/6/1902).—*Cypripedium Leeanum superbum* and *C.* 'Calypso' *superbum*, raised by crossing *C. insigne Chantini* and *C. Spicerianum magnificum*. The latter is a cross between *C. Boxallii superbum* and *C. Spicerianum magnificum*. The flowers are superior in shape and colour to the types, and are besides extraordinarily robust and free. The ordinary time of flowering is from December till February.—*G. R.*

Cypripedium hybridum "Frau Geheimrat Borsig" (*Gartenflora*, p. 393; pl. 1,501; 1/8/02).—Coloured plate of a hybrid between *C. insigne* and *C. Chamberlainianum*.—*J. P.*

Cypripedium × Lebaudyanum (J. E. Rothwell in *Amer. Gard.* xxiii. pp. 385, 386, and 387, fig. 90; 14/6/1902)—A hybrid raised in 1895 in the collection of M. Robert Lebaudy, of Bougival, Belgium, between *C. Haynaldianum* and *C. philippinense*. Flowers 4–5 on the 2-feet scape, borne on one-year growth; intermediate in shape, but larger than either parent; pouch yellow; dorsal sepal white and pale green, with crimson spots and stripes; petals spotted and tipped with mauve.
C. C. H.

Cypripedium × Rhodopsis (Cogniaux in *Dict. Icon. Orch., Cyp.* × pl. 51; 6/1902).—A new hybrid raised by Mr. Reginald Young, of Liverpool, out of *C. Charlesworthii* by *C.* × *enfieldiense* (*C. Lawrenceanum* × *C. Hookeræ*).—*C. C. H.*

Cypripedium × 'Svend Brun' (J. E. Rothwell in *Amer. Gard.* xxiii. p. 385, fig. 89; 14/6/1902).—A garden hybrid between *C. Lowii* and *C. Curtisii*. Dorsal sepal much like *C. Curtisii*; petals and pouch intense wine-colour, the former beautifully spotted with dark brown; leaves leathery, slightly tessellated.—*C. C. H.*

Cyrtopodium punctatum, Lindl. By Dr. F. Kränzlin (*Gartenflora*, p. 505, pl. 1,503, and 2 figs.; 1/10/1902). A coloured plate and two figures of this tropical American Orchid, with short description and history of the species.—*J. P.*

Decaisnea Fargesii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7848).—Nat. ord. *Berberideæ*, tribe *Lardizabaleæ*. Native of China. It flowered at Kew 1901; now a shrub 7 feet high. It is closely allied to *D. insignis* of E. Himalaya.—*G. H.*

Dendrobium Brymerianum, Hybrid (*Orch. Rev.* p. 153 ; May 1902).—Particulars are here given of the first hybrid that has been induced to flower from the influence of *Dendrobium Brymerianum* as a parent, being also described as *D.* × *Hunteri.—H. J. C.*

Dendrobium moschatum and D. Bensoniæ. By H. Conrad (*Die Gart.* p. 522 ; 2/8/1902).—With coloured plate.—*G. R.*

Dendrobium moschatum. By James Britten (*Journ. Bot.* 476, p. 281 ; 8/1902).—An explanation that Swartz's name takes precedence of *D. Calceolaria* of Hooker, formerly figured and described by Buchanan as *Epidendrum moschatum.—G. S. B.*

Dendromecon rigidum. Anon. (*Journ. Hort.* p. 102 ; July 31, 1902).—An engraving is given of this rare Californian shrubby perennial, which has somewhat of the habit of the better known *Romneya Coulteri.* Though quite hardy, and introduced into cultivation in England by David Douglas many years ago, it is very difficult to satisfy, and very few specimens are known. It is growing well at Kew on the west wall of the Cattleya house.—*C. W. D.*

Dianthus plumarius hybrid 'Sophia Ragionieri.' By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* vi. p. 166 ; June 1902).—Exhibited by Dr. Attilio Ragionieri. It was raised from seed of *Dianthus plumarius* fertilised by pollen from *D. Caryophyllus.* It resembles the former in its very glaucous narrow leaves and its compact habit, and the latter in its dimensions. It is about 40 cm. high ; the flowers are borne on rigid stalks about 30–35 cm. long, and consist of a great number of fringed petals of a dull sulphury-pink colour and pistils of a much brighter colour, projecting from the centre ; they are about 8 cm. in breadth, and possess a delicious odour, which is that of *D. plumarius*, but slightly recalls the scent of the other parent. The plant grows freely and produces abundant flowers. It flourishes in the open, forming handsome borders, and flowering about the middle of May. If grown in a pot and allowed to become old it forms, if properly supported, fine metre-high pyramids. It may be gently forced.—*W. C. W.*

Dinacria sebæoides. By S. Schönland and E. G. Baker (*Journ. Bot.* 476, p. 282 ; 8/1902).—Description of a new Crassulad from Beaconsfield, near Grahamstown, South Africa, by Dr. Schönland, the collector, " a little glabrous annual."—*G. S. B.*

Dischidia hirsuta. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,853).—Nat. ord. *Asclepiadeæ*, tribe *Marsdenieæ.* Native of Malaya. It is one of the smallest-leaved species, the leaves being about 1 inch long. The stem clings like Ivy, and this is the only species which has flowered in Europe. The flower is $\frac{1}{3}$ inch long with a globose, blood-red corolla.—*G. H.*

Dischidia with Double Pitchers. By H. H. W. Pearson (*Journ. Linn. Soc., Bot.* vol. xxxv. p. 375, pl. 9 ; July 21, 1902).—The genus *Dischidia* is notable from the fact that the growth of some of the leaves is very different from that of the others. In these the apical growth seems to be early arrested, and "a rapid growth of the central portion of the morphologically upper surface of the leaves ensues, resulting in the formation of a hollow pitcher, the inner surface of which is homologous with the lower surface of the leaf." In some species the pitchers are double : that is, there is a small pitcher within the other. The outer pitchers are large flattish structures of a somewhat oval form, measuring at times $2\frac{3}{4}$ inches by 2 inches. The "inner pitcher" is "formed by the inflexed margin of the outer pitcher," opposite the insertion of the petiole. "One or two roots, arising from the petiole or from points on the stem close to it, enter the pitcher through the orifice and give rise to numerous branches, which in some cases almost fill the cavity." "In all cases more or less soil is present in the outer pitcher among the roots." It is impossible that the soil should find its way into the pitcher by the action of gravity, and "it has been proved that ants frequent the pitchers and make their nests in them," so it is fair to conclude that the soil is brought in by the ants as material for their nests. "To what extent the welfare of the plant is dependent on the food-materials obtained by these pitcher-roots is unknown." Certain suggestions made in the paper as to the use of the inner pitchers, the presence of the hyphæ of a fungus, will, the author says, require modification when the living plants can be studied. The present investigations were made from specimens in the Kew Herbarium.—*G. S. S.*

Echinocactus microspermus. By Sir J. D. Hooker (*Bot. Mag.* tab. 7840).—Nat. ord. *Cacteæ*, tribe *Echinocacteæ*. Native of Argentina. The stem is small, globose, 2–4 in. in diameter, with radiating spines, straight or flexuous. Flowers golden yellow.—*G. H.*

Echium Wildpretii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7847).—Nat. ord. *Borragineæ*, tribe *Borageæ*. Native of the Canary Islands. A tall plant terminated by a dense-flowered thyrsus of short pedunculated cymes. Flowers pale red.—*G. H.*

Entomology, Notes on Economic. By F. V. Theobald (*Journ. S.E. Agr. Coll. Wye*, No. 11, February 1902).—Tells of the successful introduction of the Australian Ladybird (*Vedalia cardinalis*) into the United States, as a Scale destroyer. The British species do not breed in sufficient numbers to hold any species of aphis in check. He believes a Ladybird from Queensland (*Leis conformis*) with which he is experimenting would be of immense value in the Hop gardens.—*J. C. E. K.*

Epi-Cattleya × auranti-media (E. O. Orpet in *Amer. Gard.* xxiii. p. 483 ; 26/7/1902).—A new hybrid raised at S. Lancaster, Mass., between *Cattleya intermedia* ♀ and *Epidendrum aurantiacum* ♂. Flowers yellow, shaded brown, and tinted crimson-purple.—*C. C. H.*

Epi Cattleya × Nebo (E. O. Orpet in *Amer. Gard.* xxiii. p. 483, 26/7/1902).—A new hybrid of complicated parentage raised at S. Lancaster Mass., between *Epidendrum* × *O'Brienianum* ♀ (itself a hybrid between *E. radicans* and *E. evectum*) and *Cattleya* × *Claesiana* ♂ (a natural hybrid between *C. intermedia* and *C. Loddigesii*). As in similar hybrids the *Epidendrum* ancestry is again dominant over the *Cattleya* in all essential characters. Stem reed-like; flowers $1\frac{1}{2}$ inches across, borne in loose clusters, carmine-red, changing to rosy lilac; lip connate, with column as in *Epidendrum*.—*C. C. H.*

Epidendrum × Cuco (Oakes Ames in *Amer. Gard.* xxiii. p. 670, fig. 138; 18/10/1902).—A new hybrid raised by Mr. T. L. Mead, of Oviedo, Fla., between *E. cochleatum* and *E. cucullatum*. Flowers yellowish green, suffused with "muddy purple"; structure intermediate, with an inclination to the latter parent.—*C. C. H.*

Epidendrum Endresii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7,855).—Nat. ord. *Orchideæ*, tribe *Epidendreæ*. Native of Costa Rica. It bears box-like leaves and terminal racemes of white flowers, the labellum having spots of violet at the base.—*G. H.*

Epiphytes. (From a lecture given by R. A. Rolfe, A.L.S. (*Orch. Rev.* p. 138; May 1902.) Continued from p. 104 of the previous number).—Many interesting epiphytal particulars are included of Orchidaceous plants, Bromeliads, and other generic species.—*H. J. C.*

Epirrhizanthes, Contributions to the Knowledge of. By O. Penzig (*Ann. Jard. Bot. Buit.* ser. ii. vol. ii. pt. ii. 1901, p. 142, with 7 plates).—A description of two species of the polygalaceous *Epirrhizanthes*, including an account of their histology and a demonstration that they are saprophytes, not parasites. In their histological structure, including their mycorrhiza, they conform with the general saprophytic type.—*P. G.*

Eranthemum atropurpureum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7839).—Nat. ord. *Acanthaceæ*, tribe *Justiceæ*. Native of the Solomon Islands. It has large leaves, 4–6 inches long, dark red-purple colour above, Spiciform panicles of white flowers, spotted with purple on the three lower lobes of the corolla. It flowered at Kew 1900.—*G.H.*

Erica Stuarti. By E. F. Linton (*Journ. Bot.* 478, pp. 363–4; 10/1902).—Description of a heath found in Connemara by the late Dr. Charles Stuart, and considered to be a hybrid between *E. mediterranea* and *E. Mackaii*.—*G. S. B.*

Eucalyptus cordata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7835).—Nat. ord. *Myrtaceæ*, tribe *Leptospermeæ*. Native of Tasmania. It was raised from seed at Kew and is now 15 feet high. It grew out of doors at Kew in 1851, but was killed by frost. The leaves are mealy, 3 or 4 inches long, and elliptical.—*G. H.*

Euryops socotranus. By Sir J. D. Hooker (*Bot. Mag.* tab. 7838).—Nat. ord. *Compositæ*, tribe *Senecionidæ*. Native of Socotra. It was raised from seed at Liverpool, but shows different characters from the wild plant. It bears dissected leaves with narrow linear segments, Heads yellow, sub-solitary, 1 inch in diameter, with reflexed ray-florets and orange disc-florets.—*G. H.*

Experiment Station Work (*U.S.A. Dept. Agr. Farmers' Bull.* 149, pp. 1–27, 5 figs.; 1902.—Contains:

1. A comparison of the fertilising value of manure and "meadow muck," or peat, from which it appears that the value of peat as a fertiliser is too low to pay for transportation or any general use.

2. A note on additional experiments in Potato culture, with results which emphasise the importance of maintaining a sufficient supply of humus in the soil to preserve moisture, and which also prove that tillage during a drought may be overdone. Only so much is necessary at such times as will keep the surface loose and thoroughly dry. The use of Bordeaux mixture is recommended even where blight is not prevalent.

3. A description of a model farmer's kitchen-garden which was planted in the grounds of the Horticultural Department of the University of Illinois. The idea was to provide a continual supply of vegetables throughout the season at the least possible expenditure of time and labour. The results showed an expenditure of seed that amounted to $5.45, of labour valued at $26.11, and of 50 cents' worth of insecticides; total $32.06 for the season.

In return for this a constant and varied supply of fresh vegetables was available during the season, besides Sweet Corn for tinning, Cucumbers, green Tomatos, &c. for pickling, and a supply of Cabbages, Beets, &c. for the winter, together of the estimated value of $83.84, showing a balance in favour of the garden of $51.78.

4. Observations on the shrinkage or increase in weight of crops stored under various conditions.

Indian Corn is said to be the crop in which shrinkage after storing is most evident, while Wheat harvested in the central valleys in California may possibly increase 25 per cent. on transportation to a temperate climate, and will almost certainly increase from 5 to 15 per cent. Wheat allowed to become dead ripe before harvesting weighs slightly less than when cut at the exact moment of readiness, largely no doubt through the shelling of the grain. Experiments show that on the degree of maturity at which hay is cut depends largely the extent to which it will shrink during curing, the advantage being in favour of late-cut hay.

5. An account of experiments at the Arkansas Station in transplanting and manuring Musk Melons. These seem to show that the period of maturity can be hastened two to three weeks by starting the plants in hotbeds and transplanting afterwards, and that the best and most economical method of fertilising is by applying well-rotted farmyard manure to the surface of the "hills" and working it into the soil.

6. Gives hints on the fertiliser requirements of Strawberries collected at various experimental stations. Strawberries are, by analysis, not an exhausting crop to the soil, but in consequence of their comparatively short period of growth in the early part of the year, they require relatively large amounts of immediately available nitrogen, phosphoric acid, and potash.

Well-rotted farmyard manure is the fertiliser most generally used and recommended, but in places where its cost makes its use unwise, ashes and ground bones may be used as a supplement to green manuring. The green crop should be ploughed under in the autumn, and the bone and ashes applied broadcast in the spring and lightly harrowed in.

Two formulas which have proved popular with Strawberry growers in Maryland are:

(*a*) Dissolved South Carolina rock, 1,000 lb.
Fine ground dried fish or tankage, 600 lb.
Nitrate of soda, 100 lb.
Muriate of potash, 300 lb.

applied at the rate of 400 to 600 lb. per acre before the plants are set.

For old beds the following mixture worked lightly in along the rows at the rate of about 300 lb. per acre is suggested:

(*b*) Dissolved South Carolina rock, 1,100 lb.
Dried blood, 200 lb.
Nitrate of soda, 400 lb.
Sulphate of potash, 300 lb.

In Georgia the usual mixture is:

Superphosphate, 1,140 lb.
Nitrate of soda, 540 lb.
Muriate of potash, 320 lb.

applied at the rate of 800 to 1,000 lb. per acre; but the best results are secured when 1,280 lb. of kainit are substituted for the muriate of potash.

Tests initiated by the Cornell Station on different farms and plots proved potash and phosphatic fertilisers to be more effective than nitrogenous fertilisers, especially in soils well supplied with humus.

At the New Jersey Station experiments were made with nitrate of soda, which it is becoming the practice to apply as a top-dressing in spring. 200 lb. of nitrate per acre was the quantity applied, and the fruit yield was increased from 18 to 31 per cent. by its use. It must be remembered, however, that nitrate of soda will increase the leaf-growth of the plant disproportionately unless mineral elements are also applied at the same time, or exist already in sufficient quantity in the soil.

At the Wisconsin Station they are of opinion that a liberal top-dressing with fine manure or very fertile soil after the fruiting season is the most rational method of fertilising Strawberries.

8. Some useful information on the culture of Plums, which ought to be more extensively cultivated than they are in the States. A list is given of the best and hardiest varieties, and the best soil is said to be a loose deep gravelly soil with an open subsoil, such as is suited to Apples or Potatos. The methods of planting and pruning are described and illustrated with figures, and hints on manuring, cultivating, thinning, gathering, and packing are given.

9. Results of observations on the comparative economy of hand and horse cultivation, and of field-planting and starting in beds and transplanting onions at the Texas Station.

With both the varieties of Onion experimented on the greatest profit per acre came from the crop worked by hand and grown first in beds and transplanted. Directions for this process are given.

At the New York station it has lately been recorded that in certain market-garden regions, particularly on Long Island, commercial fertilisers are habitually applied in larger quanties than the crop requires, or can consume, and at a cost which with an uncertain crop and with a fluctuating market is liable to leave too small a margin of profit to the grower.

M. L. H.

Fadogia stenophylla, Welw., var. **rhodesiana.** By Spencer Le M. Moore (*Journ. Bot.* 475, p. 253 ; 7/1902).—Description of a new variety, with larger, cream-coloured flowers, and short, broad, bright green leaves, collected by Dr. Rand at Salisbury, Rhodesia, from a specimen in the National Herbarium.—*G. S. B.*

Ferula Assa-fœtida (syn. *Scorodosma fœtidum*). By T. W. Meyer (*Die Gart.* p. 494 ; 19/7/1902 ; with illustration).—A pretty and rather uncommon foliage plant of the nat. ord. *Umbelliferæ.* Also grown for its well-known medical properties.—*G. R.*

Ficus elastica : Grafting Roots on Cuttings. By J. Foussat (*Rev. Hort.* pp. 456–7 ; Oct. 1, 1902.)—One woodcut representing a well-wooded cutting eighteen days after insertion, due to the grafting of a small piece of root about 2 in. long, not more, upon the base of the cutting *immediately below the last leaf.* Much time is thereby gained without 5 per cent. of loss. Cuttings can be removed in a fortnight from the propagating-house. The same operation is suggested for other plants difficult or slow to establish by cuttings.—*C. T. D.*

Ficus Livia (Trojan Fig). By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* vii. p. 210 ; July 1902).—Its native country is probably Asia Minor, in the region of Mount Kaz-Dagh (Mount Ida), or in the peninsula near the Adramyttic Gulf. In the plain of Mendere (Skamandros) this Fig is cultivated in enormous quantities, and it is not impossible that it has always been found there. After the conquest of Troy the Greeks probably carried off this Fig, amongst other precious fruits, to their own country, whence it would, under the name "Trojan Fig," have been eventually brought to Italy. Palestine, Syria, Asia Minor, &c. are the centres of its greatest prosperity, where it grows tall and robust, and in height rivals the Plane-tree. Hesiod does not mention it, but Archilochus, 700 B.C., speaks of it as a product of his island, Paros. The when and how of its introduction into Italy remains obscure, but there is a legend of *Ficus ruminalis* in whose shade Romulus and Remus were suckled by the wolf. It is also known that under Tiberius, a great lover of fresh fruits, many Fig-trees, cultivated and improved, had been imported from Greece. This Fig rarely bears male flowers. The fruit is large, pyriform, smooth, at first bright green, becoming reddish on the side next the sun ; the rind, on ripening of the fruit, easily splits. The pulp is of a rose-wine colour, saccharine, and melliferous, weighing 50 to 70 grams. With the Neapolitans, rich and poor alike, it forms an important article of food. It is one of the most reliable trees for producing annually a large crop of fruit. Desiccation of the fruit must take place *before* the autumn rains. The first fruits ripen at the end of July in the warmest position, and continue to do so until November. After drying in the sun the fruit should be placed in an oven for a quarter of an hour, otherwise it will not keep well. The tree is often gigantic in size, forming a very broad crown of long, sometimes contorted and irregular, branches, this latter character being often due to rough usage by the peasants while gathering the fruit. The trunk is erect, with an ash-coloured bark. The wood, valueless when young, is, when old and well dried, very hard. The long-stalked leaves are very broad, more or less regularly trilobed, slightly sinuate and denticulate, cordate at the base, with whitish venation, of a bright green on the upper, of a glaucous tinge and rough on the lower surface. Goats are very fond of them. The first flowers appear in May, when the annual branches have attained half their size. The chief centres of the Fig's cultivation are Naples, Gaeta, Capua, Caserta, and Salerno. The plant is not dainty as regards choice of soil, but prefers a good cultivated medium, though it flourishes equally well in light poor soil.—*W. C. W.*

Fig Culture Out of Doors and Under Glass. By O. Thomas (*Garden*, No. 1,596, p. 414; 21/6/1902).—A valuable article on this important subject. Training, thinning the fruit, ventilation, time of flowering, and fertilisation are thoroughly gone into. "Every year the Fig is becoming more sought after, and as the art of growing it to greater perfection becomes better known, so will there be an increased demand for the fruit."—*E. T. C.*

Finger-and-Toe in Turnips (*Plasmodiophora brassicæ*). Anon. (*Journ. Bd. Agr.* vol. ix. pp. 145–149, with fig.).—An extremely infectious fungoid disease, often very destructive both in the garden and field. It is said, however, to be practically unknown on soils naturally containing a high percentage of lime. As a preventive, the use of burnt lime has been found to give the best results.—*R. N.*

Flax Wilt and Flax-sick Soil. By H. L. Bolley (*U.S.A. Exp. Stn., N. Dakota Bull.* No. 50; with woodcuts).—There is a diseased condition of Flax soils long known as "Flax-sick soil." The plants die at all ages as if attacked by "wilt." The direct cause is a fungus parasite which grows on the inside of the Flax plant, starting from the seed or the roots, chiefly by way of the seed. This fungus belongs to the genus *Fusarium*, and a new species to be called *Fusarium lini*. When the soil is once infected no way is known to rid it of the parasite. The seed Flax should be thoroughly cleaned before treating. Scaly Flax seed and seed which has been wet are always very poor for seed. Such seeds harbour the spores of fungi which kill the young plants as soon as the seeds germinate. Cease growing Flax year after year on the same land. Burn as much of the old Flax straw and stubble which remain upon the ground as possible. The Flax-wilt disease does more injury to the seedlings when the seed is placed deep in loose soil than when planted shallow. One-half to three-fourths inch is the best depth.—*M. C. C.*

Floral Exhibits, Artistic. By Georges Bellait (*Rev. Hort.* pp. 282–5; three illustrations; June 16, 1902).—A very interesting article on the art of grouping cut flowers artistically, as opposed to the prevalent bunching methods, with numerous descriptive examples.—*C. T. D.*

Forest Lands, A Working Plan for, near Pine Bluff, Arkansas. By Frederick E. Olmsted (*U.S.A. Dep. Agr.* (*Bur. Forestry*) *Bull.* 32).—This may best be described as a systematic plan for lumbering, giving in a precise and practical way the yield of timber that may be expected from a given area and the conditions governing the transport and marketing of the timber when felled. The work is divided into two parts—the Timber Lands and Forest Management—with a number of beautifully executed illustrations and working plans for the forest land. It is published under the direction of the United States Department of Agriculture—an example that might well be followed by our Board of Agriculture at home, where forest literature and evidence given as to planting up some of the waste lands of the British Isles receive but scant attention.

That great good will be brought about by a systematic plan of working the forest lands of any country goes without saying, irregular and too heavy cuttings being thus prevented, while an annual inspection by a reliable Government official will greatly tend to minimise the waste in felling which has generally been associated with lumbering in the past.
A. D. W.

Fritillaria askabadensis. By Sir J. D. Hooker (*Bot. Mag.* tab. 7850).—Nat. ord. *Liliaceæ*, tribe *Tulipeæ*. Native of Central Asia. Perianth 1 inch long, pale yellow-green.—*G. H.*

Fritillarias and their Culture. By G. B. Mallett (*Garden*, No. 1,590, p. 305; 10/5/1902).—The first article on these quaint and interesting plants, with a life-sized illustration of *F. aurea*, and one of a colony of the Meadow Fritillary (*F. Meleagris*), and with descriptions of the Crown Imperials and *F. libanotica* and its allies. The genus contains about sixty species, of which, perhaps, twenty-five are sufficiently ornamental to be worthy of a place in most gardens, whilst quite twenty of these are first-class garden plants, bright and interesting to a marked degree. Their cultivation is, in the main, quite an easy matter; the chief difficulties centre around the resting period, for the majority of these plants hail from drier countries than our own, and the chief difficulty the cultivator has to face is that of keeping the bulbs sound and plump, yet dry, in early autumn, or they will start to grow early in the winter and perish in the attempt.—*E. T. C.*

Frost Blisters on Leaves. By Paul Sorauer (*Zeit. f. Pflanz.* xii. 1902, pp. 44–47; 1 plate).—Spots on the leaves of Apple and Cherry are traced to the action of slight spring frost on the young leaves. The epidermis is so affected when the leaves expand that it separates from the inner tissue and forms hollow blisters, in which the mesophyll cells are considerably elongated.—*W. G. S.*

Fruit Garden, The Home. By L. C. Corbett (*U.S.A. Dep. Agr. Farm. Bull.* 154, illustrated).—Is described as eminently desirable as a means: (1) of increased supply; (2) of cultivating a taste for quality; and (3) as a source of healthful and pleasurable occupation. The paper is chiefly intended for those who wish to produce fruit for family use, and for the pleasure afforded. The production of new forms will appeal to others. It deals, therefore, chiefly with propagation, planting, pruning, and general cultivation, laying stress upon the axiom that "Tillage is manure."

The combination of high and low-growing fruits on one plot is recommended, as, for instance, Strawberries, Currants, and Grapes, or Raspberries between Apple-trees. Grapes can be trained to shelter more tender plants, or to afford shade to those requiring it.

One or two plans are given for making the best use of small areas. For instance, a back yard 25 × 80 ft. contains sixteen grape vines, several dozen Strawberry plants, a row of Currants, a limited supply of vegetables and annual flowers, and a few square yards of turf. Another area of 60 × 80 feet contains 442 fruit-bearing plants, &c.

A list of varieties for Northern Ohio is given, which acts also as a guide to the proportionate allotment of plants in a home garden.

C. H. C.

Fruits, Tropical, for English Gardens. By W. W. (*Garden*, No. 1,588, p. 268, 26/4/1902; No. 1,589, p. 288, 3/5/1902; No. 1,590, p. 305, 10/5/1902; No. 1,591, p. 326 17/5/1902; No. 1,592, p. 339, 24/5/1902).—The tropical fruits that may with advantage be grown in this country are treated of, full cultural notes being given, as well as a generally interesting account of the fruits themselves. The fruits of the Passion Flower, *Vanilla*, *Monstera*, Guava, Loquat, Japanese Medlar, Pomegranate, various Lemons and Oranges are a few of the most important. Many are illustrated.—*E. T. C.*

Fruit Trees, the Summer Pinching of. By Alger Petts (*Garden*, No. 1,586, p. 235; 12/4/1902).—The reasons for the summer pinching of fruit trees are here most fully and clearly explained. The article is of great value to amateur fruit-growers.—*E. T. C.*

Fungi, Endophytic Orchid. By G. T. Grignan (*Rev. Hort.* pp. 361–5; August 1, 1902).—A very interesting *résumé* of M. Noël Bernard's observations subsequent to his paper published in the *Revue Générale de Botanique* (July 16, 1900, p. 381). He enters somewhat fully into the various saprophytic, parasitic, and symbiotic fungi peculiar to Orchids, especially the last class, but finally expresses some doubts as to the need on the part of the Orchids of the symbiotic or endophytic fungi, seeing that the former apparently thrive equally well in the absence of the latter. The benefit of artificial introduction of such fungi into Orchid culture is left, therefore, an open question.—*C. T. D.*

Fungi, Japanese. By P. Hennings (*Engl. Bot. Jahrb.* vol. xxxi. 1902, pp. 728–742; vol. xxxii. 1902, pp. 34–46).—Gives a systematic list of Fungi comprised in various collections made in Japan. Several new species are described.

P. Dietel (*op. cit.*, vol. xxxii. pp. 47–55) gives a further instalment of his notes on Japanese *Uredineæ*.—*A. B. R.*

Fungi, Three new Genera of. By G. F. Atkinson (*Bot. Gaz.* xxxiv. No. 1, p. 36).—The author describes species of *Eomycenella*, a new genus of *Hymenomycetes* (with figure), occurring on decaying leaves of *Rhododendron maximum*; *Eoterfezia*, a new genus and family of *Elaphomycetes*, parasitic on perithecia of a *Sordaria* (with figure); and *Dictyobole*, a new genus of Phalloids, occurring in sandy soil (with figures).—*G. H.*

Fungi, Two New Parasitic. By P. Hennings (*Zeit. f. Pflanz.* xii 1902; pp. 14–16).—*Septoria Caraganæ*, n. sp., on leaves of *Caragana arborescens*, L.; the spots are first yellowish, then brown, causing discoloration and withering of the leaf. *Fusarium Vogelii*, n. sp., on False Acacia (*Robinia*); brown spots on the leaf, then shot-holes. Both came from tree-nurseries at Tamsel, Germany.—*W. G. S.*

Gelsemium sempervirens. By Sir J. D. Hooker (*Bot. Mag.* tab. 7851).—Nat. ord. *Loganiaceæ*, tribe *Gelsemieæ*. Native of Southern United States. It was introduced by Tradescant in 1640. A tall climber, with fragrant golden-yellow flower-buds, but paler in blossom. *G. H.*

Gentiana tenella. By B. Daydon Jackson (*Journ. Bot.* 476, pp. 296–7; 8/1902).—An explanation that the correct authority for this name is Rottböll, to be cited as "Rottb. in Kiöb. Skr. Selsk. x. (1770), 436."—*G. S. B.*

Geographical Distribution of North American Plants. By A. Engler (*Not. König. Bot. Berlin*, Appendix IX.; May 15, 1902).—This is a long article on that section of the New Botanic Garden at Dahlem-Steglitz, near Berlin, which has been arranged to illustrate the geographical distribution of North American plants. The paper is too long to abstract in full, but the following outline will give some idea of the plan pursued:—

Engler subdivides North America into four principal regions: (i.) Arctic America, the plants of which can be but imperfectly represented in his garden. (ii.) Sub-Arctic North America, with the provinces of Alaska, the Peace River district, Hudson's Bay, and Labrador, especially rich in conifers and more or less continuous with corresponding regions in Asia and Europe; the plants of this region are abundantly represented. (iii.) Atlantic North America, with provinces such as those of the great lakes (*Pinus Strobus* and the deciduous forests), the Mississippi and Alleghany provinces with deciduous forests passing down into the Pine barrens and drier regions, the district of evergreen forests characteristic of the Southern Atlantic States, and finally the great prairie zones. (iv.) The North American Pacific region, including the district of Pacific *Coniferæ*, that of the Rocky Mountains, and those of the Western prairies, deserts, and salt lands.

These are dealt with in great detail, and the paper is in effect an essay on the geographical subdivision of North America, with respect to its flora, illustrated with a map. A plan of the gardens is also added, showing how the author has grouped the various plants selected to represent his views.—*H. M. W.*

Geographical Distribution, Maps illustrating (*Not. König. Bot. Berlin*, vol. iii. 1902).—Engler, Pax, and Graebner continue their maps illustrating the geographical distribution of plants. Two maps are given, one showing the areas occupied by the genus *Populus*, the others those of the genus *Magnolia*.—*H. M. W.*

Germination Apparatus for maintaining constant humidity (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 289–292).—Dr. A. Y. Grevillius describes and figures a new apparatus for the above purpose. It is designed by himself, and was made after Herr Schwanen's model by the firm of Max Kaehler & Martini, Berlin.—*G. F. S.-E.*

Gladioli, Culture of. By the Rev. H. H. D'ombrain (*Garden*, No. 1,585, p. 222; 5/4/1902).—A most valuable article, dealing thoroughly with the culture of this beautiful and interesting flower.
E. T. C.

Gladiolus Mackinderi. By Sir J. D. Hooker (*Bot. Mag.* tab. 7860). —Nat. ord. *Irideæ*, tribe *Ixieæ*. Native of British East Africa. Flowers 1½ inch across; wholly scarlet.—*G. H.*

Gomphocarpus textilis. By Ed. André (*Ann. Soc. Hé.* p. 86; April 1902).—This annual Asclepiad, native of Arabia, is naturalised on the Mediterranean shores of France. It is ornamental in French gardens, cultivated as a half-hardy annual, and producing abundance of umbels of rose-coloured flowers in summer. It is closely allied to *G. fruticosus*, which is grown as a half-hardy annual at Kew.—*C. W. D.*

Grafting, The Evils of. (*Garden*, No. 1,604, p. 105; 16/8/1902.) —An article on the propagation of Conifers, of great importance to all interested in trees and shrubs. Many mistakes have been made in propagating the *Coniferæ*, and, to make matters still worse, the old erroneous doctrines are still preached and practised. A list of Conifers is given, with the best method of propagating in each case.—*E. T. C.*

Grafting Herbaceous Plants. By W. S. Palmer (*U.S.A. Hort. Soc. Rep. Michigan*, 1902, pp. 110–112).—Cleft and veneer grafts were used. Tomatos grew more vigorously on Potato than on Tomato stock; weak varieties of Geranium showed marked improvement when grafted on stronger varieties; *Achyranthes* grew rapidly on *Coleus*. Variegation was transmitted to a very limited extent from stock to scion in the *Coleus* and *Achyranthes*. In grafting a monocotyledon on a dicotyledon cellular union was obtained between *Zebrina pendula* and *Coleus*.

It was found that grafting wax injured the tender tissues, but plaster of Paris was used with good effect.—*F. J. C.*

Grafting; how, when, and why. By Professor Taft (*U.S.A. Hort. Soc. Rep. Michigan*, 1902, pp. 183–187; one plate).—A résumé of the methods of grafting, with their relative advantages. Contains nothing new.—*F. J. C.*

Grafts, Interesting (*Rev. Hort.* p. 327; July 16, 1902).—M. Lindemuth, of Berlin, has grafted *Abutilon Thompsoni* on Palavia (species not indicated), the stock emitting basal branches of spotted foliage; numerous adventitious roots developed at the grafting point. Also *A. Thompsoni* was grafted twice on *Sida Napæa*, one case resulting in branches of *Sida* spotted, and in the other they remained green; differences subsequently maintained. Also *Anoda hastata* on *Abutilon Thompsoni*, one of the grafts yielding foliage spotted with yellow; the normal coloration is otherwise affected, and the seed capsules are spotted until they ripen.—*C. T. D.*

Grain Experiments (*Holmes Chapel Hort. School Rep.*, 1901).—Wheat on clay-loam soil: best results from 'The Squarehead,' 'New Standard,' and 'Windsor Forest.' No bunt in any of the plots, but smut was seen in 'Kansas' Wheat and in less degree in 'Mont Blanc.'

Oats on loam: Most profitable return in grain, 'Waverley' (Garton), 'Newmarket' (Webb); in straw, 'Potato' and 'White Cluster' (Carter).

J. C. E. K.

Grapes, Variation in Colour of, from a correspondent (*Bull. Bot. Dep. Jam.* ix., Pt. 4, p. 55), who writes:—"A plant of so-called 'Madresfield Court' bore two flavourless branches of *purple-coloured* Grapes in 1900 without being pruned; and after being pruned in February 1901 the vine fruited four bunches of round *white* Grapes with full 'Muscat' flavour."

Another writes to say that 'Royal Ascot' (a *black* Grape) bore in 1902 *white* fruit with an improved flavour.—*G. H.*

Grasses. By S. A. Hoover (*U.S.A. St. Bd. Agr. Missouri, Rep.* 1902, pp. 449–456.).—Contains economic notes on the grasses of S.W. Missouri.—*F. J. C.*

Grass Eperiments. By H. J. Wheeler and G. E. Adams (*U.S.A. Exp. Stn. Rhode Is., Bull.* 82; February 1902).—Records results of experiments carried out on pastures, and emphasises the importance of chemical manures in their cultivation.—*F. J. C.*

Guavas, Botanical differences. By J. B. Davy (*U.S.A. Exp. Stn. California, Rep.* 1898–1901, pp. 86–88).—The botanical characteristics of the cultivated species of *Psidium* are briefly described.

F. J. C.

Hailstorm in West Kent. By G. Woodward (*Gard. Chron.* No. 821, p. 220; Sept. 20, 1902).—A very graphic account is given of a most destructive hailstorm that occurred in the valley of the Medway on September 10. As is usually the case with these exceedingly violent storms, the area devastated by them is very limited. The writer lost over 3,000 panes of glass, and says that he has not an Apple, Pear, Peach, Plum, or Damson that is of any use, nor a particle of any green vegetable left. The leaves were entirely stripped from some 2,000 Chrysanthemums. At one time the hail was from 6 to 9 inches deep.

G. S. S.

Hardy Plants, Improvement in. By Amos Perry (*Journ. Hort.* p. 6, July 3; p. 26, July 10; p. 55, July 17, 1902).—Amateurs are advised to devote attention to improvement by selection of the finest individuals of hardy plants for seed, and especially, if they have an opportunity of visiting the habitat of garden plants when in flower, to search out the finest examples. In this way great advances may be made without departing from the type of a species.—*C. W. D.*

Heaths, The Hardy (*Garden*, No. 1,597, p. 430, 28/6/1902; No. 1,605, p. 128, 23/8/1902).—Comprehensive notes of Heaths, arranged in alphabetical order, are given, pointing out the best Heaths for the garden. Full cultural notes are given, and there are illustrations.
E. T. C.

Helenium autumnale superbum. By S. Mottet (*Rev. Hort.* p. 412–14; two woodcuts illustrating great superiority to type; September 1, 1902).—A huge hemispherical corymbose inflorescence over a yard wide on a single stalk; flowers a brighter yellow than the type. Cultural advice. Sent out by Vilmorin.—*C. T. D.*

Heliotrope, Giant White. By S. Mottet (*Rev. Hort.* p. 347; one woodcut; July 16, 1902).—Huge corymbs of white flowers, over a foot in diameter, raised by Lemoine by crossing *Heliotropium peruvianum* with *H. incanum.* Comes true from seed.—*C. T. D.*

Hellebores, Hybrid. By Ed. André (*Rev. Hort.* pp. 384–6; coloured plate and woodcuts; August 16, 1902).—The plate illustrates three remarkably pretty flowers 'Ministre Jean Dupuy,' deep rose, liberally blotched with crimson about the centre of the petals; 'Gaston Dugourd,' a much lighter tint of same type; and 'Henri Dugourd,' a larger flower with more pointed petals, pure white with red central maculation. Over two dozen other types are mentioned as in the same collection of M. Dugourd at Fontainebleau, derived from crossings between *Helleborus fœtidus* (an unproved wild sport) and *H. purpurasceus*, and subsequently with *H. niger.* The woodcut shows the flowers to be boldly carried on tall stiff stalks in twos and threes.—*C. T. D.*

Hetæria cristata var. **minor.** By A. B. Rendle (*Journ. Bot.* 477, p. 310; 9/1902).—Description of a new variety collected by Mr. John M. Dalziel in Southern China in damp woods at an altitude of 2,000 feet, associated with *H. discolor*, from a specimen in the British Museum Herbarium. The type of the species was found by Blume in Java.
G. S. B.

Heterotoma lobelioides. By Sir J. D. Hooker (*Bot. Mag.* tab. 7849).—Nat. ord. *Campanulaceæ*, tribe *Lobelieæ.* Native of Mexico and Guatemala. Flowers, from base of corolla (which is scarlet) to tip of anthers, 2 inches; lip of corolla yellow.—*G. H.*

Heucheras, New. By G. B. Mallett (*Garden*, No. 1,598, p. 9; 5/7/1902).—Description of *H. zabeliana* and *H. brizoides gracillima*, both of great value.—*E. T. C.*

Hidalgoa Wercklei. By Ed. André (*Rev. Hort.* pp. 208–9; May 1, 1902).—Coloured plate representing a climber of single brownish red

Dahlia type. Native of Mexico, and of Dahlia character as to half-hardiness. Suggested as good material for hybridisation with Dahlias in cultivation.—*C. T. D.*

Holland House. By G. S. Boulger (*Gard. Chron.* No. 809, p. 425, figs. 161 to 169; June 28, 1902).—This well-known house and its grounds are described, and several views are given of both. The erection of the house was commenced in 1617, but it was then known as Cope's Castle, after the name of the owner of the property. The grounds were originally laid out about 1769, when in the possession of Henry Fox, afterwards Lord Holland, by Charles Hamilton of Pain's Hill; but the present owner, Lord Ilchester, has done much towards bringing the gardens to their present perfection.—*G. S. S.*

Hollyhocks: why they fail (*Garden*, p. 157; 6/9/1902).—A question is asked of Messrs. Webb & Bland, the well-known Hollyhock-growers, as to the means of getting rid of the disease. The reply is: "We have found nothing of any good in the way of dressing, but find from experience that the hardier the plants are treated the less they suffer from it. Instead of wintering under glass as formerly, they succeed much better by being planted in the autumn in moderately rich soil away from the drip of trees, and as much exposed as possible to the fresh air, with liberal waterings with liquid manure when the buds are forming."

E. T. C.

Honckenya ficifolia. By Sir J. D. Hooker (*Bot. Mag.* tab. 7836). —Nat. ord. *Tiliaceæ*, tribe *Tilieæ*. Native of Tropical Africa. It is a stellately pubescent shrub with a fibrous brown bark, large sub-solitary flowers with broadly clawed purplish-pink petals, the flower being 3 inches across. The leaves are 6 inches long and five-lobed.—*G. H.*

Horticulture in California. (*U.S.A. Exp. Stn. California, Rep.* 1898–1901.) This report gives an outline of the work of an experiment station and shows well the value of such stations to the agricultural and horticultural industries of the neighbourhood.—*F. J. C.*

Horticulture in Missouri. (*U.S.A. St. Bd. Hort., Missouri. Rep.* 1902, pp. 408; few figures).—This report gives an account of the summer and winter meetings held for the discussion of various matters connected with horticulture, especially fruit-growing, between the scientific staff of the State of Missouri and the growers of fruit and vegetables.

F. J. C.

Houstonia cærulea. By S. Mottet (*Rev. Hort.* p. 319; with woodcut; July 1, 1902).—Introduced by Vilmorin. Plant like a dwarf Lobelia in habit; flowers blue with yellow eye. Hardy, but best grown in cold frames. Seeds sown in spring flower in June. There is a pretty white variety, which, however, is sterile, but can be propagated by division.

C. T. D.

Huron River Valley, A Survey of the. I. The Ecology of a Glacial Lake. By H. S. Reed (with 4 figures) (*Bot. Gaz.* xxxiv. No. 2,

p. 125).—The object of the paper is to preserve as complete a record as possible of the extent, physical characters, and biological relations of the glacial lakes and ponds, since at no very distant day they must disappear if the processes now in operation continue.

The general change has been from semi-arctic and hydrophytic to temperate and mesophytic conditions. At the same time there has been a continuous reaction of plant life upon environment; the advancing zones leave soils behind them different from those they found. Sphagnum swamps and peat bogs are the last stages in the life history of glacial lakes.

The lake selected was a "kettle-hole" in the terminal moraine on the north-west shore of the ancient Lake Maumee. It was formerly much larger, then shrank into two, one nearly having disappeared. It is at present east and west 1,300 feet, and north and south 700 feet. Between the water's edge and the higher ground is a swampy border 10 feet to 20 rods wide. The lake basin proper is surrounded by a shallow marginal rim, 40–75 feet in width, descending to 20 feet below the surface. This marginal rim owes its existence to organic factors still at work, the soil being of organic material for several feet in depth. The central area is entirely barren of vegetable life in consequence of the feeble amount of light.

The plants are grouped into five fairly well-defined zones as follows: —(1) The innermost is a zone of *Potamogeton zosterifolius* in water from 18 to 6 feet in depth; it is 30 feet wide. (2) A zone of *Nuphar advena*, 30–70 feet wide up to the water's edge. (3) A zone of *Carex* and *Sphagnum* from the water's edge to 25 feet. (4) A zone of *Salix* and *Populus*, 10 to 40 feet wide, on soil of almost entirely vegetable origin. It never becomes mesophytic, and is often hydrophytic. (5) A zone of *Gramineæ* and *Compositæ* outside the last. It is the transition zone in which mesophytic species begin to mix with hydrophytes; its landward border merges gradually into the vegetation of the surrounding country. Each of these zones is continually encroaching upon the next inward, as soil increases and the plants can adapt themselves to deeper water. *Scirpus lacustris* is one of the foremost plants, and *Salix rostrata* with *Betula pumila* are among the foremost plants encroaching upon the Carex zone.

The "dead lake" alluded to has water in the middle in spring-time only. In the centre of the depression there is a group of Sedges and Ferns, which are surrounded by a wide belt of Willows; outside these is a zone of Grass and other plants. The Sedges have exterminated the water-plants, and now the Willows have all but exterminated the Sedges.

G. H.

Hyacinth Culture in the British Isles. (*Garden*, No. 1,590, p. 297; 10/5/1902).—An article on what the writer says "truly should be an important industry in these isles." A sandy, saline soil would appear to be necessary for their proper cultivation, and an account is given of trials in Norfolk, where the soil of the district has been recently, so to speak, reclaimed from the sea. The method of propagation is described, and the writer says: "I feel sure there is a great future for the English

Hyacinth, and one great recommendation to gardeners who force is the fact that the bulbs can be got two months earlier than the Dutch—which is a matter of great importance—giving a longer period for root action before the plants are forced."—*E. T. C.*

Hybrid Orchids and Mendel's "Law of Inheritance" (*Orch. Rev.* p. 236; August 1902).—Several illustrations are pointed out, showing how utterly impossible it is to regard the application of "Mendel's Law" to facts already observed among hybrid Orchids.—*H. J. C.*

Hybrids, Spontaneous. By F. W. Burbidge (*Gard. Chron.* No. 822, p. 233; Sept. 27, 1902).—At Dalkey, on the coast, eight miles from Dublin, *Senecio Cineraria* was popular as a bedding plant, the seeds were blown to the rocky shore, and increased by the thousand, it gradually extended along the shore until it met the native Ragweed, *S. Jacobæa*, and this year many hybrid plants between them appeared in flower. These hybrids appear to vary considerably, but are biennial, like *S. Jacobæa*, the mother-plant. This is the second instance of hybrid Senecios occurring in Ireland.—*G. S. S.*

Impatiens cuspidata, var. **arthritica.** By Sir J. D. Hooker (*Bot. Mag.* tab. 7844).—Nat. ord. *Geraniaceæ*, tribe *Balsamineæ*. Native of the Nilghiri Mountains. It differs from the type form by the conspicuous snow-white farina on the stem. Peculiar swellings at intervals, which may be a diseased condition, suggested the varietal name.—*G. H.*

Insecticides, Insects and. By C. P. Gillette (*U.S.A. Exp. Stn. Colorado, Bull.* No. 71, pp. 1–40; Ap. 1902).—The preparation and use of most of the insecticides in use in the United States are given in a concise and useful form for reference. Among the substances that are less known to English horticulturists are the following:—

Pyrethrum, or Buhach.—A substance obtained by pulverising the dried blossoms of various species of the genus *Pyrethrum*. The proportions given for application with water are:—Pyrethrum, 1 ounce; water, 3 gallons.

Use.—If thoroughly disseminated in the air of a room it will soon bring to the floor all the flies and mosquitos therein. A good way to rid a room of flies is to make the application and close the room tightly for the night. Then in the morning sweep up the flies and burn them. If they are not destroyed in this way, after being stupefied, many will overcome the action of the powder and will live.

If applied dry, use pure and make a very light application, or dilute with flour and apply more freely.

This insecticide has been used in this country as a remedy for noctuid larvæ infesting *Adiantum* and other species of Ferns growing in artificial rockeries and has given satisfactory results.

Borax.—Used chiefly for the destruction of cockroaches. Spread the powdered borax upon bread, sweet potato, or banana peelings, or mix with sweetened chocolate, and place the bait where the cockroaches can get at it.
R. N.

Insect Enemies of the Pine in the Black Hills Forest Reserve. By A. D. Hopkins (*U.S.A. Dep. Agr.* (*Div. Ent.*) *Bull.* No. 32 n.s. pp. 1–24 ; pls. i.–vii., text figs. 1–5).—The investigations show that vast numbers of the Rock Pine (*Pinus ponderosa scopulorum*) are annually destroyed by an hitherto undescribed bark-boring beetle, *Dendroctonus ponderosa*, Hopkins : a small, black species, apparently not much unlike the Pine-borer (*Hylurgus piniperda*, Lin.) of this country, and, like the latter, it also makes tunnels under the bark. The amount of Pine-trees destroyed by this pest in the Black Hills forest reserve in 1897 is estimated at 3,000 acres. Further data furnished by the Bureau of Forestry show that the actual amount of dead timber, as determined by Mr. Griffith and party in a detailed survey of the timber resources of the reserve in 1901, is, "an average stand of 1,956 feet board measure of bug-killed timber 116,000 acres, giving a total of 226,890,000 feet board measure.

Other allied beetles are discussed and photographs of their borings are also shown.—*R. N.*

Insecticides and Fungicides, Methods for the Analysis of. By J. K. Haywood (*U.S.A. Dep. Agr. Cir.* No. 10, pp. 1–8).—This paper treats of the various methods for the analysis of the following : Paris green, London purple, copper carbonate, soda lye, tobacco and tobacco extracts, formalin or formaldehyde.—*R. N.*

Insects, Injurious, in New Hampshire, 1901. By C. M. Weed (*U.S.A. Exp. Stn., New Hampshire, Bull.* 90, March 1902).—The enormous numbers of the fly *Bibio albipennis* caused fear of injury to plants, but this, like the common British *Bibio*, is an insect that feeds on decaying vegetable matter. The Squash bug (*Anasa tristis*, De Geer) did considerable damage, but the sudden wilting of the Cucumber is probably due as a rule to the presence at the root of the larvæ of the striped Cucumber beetle (*Diabrotica vittata*, Fabricius). Another insect doing considerable damage was the Elm beetle (*Galeruca xanthomelæna* Schrank), a new importation into New Hampshire. The San José Scale has not yet reached that district.—*F.J.C.*

Insects Injurious to Vegetable Crops. By F. H. Chittenden. (*U.S.A. Dep. Agr., Div. Entom., Bull.* 33, 1902 ; 30 figs.).—An excellent series of articles on insects injurious to vegetables, with illustrations of each species. Some of the articles are noted under their proper headings.—*F. J. C.*

Insects liable to be distributed by Nursery Stock. By Principal Nathan Banks (*U.S.A. Dep. Agr., Div. Entom., Bull.* 34, 1902 ; 43 figs.).—This bulletin gives a list of the insects likely to be distributed on nursery stock, with a figure and short description of each, and notes on the injury caused. The list may be of interest, as such means of distribution are not unknown here, and are well worth guarding against.

Scale insects : Peach Scale, Oyster-shell Scale, Scurfy Scale (*Chionaspis furfurus*, Fitch), species of *Aspidiotus* including San José Scale, and others. Various species of plant-lice (Woolly Aphis, Peach Aphis, Apple Aphis, and Plum and Cherry Aphis). *Psylla pyricola* on Pears, and the

Ceresa bubalus, Say, on Apples, &c. The following caterpillars or their eggs or pupæ: *Clisiocampa americana*, Harr.; *Hyphantria cunea*, Dru.; Brown-tail moth, *Mineola indiginella*, Zell.; the white-marked Tussock moth, Gipsy moth, *Alsophila pometaria*, Harr.; *Paleacrita vernata*, Peck; Peach tree-borer, Peach twig-borer, "Bag-worm," and a few other smaller caterpillars. Beetle grubs, eggs or pupae. Apple tree-borer, Pear tree-borer, Bark beetle, Apple twig-borer, Pear blister-mite.

Fruits may be infested with Codlin moth (in Apple, Pear, or Quince), Apple maggot (*Rhagoletis pomonella*, Walsh), Cherry fruit fly (*Rhagoletis cingulata*, Loew), Plum weevil (also in Peach and Cherry), Quince weevil, Pear midge (*Diplosis pyrivora*, Riley).—*F. J. C.*

Insect Pests for 1899 (*Journ. S.E. Agr. Coll. Wye*, No. 9; April 1900).—Gives history of the Asparagus Beetle (*Crioceris asparagi*). Lime dusting keeps in check, and is said to benefit plants. Vines attacked by mealy bug have been fumigated with cyanide with successful results—bugs destroyed, vines uninjured. In vinery of 3,825 cubic feet capacity, amount used: cyanide 27 oz., acid 40 oz., water 60 oz., temperature 60°.—*J. C. E. K.*

Insects: Their Effect on Health in Rural Districts. By L. O. Inward (*U.S.A. Dep. Agr. Farmers' Bull.* 156; 16 figures; 1902).—A recapitulation of the theory of the transmission of malarial and yellow fever by the bites of certain mosquitoes from one person to another, and of the spread of typhoid-fever germs by the agency of house flies, with a plea for the suppression of these diseases by sanitary and other precautions in country or malarial districts.—*M. L. H.*

Introduced Plants (*Beih. Bot. Cent.* bd. xii. ht. 1, pp. 44–54).—Dr. F. Höck continues his list of foreign plants which have settled in Middle Europe during the last fifty years. This paper contains the names of the *Compositæ*, and adds fifty-eight to the 312 species already recorded.—*G. F. S.-E.*

Ipomœa. By A. B. Rendle (*Journ. Bot.* 473, p. 190; 5/1902).—Descriptions of two new species, *I. Ommannei*, collected at Johannesburg in the Transvaal, by Mr. H. T. Ommanney, and *I. Barretti*, collected in the Orange River Colony by Captain G. C. H. Barrett-Hamilton, from specimens in the National Herbarium.—*G. S. B.*

Ipomœa rubro-cærulea. By Marc Michell (*Rev. Hort.* pp. 336-7; coloured plate; July 16, 1902).—Introduced by seed from Mexico; 1,000 metres altitude. Temperate house. Illustration represents a pretty blue Convolvulus flower like a self-coloured *C. major*. Highly recommended.—*C. T. D.*

Iris alata. By Ch. Sprenger (*Rev. Hort.* pp. 392–4; one woodcut illustrating flower; August 16, 1902).—An interesting article on natural habitat, soil, culture, and propagation as effected in Italy, with a description of several varieties, the writer cultivating more than thirty-five magnificent ones; now quite hardy in France.—*C. T. D.*

Iris Aschersoni. By Sir Michael Foster, V.M.H. (*Garden*, No. 1,589, p. 288; 3/5/1902).—A description, illustrated by two photographs. It cannot be spoken of as a strikingly handsome Iris, since the colour seems to be a greenish yellow with thin purple veins; but, judging from the photograph, it is very floriferous, and so will, perhaps, prove a useful addition to the garden. It is interesting as being closely allied to the strange *I. Grant-Duffii*.—*E. T. C.*

Irises, New Cushion. By G. B. Mallett (*Garden*, No. 1,595, p. 393; 14/6/1902).—A description of two new *Oncocyclus* Irises, *I. sofarana magnifica* and *I. lupina robusta*. The writer says "two really magnificent varieties, of strong growth, with flowers equal to those of the best of the genus. Moreover, one year's cultivation, though insufficient for a definite opinion, shows that they are not likely to prove difficult to manage, for 70 per cent. of the plants have flowers, many bearing more than one."
E. T. C.

Irises, New Species from Bokhara. By Sir Michael Foster (*Gard. Chron.* No. 807, p. 385, figs. 134 and 135; June 14, 1902).—Two new species are described and figured from among a number of bulbs sent by one of Messrs. van Tubergen's collectors from Central Asia. They are named respectively *I. bucharica* and *I. warleyensis*. Both species appear to be very closely allied to *I. orchioides*, and, I should think, will very probably prove to be only varieties of that species. (Fig. 174).—*G. S. S.*

Irises, Oncocyclus. A test record (*Garden*, No. 1,596, p. 408; 21/6/1902).—The results of a trial of eight species of *Oncocyclus* Irises, planted in four sections in as many different composts.—*E. T. C.*

Iris Leichtlini. By Sir J. D. Hooker (*Bot. Mag.* tab. 7861).—Nat. ord. *Irideæ*, tribe *Moreæ*. Native of Bokhara. Perianth tube dilated, segments with a beard of yellow hairs; margins undulate; tips violet-blue, with copper-coloured edges.—*G. H.*

Irrigation. By C. T. Johnston, and J. D. Stannard (*U.S.A. Dep. Agr. Farmers' Bull.* No. 158; 9 figures).—Deals with the construction, cost, and management of small irrigation ditches. Clear instructions and excellent figures are given, and the subject is divided into the following sections:—

Varying grades of ditches. Methods of running grade lines. Selection of site for head-gate and ditch lines. Laying out field laterals. Method of applying water to crops. When to irrigate. Cost.—*E. A. B.*

Irrigation. Report of Investigations for 1900. By E. Mead and others (*U.S.A. Dep. Agr. Office Exp. Stn. Bull.* No. 104; 25 plates, 29 figures).—An elaborate report of investigations carried out by special observers in New Mexico, Arizona, California, Nevada, Utah, Nebraska, Wyoming, Idaho, Washington, and Montana.

The review of the investigations is by Elwood Mead, who points out that, whereas many works have been planned on the assumption that water enough to cover the land to a depth of one foot during the season would bring crops to maturity, the average depth of water used, as measured at the head-gate, was in 1900 4·13 feet, and the average of the percentages of losses by seepage and evaporation shows a loss per

Fig. 174.—Iris bucharica. (*Journal of Horticulture.*)

mile of 2·47 per cent., the heavy losses in Utah canals making the average so large.

In the Discussion of Investigations, by C. T. Johnston, descriptions and figures are given of the instruments used, such as water registers, sample traps, and current meters.—*E. A. B.*

Irrigation, Amount of Water needed for. (Extract from "Irrigation in Humid Climates," by F. H. King, Farmers' Bulletin No. 46, U.S.A. Dep. of Agr.) (*Bull. Bot. Dep. Jam.* ix., Pt. 6, p. 92).—*G. H.*

Ivy. By J. R. (*Journ. Hort.* p. 120; August 7, 1902).—Amongst other hints for the management of Ivy the writer advises that it shall be cut back annually in August instead of in March as usual. In either case the leaves have grown again in six weeks, but the long, untidy shoots which grow in June in the latter case remain hanging for nine months, but if cut back in August they do not grow again till the following June, so the Ivy remains neat and close for nine months.

C. W. D.

Kalanchoe kewensis (*Garden*, No. 1,599, p. 26; 12/7/1902).—"A remarkable and decidedly beautiful hybrid" raised at Kew. Two illustrations are given. The flowers are bright rose-pink in colour.

E. T. C.

Kniphofia multiflora. By Sir J. D. Hooker (*Bot. Mag.* tab. 7832);—Nat. ord. *Liliaceæ*, tribe *Hemerocallideæ*. Native of Natal. Thirty-four species of this genus are now known. This is one of the very few with erect flowers like *K. pallidiflora* of Madagascar. It flowered at Kew in 1900. It has leaves from 3 to 6 feet long, 1 inch broad. Flowers densely crowded, white or suffused with green; filaments long.—*G. H.*

Lælio-Cattleya × Doris 'Marquis de Colbert' (Cogniaux in *Dict. Icon. Orch., L.-C.* × pl. 22; 6/1902).—A fine variety of this hybrid raised by M. Fournier, of Marseilles, out of *C. Trianæi* by *L. harpophylla*. Flowers a peculiar shade of reddish-orange; lip crimson-purple, with yellow base.—*C. C. H.*

Lælio-Cattleya × Gladys (Cogniaux in *Dict. Icon. Orch., L.-C.* × pl. 20; 6/1902).—A hybrid raised by M. Fournier, of Marseilles, out of *C. Harrisoniana* by *L. cinnabarina*. Flowers white, shaded rose; lip sulphur-yellow.—*C. C. H.*

Lælio-Cattleya × highburiensis Fournieri (Cogniaux in *Dict. Icon. Orch., L.-C.* × pl. 15A; 9/1902).—A particularly fine colour variety of the well-known hybrid between *C. Lawrenceana* and *L. cinnabarina*. Sepals rich orange-colour; petals orange-yellow, suffused with bright crimson; lip vinous-purple; throat orange-yellow, lined with purple. Raised by M. Louis Fournier, of Marseilles.—*C. C. H.*

Lælio-Cattleya × Lucasiana (Cogniaux in *Dict. Icon. Orch., L.-C.* × pl. 25; 9/1902).—A hybrid raised by M. Maron, of Brunoy, in 1900, between *C. labiata* and *L. tenebrosa*. Sepals, petals, and lip rich violet-purple.—*C. C. H.*

Lælio-Cattleya × 'Mme. Marguerite Fournier' (Cogniaux in *Dict. Icon. Orch., L.-C.* × pl. 21; 6/1902).—A fine new hybrid raised by M. Fournier, of Marseilles, out of *L. Digbyana* by *C. labiata*. Flowers white, shaded rose; lip large and fringed; margin deep rose; throat orange-yellow, lined with purple. As *L. Digbyana* is now referred to *Brassavola*, this hybrid is, strictly speaking, a *Brasso-Cattleya.—C. C. H.*

Lælio-Cattleya × Truffautiana (Cogniaux in *Dict. Icon. Orch. L.-C.* × pl. 23; 9/1902).—A hybrid first raised by M. Maron, of Brunoy, in 1901, between *C. Dowiana aurea* and *L. tenebrosa.* Sepals and petals reddish yellow, lined with brown; lip intense violet-purple, with a whitish margin. This particular form was raised by M. Fournier, of Marseilles.
C. C. H.

Leaves. By Prof. A. T. Erwin (*U.S.A. Hort. Soc. Iowa,* 1901, p. 184).—The subject of leaves is here dealt with from a horticulturist's point of view. According to the writer, leaves ought to be described as not only the lungs of a plant but also the stomach, since digestion as well as respiration are functions of the leaf. A wet soggy soil is indicated by the bilious appearance of the leaf, while from a lack of moisture the tips of the leaf become brown and dead. As regards fruit-trees, a rich soil with an excess of nitrogen will cause a heavy foliage and wood growth, but often *at the expense of the fruit,* so that a poor clay soil may be better for fruit-trees than a good black earth. It is evident, however, that a plant can do its best work as a crop-producer only when it possesses a good healthy foliage. In orchards, for instance, it is equally as important to spray to preserve the foliage from disease as for the protection of the fruit. In Illinois State, in the season 1898, the loss through premature dropping of fruit was excessive, and upon investigation by the Experiment Station it was proved that this trouble was caused by an attack of the Apple scab on the leaves and young stems, thus cutting off the food supply. The writer concludes with a desire to emphasise the important work the leaf has to perform in furnishing us with good fruit, and hence the necessity of such a system of cultivation and spraying as will best protect the foliage. We should be close students of the leaf growth and take advantage of any favourable variations.—*V. J. M.*

Leaf-spots caused by Animals. By A. Zimmermann (*Ann. Jard. Bot. Buit.* ser. ii. vol. ii. pt. ii. 1901, p. 102; 20 woodcuts and 2 coloured plates).—A description of the external and internal morphology of spots on the leaves of certain tropical plants, includings Figs, Orchids, Coffee, caused by various small animals, among which are insects, especially *Rhynchota* (Cicadas, *Pentatomus*), and *Physapoda* (Thrips, Heliothrips); *Arachnida,* especially *Acarina* (*Tetranychus*); and finally Nematode Worms (*Tylenchus*).—*P. G.*

Lettuce forcing and fertilisers. By S. A. Beach and H. Hasselbring (*U.S.A. Exp. Stn. New York, Bull.* 208; December 1901).—The best results were obtained on a clay loam fertilised with 5 per cent. stable manure and commercial fertilisers (dried blood, nitrate of soda, and sulphate of ammonia, dried blood being the best). Full details of the experiments are given.—*F.J.C*

Libocedrus, Chinese, The. By Augustine Henry (*Garden,* p. 183; 13/9/1902).—An important article upon a species lately introduced by

Messrs. J. Veitch & Sons from seeds collected at Szemao, in Yunnan, by Mr. E. H. Wilson, when paying the writer a visit at that station in the autumn of 1899. The tree is very ornamental, and produces most valuable timber, but it is very doubtful if it will prove hardy in these isles, except in the warm corners of South-western Ireland and Cornwall.

E. T. C.

Lichens collected in Java, 1894-5. By Abbé Hue (*Ann. Jard. Bot. Buit.* ser. ii. vol. ii. pt. ii. 1901, p. 171).—Identifications and descriptions.—*P. G.*

Ligularia macrophylla, Polygonum polystachyum, Senecio pulcher, Stokesia cyanea. By G. Besoke (*Die Gart.* p. 493; 19/7/1902).—The first is well known as a foliage plant, while the other three are strong, late autumn flowering plants, also well recommended for pot culture. *Stokesia cyanea* was formerly often found on the Continent as a market plant, the large, showy purple-blue flowers appearing from October till December. Though quite hardy, it grows often better under glass, especially as during our often sunless autumns the flowers have little chance of expanding.—*G. R.*

Lilac, To Bloom, in Autumn. By M. C. Renault (*Ann. Soc. Nant.* p. 33; 1902).—M. Renault quotes an article in the *Annals* of the Horticultural Society of Haute-Garonne describing how Lilac may be made to flower in the autumn by stripping the bush of leaves in August and then watering daily. It would probably quite prevent the tree from flowering the following spring, but if successful might be worth while for commercial purposes.—*M. L. H.*

Lilies of Japan. By P. Barr (*Gard. Chron.* No. 817, p. 129; Aug. 23, 1902).—The writer comments on the various Lilies which have been imported from Japan and their varieties, and criticises the writings of others on this subject.—*G. S. S.*

Lisianthus (Gentianaceæ), Revision of the Species of. By J. Perkins (*Engl. Bot. Jahrb.* Vol. xxxi. 1902, pp. 489–494; 2/9/1902).—A systematic revision of the fifteen species of this West Indian and Central American genus.—*A. B. R.*

Lotus peliorhynchus. By Ed. André (*Ann. Soc. Hé.* p. 55; February 1902).—This ornamental plant, from Teneriffe, where it grows on the bare rocks in full sun, is cultivated in pots in Holland and France, and in May suspended out of doors, where it remains till September, when it is again removed to shelter till the following spring.

C. W. D.

Lupines for Green-manuring. By J. Burtt Davy (*U.S.A. Exp. Stn. California, Report for* 1897–8, pp. 203 to 225; plates and tabs.)—This is a series of very interesting and valuable articles on this subject, illustrated by several photographs. Green-manure crops are treated of generally by way of introduction, and the advantages of plants of the leguminous order (Clovers, Peas, Beans, Lupines, &c.) pointed out. The legumes combine all the points required of a green manure : plant-nitrogen absorption from the air, deep-rooting, and, at the proper stage of growth, that succulence which is conducive to quick decay. Details are given of the several species of Lupines : (1) *Lupinus pilosus*, Linn. ; (2) *Lupinus pilosus cœruleus*, Hort. ; (3) *Lupinus pilosus roseus*, Hort. ; (4) *Lupinus luteus sativus*, Hort. ; (5) *Lupinus affinis*, Agardh, &c. Hints are given for sowing and cultivation, and upon the various uses to which the plants and seeds may be put, apart from manuring. The Small Blue Lupine and Small White Lupine would seem, as a result of experiment, to be the best for light soils, and the Large White Lupine has proved satisfactory, but is valueless on a stiff clay soil. Comparative tables are given showing (1) cultures of various Lupines ; (2) weekly growth ; and (3) yield per acre of various Lupines.—*V. J. M.*

Mangolds and Swedes : Experiments (*Holmes Chapel Hort. School Rep.* 1901).—Mangolds : twenty-nine varieties tested on clay-loam soil. Manures applied per acre, 16 tons farmyard manure, 3 cwt. superphosphate, ½ cwt. sulphate of ammonia. Best yields from Sutton's Devon Short Top Yellow Globe, and Carter's Mammoth Prize Long Red.

Swedes, twenty-four varieties tested. Manures per acre, 16 tons farmyard manure, 6 cwt. superphosphate, ½ cwt. sulphate of ammonia. Yield varies from 17 tons to 3 tons per acre. Carter's 'Holborn Kangaroo' most profitable.—*J. C. E. K.*

Manures, Experiments with. By R. S. Seton (*Yorks. Coll. Leeds Tract.* No. 16).—Valuable returns of a series of experiments with various different manures and combinations of manures. The crop raised after application of a mixture of dung, superphosphate, and sulphate of ammonia was, for example, found to be nearly three times that from an unmanured patch in the same field. The crop experimented with was Swedes, and it was found that when artificials alone were used superphosphate was by far the best, but although the weight per acre increased with the addition of sulphate of ammonia, it did not do so in proportion to the additional outlay. It was also found that the seed came up quicker and more regularly on land previously dressed with manures harrowed in before sowing. When, however, the seed and the manures were drilled in together, the roots were found to be finer when full-grown.—*W. W.*

Manuring Meadow Hay (*Yorks. Coll. Leeds Rep.* 1900).—Two years' experiments show that an annual dressing with dung will leave considerable margin of profit. The heaviest average crop was got from an annual dressing of 1½ cwt. nitrate of soda, 2 cwt. superphosphate, and 3 cwt. kainit per plot, but the size of the plots is left to be inferred from the heading of various appendices, from which they appear to have been one-acre plots.—*W. W.*

Masdevallia Schrœderiana. By Sir J. D. Hooker (*Bot. Mag.* tab. 7859).—Nat. ord. *Orchideæ*, tribe *Epidendreæ*. Native of Peru (?). The flowers have yellow tails to the sepals, which are white, bullate, with crimson stripes.—*G. H.*

Masdevallia xipheres and its Allies. By R. A. Rolfe (*Orch. Rev.* p. 228 : August 1902).—Interesting particulars of the *M. muscosa* group are included.—*H. J. C.*

Massai Steppe, Plants of the. By O. Merker (*Not. König. Bot. Berlin*, vol. iii. (1902), p. 194).—Merker gives a list of 85 plants of the Massai Steppe (Kilimandscharo and Meru) which are used as medicines, poisons, &c., together with their native names.—*H. M. W.*

Mesembryanthemum Cooperi. By J. R. (*Rev. Hort.* p. 376 ; August 16, 1902).—This pretty and floriferous species is found to be hardy enough to stand 10 to 12° below zero C., *i.e.* about 20° F. of frost. *C. T. D.*

Mildew. By E. M. (*Journ. Hort.* p. 450 ; May 22, 1902).—Amateurs are warned not to expect plants of opposite tastes to thrive in the same house. For instance, Malmaison Carnations want abundance of air, but similar treatment is sure to cover Roses with mildew. The best remedy for Rose mildew is explained.—*C. W. D.*

Minnesota, Trees, Fruits, and Flowers of. (*Trans. Minn. Hort. Soc.* xxix. ; 1901).—An interesting record of the good work done by this society for the promotion of horticulture. Some of the principal papers read by its members before other societies are included, and an interesting biography of men prominent in horticulture, with a brief summary of their particular work, are also given. One article, dealing with "European Nurseries," gives the opinion of an American visitor as to the chief difference between their methods and ours. The lists of premiums offered for fruits, flowers, &c., and the winners of same, are given, together with an illustration of the Exhibit in the Horticultural Hall at the Minnesota State Fair.—*E. F. H.*

Mosses. The Genus *Bryum* in Bohemia (*Beih. Bot. Cent.* bd. xii. ht. 1, pp. 1–33).—Dr. Podpěra (Prague) gives a very full account of the habitats, localities, and anatomical characters of all species of this difficult genus which occur in Bohemia. The paper is, however, of special interest to British bryologists and botanists as a study in plant-distribution.—*G. F. S.-E.*

Moth-traps (*U.S.A. St. Bd. Hort. Missouri, Rep.* 1902 ; p. 105).—Trap-lanterns are declared useless in orchards, as they fail to catch Codlin moth, &c.—*F.J.C*

Musa imperialis. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* viii. p. 235 ; August 1902).—It comes from the German colony of Cameroon, in Eastern Equatorial Africa. In its own land it grows during the rainy season, remaining quiescent and almost underground during the drought ; in Europe it will therefore vegetate in spring and summer and be dormant in winter. It is found in the wooded parts of the mountains and hills of Cameroon, where it grows here and there amongst bushes of other plants. Emerging with the first rains, it rapidly vegetates, flowers, matures its seeds, and retreats on the approach of the great heat of the tropical summer. It belongs to the type of *Musa Ensete* of Abyssinia, and comes rather near to *M. religiosa* and *M. Fétiche*, introduced by Vilmorin, of Paris, and a native of the Congo. *M. imperialis* has a subterranean perennating stem, and bears a tuft of enormous and very beautiful leaves, lanceolate in shape, and of a fine emerald-green colour. It flowers readily in the south of Italy. The seeds are similar in shape to those of *M. Ensete*, but much smaller, and black with a white eye. They germinate readily, and the seedlings grow rapidly. The plants will grow either exposed to the sun or in shade, but require plenty of humus, manure, and water. They have a very different habit from the known Musas. The underground stems can be preserved even when removed from the soil, as is practised with *Erythrina*.—*W. C. W.*

Musa religiosa. By C. Sprenger (*Bull. R. Soc. Tusc. Ort.* ix, p. 280; September 1902).—This plant, first introduced by Vilmorin, Andrieux & Co., Paris, from the Congo, where it was said to be planted around the native cemeteries, was at first called *M. Fétiche.* It is hardy in Naples. It bears very tiny black seeds, which germinate easily, and the seedlings grow rapidly. The subterranean stem is only slightly raised above the ground; the plant becomes dormant in late autumn, entirely losing its leaves, remaining in that condition during the bad season, resuming growth the following April on the return of the warmth. In its native land it rests during the dry and grows during the wet season. It is a dwarf, very compact species, with dense foliage, the leaves being short and broad, and thus more immune from damage by wind and other agencies. The author grows it successfully in the open side by side with *M. Basjor* or *M. japonica*, than which it is not less hardy. From April to September it is provided with phosphated and ammoniacal liquid manures.—*W. C. W.*

Muscari latifolium. By Sir J. D. Hooker (*Bot. Mag.* tab. 7843)-—Nat. ord. *Liliaceæ*, tribe *Scilleæ*. Native of Asia Minor. Leaves 6 to 12 inches long; raceme 3–4 inches long, cylindric; flowers dark violet-blue.
G. H.

Myoporum serratum. By A. Bruttini (*Bull. R. Soc. Tosc. Ort.* vii. p. 199; July 1902).—An ornamental tree, commonly planted in some parts of Sicily. It belongs to the family *Selaginaceæ*, and is a native of Australia. It is evergreen. The leaves are simple, fleshy, lanceolate, slightly dentate, with a conspicuous middle vein, 3–10 cm. in length and 1·5–3 cm. broad. The flowers are small, about 1 cm. in diameter, hermaphrodite, and united in axillary clusters. The corolla is white, gamopetalous, regular, five-lobed, speckled with violet toward the centre, where also occur short white hairs. The calyx is green, gamosepalous, and regular. There are five stamens, alternate and concrescent with the corolla: of these the posterior one is abortive, the other four fertile, didynamous, the anterior ones being larger, with four locular, introrse anthers exhibiting longitudinal dehiscence. The pistil consists of two carpels fused together to form a bi-, tri-, or quadrilocular ovary, with anatropous, pendulous ovules separated by false septa. The fruit is a drupe, 8-9 mm. long, slightly piriform, the broadest part being next the peduncle. The epicarp, at first green, at length becomes whitish, and finally, when ripe, violet in colour. The mesocarp is colourless, juicy, and sweet. The endocarp is hard, whitish yellow, with two or four longitudinal ridges, and contains two to four loculi, each provided with one or two seeds. The seed is small and white, with a straight embryo and fleshy albumen. Flowering occurs from March to May, and the fruit ripens in July. On account of the numerous shoots springing from the stem it is much used for evergreen hedges. It has a rapid growth, reaching a height of four metres in three years. The average length of its life as known in Sicily is supposed to be from thirty-five to forty years. From its power of resistance to strong winds it could be usefully employed as a shelter. It prefers a very mild climate in winter and a not very hot one in summer, but could probably well enough adapt itself to a more northern climate. It is somewhat deleteriously affected by salt breezes, especially after a very dry summer, but soon pulls round again after the autumn rains. It readily adapts itself to sandy and calcareous soils, which are very poor and dry. The usual multiplication is by seed, but reproduction by cuttings and suckers can also be employed. As the seeds soon lose their germinative power, they are best sown as soon as the fruit is ripe, viz. in July–August or at latest in September. Germination takes place from November to March. The fruits are laid entire in the soil to a depth of 3–4 cm., and are frequently watered. Plants germinated in autumn can be transplanted the following autumn, those of March the following December. Adult plants require as a rule no manure, but a moderate annual or biennial manuring with hyperphosphate ; sulphate of ammonia or potash will greatly benefit them. The best time for pruning is in early spring, but the plant will stand this operation at any time. Old plants will not sprout after being cut down to the base, as old age first shows itself in the roots. The plant is little subject to injury by parasites, but a small cochineal insect, closely allied if not identical with *Dactylopius citri*, at times severly attacks the young branches, and the plant may then suffer injury. *Myoporum* is cultivated solely as an ornament and a screen. Its foliage is not eaten by animals. Boys sometimes eat the ripe fruits. The wood when fresh is heavy, but seasoning makes it very light, non resistent to moisture, and brittle. It is usually used as fuel, and occasionally for small objects of turnery.—*W. C. W.*

Narcissus 'Hudibras' (*Rev. Hort.* p. 199 ; May 1, 1902).—Said by Krelage, Haarlem, to be one of the finest of the yellow trumpet section. Flowers in cold frames middle of March. Flowers large and well shaped, resembling a cross between an Ajax and an Incomparablis. Perianth bright yellow, full, wider than an Ajax, but shorter ; edge frilled and very open. A difficult grower.—*C. T. D.*

Nature Study in California (*U.S.A. Exp. Stn. California, Nature Study Bulletins*, 1900).—This bulletin contains two articles. The first by C. W. Woodworth, on butterflies (with six plates), gives the causes of the distribution of butterflies, the daily life of a butterfly, its habits, its enemies, and its life-history from the egg to the perfect insect. Instructions are given as to how to collect and preserve butterflies, and, finally, a list of 354 butterflies, many of which are illustrated.

In the second, W. J. V. Osterhout speaks of "the living plant" (19 figs.), starting with a description of the seed and germination, and so on to the mature root, stem, and leaf, showing by means of simple experiments what the work of each is and how they do it.

Both articles contain some useful suggestions for all teachers of nature-knowledge.—*F. J. C.*

Nature Study in Public Schools. By S. A. Hoover (*U.S.A. St. Bd. Agr. Missouri*, pp. 241–248).—The writer of this article advocates the teaching of nature-knowledge as the basis of progress, pointing out its mental, moral, and physical values. He suggests that the teaching should be along economic lines.—*F. J. C.*

Nectria moschata. By H. Glück (*Engl. Bot. Jahrb.* vol. xxxi. 1902, pp. 495–515; 2 plates; 2/9/1902).—Gives an account of the occurrence and life-history of this fungus, which forms gelatinous masses in water pipes and on damp wood. The formation of perithecia and the development of the spores are described.—*A. B. R.*

New Land, Clearing. By Franklin Williams, Jun. (*U.S.A. Dep. Agr. Farmers' Bull.* 150; 7 figures; 1902).—A treatise by a practical master of the art of clearing forest land for cultivation in America.

Directions are given for removing trees and stumps in the cheapest and most effective way, and the one best adapted to the varying character of their root growth, whether they possess a tap-root system, a lateral or an indeterminate root system. Cutting, burning, pasturing, grubbing, drawing by machinery or horse-power, blasting and rendering susceptible in various ways to the destroying effects of wind and weather are the methods recommended by the writer for use either singly or successively, and he ends with a list of the most suitable crops to be grown on freshly cleared ground.—*M. L. H.*

Nicotiana colossea variegata. By E. Vincent (*Rev. Hort.* p. 356; Aug. 1, 1902).—One woodcut showing preparation for taking cuttings by making first an incision from below and beneath the bud, passing one-third through the branch. A few days after a second incision is made at the same place, extending the first to two-thirds, but taking care to leave a good third intact to maintain vitality. After another delay the incision is completed, and the buds inserted in a hotbed in a compost of peat, silver sand, and charcoal, equal parts. The idea of successive incisions is to induce callosity over most of the cut surface prior to entire severance.
C. T. D.

Nymphæa guineensis. By H. Baum (*Die Gart.* p. 565; 30/8/1902; with illustration).—Described as the smallest flowering Water-Lily. The leaves are dark green above, glabrous, pale green beneath, tinged with rose. The flowers are white and faintly sweet-scented. It grows in stagnant water near Hinnesera, on the Longa.
G. R.

Nitrate of Soda and Market-garden Crops. By E. B. Voorhees (*U.S.A. Exp. Stn. New Jersey, Bull.* 157; 12/5/1902).—Experiments were tried with Carrots, Celery, Cabbage, Tomatos, Turnips, Peppers, and Sweet Corn. The first application of nitrate was made when the plants had made a good start (in the case of transplanted plants when they were set), and second and third applications according to the condition of each crop. The results are shown in the following tables :—

Plot	Fertiliser	Quantity per acre	Number of applications	Yield per acre						
				Carrots		Cabbage		Celery		
				Primes	Culls	Primes	Culls	Number of roots, Primes	Number of roots, Culls	Weight of crop
		lbs.		lbs.	lbs.	lbs.	lbs.			lbs.
1	Nothing . . .	—	—	8,720	2,730	910	7,920	—	15,470	13,480
2	Nitrate of Soda	300	2	10,180	2,730	3,260	11,460	14,300	1,230	28,380
3	,, ,,	300	3	10,290	1,550	5,390	9,250	14,940	1,180	31,800
4	,, ,,	400	2	10,520	1,820	4,160	11,250	14,700	1,130	31,080
5	,, ,,	400	3	10,380	1,410	7,580	15,060	15,050	970	33,900

Plot	Fertiliser	Quantity per acre	Number of applications	Tomatos	Turnips	Peppers	Sweet Corn	
							Yield per acre	
				Yield per acre	Yield per acre	Yield per acre	Number of ears	Weight of stalks
		lbs.		lbs.	lbs.	lbs.		lbs.
1	Nothing . . .	—	—	7,390	8,230	13,480	4,610	6,850
2	Nitrate of Soda	200	2	10,610	12,740	15,750	4,620	6,300
3	,, ,,	200	3	13,270	11,220	16.930	5,890	6,800
4	,, ,,	300	2	12,000	16,520	18,240	5,680	6,650
5	,, ,,	300	3	10,930	13,360	18,230	6,290	7,300

F. J. C.

Oak, A Beautiful Old. By L. Graebener (*Die Gart.* p. 433; 14/6/1902).—Description and illustration of a 500-years-old oak growing about half a mile above Badenweiler in the Black Forest.—*G. R.*

Oak, Lucombe, What is the? By H. J. Elwes (*Gard. Chron.* No. 820, p. 195; Sept. 13, 1902).—The history of this tree has been given by Loudon many years ago, and quoted by almost every writer on English trees since, but Mr. Elwes "is inclined to think that the original Lucombe Oak is something quite different, and not a hybrid between the Turkey Oak and the Cork Oak as supposed." In support of this theory he quotes Evelyn's 'Silva,' which reads :—"Besides these seventeen species of Oaks, enumerated by Mr. Miller, there is another, described under the name of the Devonshire, or Lucombe Oak. Of this kind there is a particular account given in the 62nd volume of the 'Philosophical Transactions,' from which it appears that a Mr. Lucombe sowed some acorns from a Wainscot

Oak. Among the young trees which came from these it was noticed that one did not lose its leaves in the winter. From this a large number of trees were propagated by grafting; their leaves were evergreen, and the trees only made one shoot in the course of the season instead of two (in May and August), and grew continuously." In the (*Gard. Chron.* No. 821, p. 221, Sept. 20, 1902, are letters from Mr. W. Napper and Sir W. T. Thiselton-Dyer, giving information about these Oaks, and expressing views which differ from those held by Mr. Elwes.—*G. S. S.*

Odontoglossum × Armainvillierense var. **ardentissimum.** By R. A. R. (*Orch. Rev.* p. 209, fig. ; July 1902).—A photographic illustration of this lovely hybrid, *Odontoglossum*, which was certificated at the last Temple Show of the Royal Horticultural Society as *O.* × *ardentissimum.* The origin of the cross and other particulars are clearly given.—*H. J. C.*

Odontoglossum grande Lindl. var. *Pittianum hort.* By Dr. Kränzlin (*Gartenflora*, p. 225, pl. 1498; 1/5/02).—A description and plate of this recently introduced pale yellow variety; the labellum is white.
J. P.

Odontoglossum × Wendlandianum. By R. A. R. (*Orch. Rev.* p. 135; May 1902).—Contains some interesting particulars of the parentage of this natural hybrid.—*H. J. C.*

Oldenlandia rhodesiana. By Spencer Le M. Moore (*Journ. Bot.* 475, pp. 250, 251; 7/1902).—Description of a new species collected by Dr. Rand at Salisbury, Rhodesia, from specimens in the National Herbarium.—*G. S. B.*

Onosma echioides (*O. tauricum*). By F. W. Heyer (*Die Gart.* p. 533; 9/8/1902; with illustration).—A pretty rock plant, with bright yellow, urceolate flowers. Adapted for dry stony soil in exposed sunny position.—*G. R.*

Orange in North California. By D. H. Murray (*Bull. Bot. Dep. Jam.* ix., Pt. 5, p. 75).—This discusses the relationship between the plant and soil, winter rains, temperature, drainage, pruning, and best varieties.—*G. H.*

Orange in South California. By J. W. Jeffrey (*Bull. Bot. Dep. Jam.* ix., Pt. 6, p. 87).—Discusses varieties, cultivation, soil, insects, and marketing.—*G. H.*

Orange and Lemon Rot. By C. W. Woodworth (*U.S.A. Exp. Stn. California, Bull.* 139; 2/1902; 5 figs.).—The fungus *Penicillium digitatum* is the cause of the well-known rotting of oranges and lemons. A popular description of the fungus and its growth is given, and the way it enters the fruit pointed out. The preventive measures advised are refrigeration, ventilation during storage, wrapping. The fruit affected should be destroyed by fire or deeply buried, so as to reduce the source of infection to a minimum. The curing and packing houses should be disinfected by thorough drying in the summer, or by whitewashing, or, if this be impossible, by sulphuring the house. Fruit should not be allowed to rot on the tree.

A note is added pointing out the value of the rotted fruit as manure. It should be made into a compost heap with quicklime and earth.

F. J. C.

Orchard Enemies in the Pacific North-West. By C. V. Piper (*U.S.A. Dep. Agr. Farmers' Bull.* 153; 1902; 1 fig.).—This compilation gives a list, with notes, of the principal insect and fungus pests occurring in Oregon and the neighbouring States. Recipes are given for the making of insecticides and fungicides, and the inadequacy and worse of "quack" remedies pointed out, The principal insect pests are the San José Scale, Codlin Moth, Peach twig-borer, Cottony Scale, Apple Aphis, Woolly Aphis, and Pear-leaf Blister-mite. The bacterial and fungus diseases prevalent are the Apple Scab, Pear Scab, Brown Mould, Pear Blight, and Crown Gall on Apples, the cause of which is unknown; but a similar growth on Almond has recently been shown by Prof. J. W. Toumey, of Arizona, to be due to a slime fungus, *Dendrophagus globosus*. A disease peculiar to the district is caused by the fungus *Malicorticis glœosporium*, Cordley (syn. *Macrophoma curvispora*, Peck), which produces black or dark brown spots on the young branches and twigs, causing the death of the bark in circular areas which fall away and leave the wood exposed. Diseased spots should be cut away and burnt.—*F. J. C.*

Orchard Improvement. By F. W. Card (*U.S.A. Exp. Stn., Rhode Is., Bull.* 83; March 1902; 8 figs.).—A neglected orchard was taken in hand and by scraping bark and suitable pruning, spraying with Bordeaux mixture for fungi and "moss," and with Paris green for insect pests, and the addition of suitable manures (100 lbs. nitrate of soda, 100 lbs. dried blood, 100 lbs. tankage, 100 lbs. acid phosphate, 100 lbs. muriate of potash) was brought into good yielding condition. Methods proper to other conditions are noted. The "railroad worm," which bores in Apples, was troublesome. Spraying did not affect it. The removal of all "windfalls" and fairly deep ploughing in spring are recommended.—*F. J. C.*

Orchard Management in Massachusetts. By S. T. Maynard and G. A. Drew (*U.S.A. Exp. Stn., Mass. Bull.* 82; April 1902).—Results show that constant cultivation of land gives the best return, but where such cultivation is impossible abundance of fertilisers should be used. The best tools for orchard cultivation are a long hanging landslide plough with a long point and mould-board, the shears harrow, the wheel harrow, or the spring-tooth harrow, and a weeder. Cover crops are important in that they (1) supply nitrogen and humus to the soil; (2) improve the mechanical condition of the soil; (3) protect roots of trees from being injured by deep freezing; (4) prevent fine particles of soil from being washed away during the autumn, winter, and spring. Rye Oats, Barley, Peas, Soy Bean, Cow Pea, and Hairy Vetch have been used with advantage; those, like Peas and Barley, Soy Bean, and Cow Pea, sown in the autumn are perhaps the best. The effects of proper and improper pruning are shown by means of photographs, and concise rules on the subject are given. The proper thinning of fruit and spraying of fruit-trees are also touched upon. The following varieties of various fruits have proved the best in Massachusetts:—*Grapes*, Worden, Campbell, Green Mountain, Concord, Delaware; *Blackberry*, Agawam, Snyder, Taylor, Eldorado; *Raspberry*, Cuthbert, King, Curtland, London; *Currants*, Red Cross, Wilder, Fays, Cherry, and Pomona; *Strawberries*, Clyde, Haverland, Howard's No. 36, Sample, Gandy Belle.—*F. J. C.*

Orcharding, Experimental Work in. By H. H. Michener (*U.S.A. Hort. Soc. Iowa*, 1901, p. 266).—In a short article the writer advocates and encourages constant experiments by growers of fruits, &c. He begins by saying that the horticulturist has a mania for experimenting with and testing all new fruits of merit, also quite frequently those of no particular value; it is well he should have this mania, for otherwise who is there that would? The thorough testing of all new fruits should be left to the experienced fruit-grower and nurseryman who spends his entire time in the study of the habit of growth, proper cultivation, &c., of each particular variety. Experimental work should be carried out along definite, practical and systematic lines, making a complete record of everything. The experimenter should have a large number of tests started each year, so that perhaps at least one would be of sufficient value to continue further testing. The writer takes as an instance the Peach, and gives descriptive instructions as to the crossing, &c.—*V. J. M.*

Orchards sprayed with Poisonous Washes, Grazing in. Anon. (*Journ. Bd. Agr.* vol. ix. pp. 193-195).—The result of the experiment corroborates the observations of practical men and also the results and conclusions derived from similar trials conducted years ago in America, namely, that stock may be kept on land where trees are washed with arsenites. Copies of this paper may be obtained free on application to the Secretary, the Board of Agriculture, 4 Whitehall Place, London, S.W.
R. N.

Orchid Exhibits, Judging of. By G. T. Grignan (*Rev. Hort.* p. 210; May 1, 1902).—Suggestions as to proper determination of points of merit, ornamental and cultural, and as regards rarity. Considers that where unnamed exhibits are in question, a printed schedule should be filled up as the exhibits are inspected, this eventually to determine the award.—*C. T. D.*

Orchids, Some Remarks on the Cultivation of. By M. Verdonex (*Bull. R. Soc. Tosc. Ort.* v. p. 156; May 1902).—The soil termed at Ghent "Azalea soil" is the best fitted for potting of Orchids. It is a kind of humus occurring at the surface of the ground in woods in which dead leaves and decaying twigs are found. Preferably it should be slightly sandy, and composed of foliage of Oak, with a proper proportion of Hornbeam, Elm, and Beech leaves. It need not be sifted; enough if the arger bits and the insufficiently decomposed twigs be removed. Some growers mix sphagnum or fibrous substances with it, but the writer finds pure leaf-mould yields the best results. Orchids grown in this soil need not be repotted for two or three years. Sphagnum is placed on the soil around the plant and serves as an index of the amount of humidity in the soil, enabling the plant also to emit roots. The best drainage is afforded by a few large crocks in the pot to a height of 2 or 3 cm. Excessive dampness must be avoided, as this causes rapid decomposition of the soil, and with it that of the roots. Duval, of Versailles recommends with this kind of soil no watering, but mere light syringing of the pots. It is advisable to water very little immediately after potting, owing to laceration of the roots in this latter process. As a general rule, all Orchids adapt themselves equally well to this kind of soil. Excellent results have been obtained with *Odontoglossum, Oncidium, Lælia, Cattleya, Lycaste, Cypripedium.* The writer finds that plants potted in this soil grow more vigorously and quickly and produce superior flowers than is the case with those cultivated in the old way. This mould is also much less expensive and of much easier application. Its introduction is due to M. De Langhe-Vervaene, of Brussels.—*W. C. W.*

Orchis Hybrid. By E. F. Linton (*Journ. Bot.* 476, p. 297 ; 8/1902).—Recording the undoubted occurrence of a bigeneric hybrid between *Orchis maculata* and *Habenaria conopsea* in a wild state from two or three localities.—*G. S. B.*

Pæonia arborea 'Elisabeth.' By E. J. Peters (*Die Gart.* p. 556 ; 23/8/1902 ; with illustration).—This sort is one of the best, most strong and free flowering among double-flowering kinds, of a bright rose colour. They are much more grown on the Continent than in England, and also more successfully on the Continent. They are hardy, but require protection against spring frosts, which is the only secret to a successful culture.—*G. R.*

Parkinson, John. By G. S. Boulger (*Gard. Chron.* No. 803, p. 317, fig. ; May 17, 1902).—The author of "Paradisus," or, to give part of its full title, "Paradisi in sole paradisus terrestris, or a garden of all sorts of pleasant flowers which our English ayre will permit to be nursed up, &c.," well deserves the obituary notice that Prof. Boulger has written about him : in it is given a most interesting account of the above mentioned book. In 1629, when it was written, unlike the present time, when one has almost lost count of the number of books on gardens and gardening, there were but few on these subjects, and the author himself says : "None of them have particularly severed those that are beautiful flower plants fit to store a garden of delight and pleasure, from the wilde and unfit." A copy of a photograph of the statue of John Parkinson in the Palm House at Sefton Park, Liverpool, is given.—*G. S. S.*

Passion Flower, A Superb. By Ed. André (*Rev. Hort.* pp. 287–9 ; with coloured plate of *Passiflora quadrangularis* var. *Decaisneana* ; June 16, 1902).—A splendid variety with dark crimson petals, with a large cup-shaped whorl of numerous long filaments, white spotted with red, with tortuous tips ; very handsome and delicately perfumed. Native of Brazil and requires a warm house, in which it becomes a rampant grower, very free-flowering.—*C. T. D.*

Peach, Disease in. By Dr. E. F. Smith (*U.S.A. Hort. Soc. Rep. Mich.* 1902 ; pp. 170–177).—Describes a disease of Peaches called the

"Little Peach" disease, in which the fruit and leaves are much reduced in size, while the root-hairs on the finer roots and even the smallest roots themselves are quite dead. The disease is not common in young trees, those most frequently attacked being from seven to twelve years old. The most regular and heavy bearers are those most frequently attacked, and death appears to occur in about two years. At present the disease appears to be confined to Michigan. The cause of the disease is unknown; various causes have been attributed; it is possible that adverse soil conditions are answerable at least in part for the injury, but a fungus (unknown) is present on the roots in all cases.—*F. J. C.*

Peach 'Opoix.' By Louis Tillier (*Rev. Hort.* p. 408; September 1, 1902).—Coloured plate representing a very fine late Peach, described as a good bearer and highly recommended. Originated in Russia, distributed by M. Boucher, 164 Avenue d'Italie, Paris.—*C. T. D.*

Pear, 'Conference.' By C. Mathieu (*Gartenflora*, p. 449, pl. 1502. 1/9/1902).—A coloured plate and description of the fruit.—*J. P.*

Pears and Apples, Preservation of, by Gum Arabic (*Rev. Hort.* p. 200; May 1, 1902).—Sound fruit dipped in a solution of 500 grammes of gum to the litre of water and then dried remain sound until the following autumn. When required for use they are placed in water for two or three hours and then rinsed and dried. While gummed they remain absolutely *in statu quo* as when gathered, and can be subsequently matured after washing.—*C. T. D.*

Pear-trees, Pyramid. By G. Wykes (*Garden*, p. 220; 27/9/1902).—A practical article about the culture of pyramid Pear-trees and the best varieties for the purpose, with two excellent illustrations of trees in the Royal Horticultural Society's Gardens at Chiswick.—*E. T. C.*

Pentanisia. By Spencer Le M. Moore (*Journ. Bot.* 475, pp. 251, 252; 7/1902).—Descriptions of two new species, *P. sericocarpa* and *P. rhodesiana*, collected by Dr. Rand at Salisbury, Rhodesia, from specimens in the National Herbarium.—*G. S. B.*

Petrea volubilis. By G. Besoke (*Die Gart.* p. 521; 2/8/1902).—A pretty climber for temperate houses. The strong flowers are star-shaped, the centre deep blue, margin of a paler blue.—*G. R.*

Phalænopsis × leucorrhoda (Cogniaux in *Dict. Icon. Orch.*, *Phal.* × pl. 1; 6/1902).—A fine form of what is generally considered to be a natural hybrid between *P. Aphrodite* and *P. Schilleriana*, introduced from the Philippines in 1874, by Messrs. Low & Co., together with its supposed parents. Flowers white, suffused with rose.—*C. C. H.*

Pineapples, Cultivation of. By W. Cradwick, Travelling Instructor (*Bull. Bot. Dep. Jam.* ix., Pt. 5, p. 68).—This paper discusses the soil, drainage, preparation of soil, selection of suckers, planting, and cultivation.—*G. H.*

Pink, The Cheddar, at Home. By H. R. Richards (*Journ. Hort.* p. 144; August 14, 1902).—The English habitat, the Cheddar Rocks in Somersetshire, is described, and visitors are exhorted not to pull up the plants, which will not transplant, but to collect seed, to sow on walls and rockeries. Amongst other wild flowers associated with the Pink, the yellow Welsh Poppy, *Meconopsis cambrica*, is mentioned, a plant not generally known to exist there. (The readiness with which *Dianthus cæsius* crosses in gardens makes it difficult to get cultivated seed which will come true.)—*C. W. D.*

Pinus (Laricio) pindicia. By M. T. Masters (*Gard. Chron.* No. 802, p. 302; figs. 95–97; May 10, 1902).—This tree was considered a distinct species by M. Formanek, but Dr. Masters is of opinion that it is only a marked variety of *P. Laricio*, which is a very variable species, and he says: "To cultivators it is not material whether the form be considered as varietal or specific; suffice it to say that for cultural purposes it is distinct." A copy of the original Latin description is given, also a description of *P. Heldrichii*, so that it may be better distinguished from that species. This variety or species, whichever it may be, is a very distinct form, and well worth cultivating.—*G. S. S.*

Plant Diseases. By J. Percival (*Journ. S.E. Agr. Coll. Wye*, No. 11, pp. 81–89; February 1902).—Experiments showed that Chrysanthemum rust may be completely arrested by spraying once or twice a week with solution of flowers of sulphur, at the rate of one ounce in ten gallons of water, with a little soft soap added to make lather.—*J. C. E. K.*

Plant Diseases of 1901. By Wendell Paddock (*U.S.A. Exp. Stn., Colorado Bull.* No. 69; 9 plates).—The diseases enumerated are:—Apple tree root-rot; Apple tree rosette; Blackberry root disease (*Rhizoctonia*); Cherry-tree wound parasite; Asparagus rust (*Puccinia*); Aster wilt (*Fusarium*); Currant-cane disease (*Nectria*); Grape anthracnose (*Sphaceloma*); Pea-root disease (*Rhizoctonia?*); Plum-leaf blight, or shot-hole; Potato diseases; Quince rust (*Gymnosporangium*); Strawberry-leaf blight (*Sphærella*); Wheat stinking smut (*Tilletia*).
M. C. C.

Plectranthus saccatus. By Sir J. D. Hooker (*Bot. Mag.* tab. 7841).—Nat. ord. *Labiatæ*, tribe *Ocymoideæ*. Native of Natal. It is a suffruticose plant with large flowers nearly $1\frac{1}{2}$ inch long, with pale blue corollas. It flowered at Cambridge.—*G. H.*

Podocarpus pectinata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7854).—Nat. ord. *Coniferæ*, tribe *Podocarpeæ*. Native of New Caledonia. It flowered at Kew in 1902. Male flowers only known.
G. H.

Pollination of Pears and Apples. By D. S. Bullock (*U.S.A. Hort. Soc. Rep. Mich.*, 1902; pp. 115–116).—A list of insects (families only) visiting Pear and Apple flowers. Hymenopterous insects most useful and abundant.

In the same report (p. 120) O. L. Ayrs concludes that wind-fertilisation of Apples and Pears is impossible.—*F. J. C.*

Polygonum Baldschuanicum. By S. Mottet (*Rev. Hort.* p. 357, Aug. 1, 1902; p. 375, Aug. 16, 1902).—Can be propagated by means of suckers developed at the base, which form adventitious roots *in situ.* If these be detached and shortened they soon root in a cold close frame. Suggests cutting down strong plants to induce such growths, the plant being otherwise difficult to propagate. Subsequently some lower branches were layered with incisions in the same way as Carnations. Rooting resulted in a few weeks.—*C. T. D.*

Potato Experiments (*Holmes Chapel Hort. School, Cheshire, Report,* 1901).—It was found that fairly large sets give a greater return than small ones; that on loamy clay the most profitable yields were obtained from a good dressing of farmyard manure, supplemented with a full mixture of artificials, containing nitrogen, phosphorus, and potash. Also that kainit is the least profitable of the potassic manures.—*J. C. E. K.*

Preservatives. (*a*) *Formalin* (*Bull. Bot. Dep. Trin.* No. 34, p. 457; July 1902).—A 2 per cent. solution has been found useful in sending fleshy tropical fruits to a distance for examination. Herbarium specimens are improved if dipped in a 5 per cent. solution for two or three minutes previous to being dried.

(*b*) *Chloretone* (*ib.* p. 462).—A new antiseptic proved effective in preserving vegetable substances.—*E. A. B.*

Primula obconica as a Bedding Plant. By W. S. (*Journ. Hort.* p. 34; July 10, 1902).—It is said that at Forde Abbey this is used very successfully as a summer bedding plant, and instructions are given about it.—*C. W. D.*

Primulas, The Mountain. By H. Correvon (*Garden,* No. 1,588, p. 271, 26/4/1902; No. 1,591, p. 327, 17/5/1902; No. 1,593, p. 358, 31/5/1902; No. 1,595, p. 396, 14/6/1902; No. 1,597, p. 429, 28/6/1902; No. 1,599, p. 28, 12/7/1902; No. 1,602, p. 81, 2/8/1902; No. 1,604, p. 113, 16/8/1902; No. 1,605, p. 131, 23/8/1902).—This interesting and useful series of articles upon the Alpine Primulas is divided into sections, the hardy ones as follows:—(1) Saxatile species, which grow naturally in the fissures of rocks and natural stone-heaps. (2) Marsh-loving species, liking porous, peaty soils, and cool, damp places. (3) Species that need silica and special culture. (4) Species easily grown in the open in good garden soil. The articles are well illustrated by drawings of the most important species.—*E. T. C.*

Primula violodora. By S. T. Dunn (*Gard. Chron.* No. 817, p. 129, Aug. 23, 1902).—A new Primrose discovered in Central China by Mr. Wilson, and presented to Kew Gardens by Messrs. Veitch & Sons. It is allied to the Himalayan *P. mollis.* The flowers are mauve, and have a delicate scent resembling that of violets, which is particularly noticeable of an evening. A full description in Latin is given.—*G. S. S.*

Propagation of Plants. By L. C. Corbett (*U.S.A. Dep. Agr. Farmers' Bull.* 157 ; 22 figures ; 1902).—An enumeration of all the natural and artificial means of propagation possible with plants.

In the case of the latter class minute directions are given for the successful performance of the operations of cutting, budding, and grafting in all their different varieties ; hard-wood cutting, herbaceous or soft-wood cutting, tuber cutting and root cutting, layering, cleft grafting, whip grafting, bark grafting, splice grafting, saddle grafting, veneer grafting, and budding ; each process being illustrated by useful figures.—*M. L. H.*

Pseudocedrela. By H. Harms (*Not. König. Bot. Berlin*, vol. iii. (1902), p. 213).—Harms gives a short note to the effect that *Pseudocedrela Kotschyi*, Schweinf., is not of importance as a substitute for Mahogany in the Togo country, as he had surmised it might be.

H. M. W.

Pteris aquilina cristata. By C. T. Druery (*Gard. Chron.* No. 822, p. 226, figs. 77 and 78 ; Sept. 27, 1902).—The rarity of natural sports in Ferns is pointed out, and a figure is given of a crested variety of the common Bracken *in situ*, which was found growing over a considerable district near Faygate, Sussex. There are also figures showing a frond of the crested variety, and also fronds of two other varieties which were growing at the same place.—*G. S. S.*

Range Improvement in Arizona. By David Griffiths (*U.S.A. Dep. Agr., Bur. Plant. Ind. Bull.* 4).—A paper dealing with the existing conditions and character of the forage supply on ranges in Arizona. This, together with suggestions for their improvement, is of great value to those interested in the industry of ranging and cattle-feeding.

E. F. H.

Ranunculus Pæony-flowered (*Rev. Hort.* p. 199 ; May 1, 1902).—Two new varieties from Krelage, Haarlem : *purpurea grandiflora*, fine flowers of a velvety intense purple, rich colour ; and *grandiflora rosea*, flowers, well made, of a salmon-tinted carmine rose. Both highly recommended.—*C. T. D.*

Raspberries, Wintering. By O. H. Barnhill (*U.S.A. Hort. Soc. Iowa*, 1901, p. 424).—Mr. Barnhill believes that one of the greatest hindrances to success in growing Raspberries is the winter killing of the vines, and that the subject is one that is generally neglected. Moisture may be conserved by maintaining the dust mulch, and the dreaded anthracnose kept in check by spraying, but the vines have yet to be preserved from freezing to death. The Raspberry is just the opposite to the Apple in that it is the tops and not the roots that winter kills. The roots will usually pass through the hardest winter uninjured, but it is the tops that need protection. After mentioning various theories and suggestions of remedies, the writer states that there is only one known way of wintering Raspberries safely, and that is by laying down the vines in the fall of the year and covering them with earth. This method involves considerable work, and the drawback to it seems to be its cost.—*V. J. M.*

Rhododendrons, Deciduous (Azaleas). By W. Dallimore (*Garden*, No. 1,596, p. 416; 21/6/1902).—A description of the best species in cultivation, with photograph of the Azalea garden at Kew.—*E. T. C.*

Rhododendron Griffithianum (Aucklandii) ♀ × Rh. arboreum hybridum ♂, Hybrids of. By L. Wittmack (*Gartenflora*, p. 281, pl. 1499 and 4 figs.; 1/6/02).—*Rh. Griffithianum* was used as the seed-bearing parent, the pollen being obtained from several varieties of *Rh. hybridum*, 'Dr. Mil,' 'Koh-i-noor,' 'Gabriel Liebig,' and others. The plate given represents a seedling from *Rh. Griffithianum* (white corolla) crossed with *Rh. hybridum* 'Dr. Mil' (carmine-red). Characters belonging to both parents are present in the offspring.

The influence of the mother is seen in the bark, the somewhat lengthened axis of the inflorescence, the thick flower-stalks, large calyx-lobes, and bell-shaped corolla.

The strong growth, harder wood, thick leaves, and the beautiful carmine colour of the flowers are characters transmitted from the male parent.—*J. P.*

Rhododendrons, Hardy Hybrid. By W. Dallimore (*Garden*, No. 1,601, pp. 61–3, 26/7/1902; No. 1,602, p. 78, 2/8/1902).—An interesting article on this subject, dealing fully with the *R. Thomsonii* and *R. Griffithianum* and *Smirnowi* groups. Several illustrations are given.—*E. T. C.*

Rhododendron King Humbert I. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* v. p. 138; May 1902).—Raised from seed by Sig. Giovanni Chiari, gardener of Marquis Carlo Torrigiani. Vigorous, well-shaped plant, with leaves oblong-lanceolate, 20 cm. long, clear, opaque green above, very transparent below, smooth; flowers united to the number of 15–20 in broad, compact corymbs at the ends of branches, lilifloro-campanulate, more than 10 cm. in width, of very elegant shape, white, with a delicate pink transparence, with small, dark crimson spots at the base, the upper petal speckled dark red, undulate at the margins, slightly odorous, stamens ten. The buds are pink externally and preserve this colour until after opening of the flower, although it is then somewhat less deep, and it is this which yields the roseate transparence to the flower itself.

From the shape as well as the scent of the flowers the new variety probably arises from seed of a *R. ponticum* which has been fertilised by some species or variety of a Himalayan Rhododendron.—*W. C. W.*

Ribes Grossularia ♀ × R. nigrum ♂. *R. Schneideri*, Maurer in litt. By E. Koehne (*Gartenflora*, p. 409; 1/8/02).—The hybrid appears to be a casual seedling from a Gooseberry pollinated by Black Currant. The stems and leaves have no prickles, and in the smoothness of the interior of the calyx tube and slight hairiness of the style the plant resembles the Black Currant. The fruits are seedless, dark red, covered with fine hairs, and of acid taste, similar in shape to those of the Gooseberry. Very few glands are met with in the leaves.—*J. P.*

Richardia hybrida 'Solfatara.' By G. Bornemann (*Die Gart.* p. 584; 6/9/1902; with coloured plate).—A new hybrid, the product between *R. Elliottiana* and *Adlami.* The flowers are yellow, with a dark central spot. As in most hybrids, this new form is more floriferous, more robust in growth, and the flowers are of finer texture and very distinct.

G. R.

Ricotia Lunaria. By S. Mottet (*Rev. Hort.* p. 320; with woodcut; July 1, 1902).—Introduced by Vilmorin from Palestine. Bunches of lilac-pink flowers; dwarf habit. Annual. Sow early spring, but can be sown later for succession. The best plan is to sow where required, in April, 6 to 8 inches apart. Flowers then end of May.

C. T. D.

Road Improvement (*U.S.A. St. Bd. Agr. Missouri*, vol. i., No. 10; January 1902).—An abstract of papers read at the tenth annual meeting of the Missouri Road Improvement Association. Illustrations are given showing the appearance of dirt roads which are almost left to take care of themselves, and the greatly improved condition where dragging is carried out after rain, about once a month on an average.

It is the object of this association to create public interest in the matter of roads, as at the time of the meeting only 1 per cent. of entire mileage of Missouri State roads was composed of free gravel or macadam.

E. F. H.

Roads Congress, Proceedings of the International Good, Buff., N.Y., September 1901 (*U.S.A. Dep. Agr. Pub. Rd. Inquiries, Bull.* 21).—This congress was held for the purpose of stimulating the efforts already being made in improving the public highways. An endeavour was made to get Congress to vote a sum sufficiently large to assist every State in building good hard roads.—*E. F. H.*

Roads, Earth. By Maurice O. Eldridge (*U.S.A. Dep. Agr., Farm. Bull.* No. 136; 1902).—A very useful work dealing with the formation of earth roads, which predominate largely in some portions of the United States. The principal requirements in the formation of these roads are thorough drainage for the road base, and a rapid transit of water from its surface. For this purpose a good crown is necessary, which conducts the water quickly to the sides, and in a short time leaves the centre quite dry. Occasional rolling after rain directly the surface is sufficiently dry to prevent sticking, and working with the road machine, which acts like a large scraper and takes off any lumps, leaving a fair surface, are the principal part of attention given. The improved conditions of traffic well repay the amount expended in these operations.—*E. F. H.*

Rock-garden Making. By F. W. Meyer (*Garden*, p. 213; 27/9/1902).—An introduction to a series of freely illustrated articles upon this important subject. As the writer here says: "Of all the numerous branches of horticulture there is perhaps none more abused than the making of rock-gardens. Many are the instances in which an otherwise pretty garden has been spoiled by so-called rockwork badly constructed and utterly out of character with its surroundings. It must be borne in mind that no rocks of any kind can possibly be ornamental to a garden unless they are either natural or appear to be so, and are associated with suitable plants."—*E. T. C.*

Rodgersia, The four Species of. By A. Henry (*Gard. Chron.* No. 817, p. 131, fig. 44; Aug. 23, 1902).—Descriptions are given of the four species, and a figure is given of *R. pinnata*, which is now flowering at Kew for the first time in Europe. It is a native of Yunnan, where it grows on cliffs 8,000 feet above the level of the sea. It is perfectly hardy. This species is remarkable for its peculiar leaves, which are described as semi-digitate; the flowers are reddish, and grow in a somewhat narrow cymose panicle; it attains a height of rather more than three feet. This genus is nearly allied to *Astilbe*. The three other species, *R. podophylla*, *R. æsculifolia*, and *R. Henrici*, are described, and their native localities given.—*G. S. S.*

Root Sensitiveness (*Beih. Bot. Cent.* bd. xii. ht. 2, pp. 243-247).—As the result of several experiments similar to those carried out by Sachs as to the positive thigmotropism or sensitiveness to contact of the growing zone in roots, Professor Newcombe suggests that the effects are really due to traumatropism, *i.e.* injury at the points of contact. He finds that no curvature is produced by glass, the wood of *Pinus Strobus*, or that of the Tulip-tree.—*G. F. S.-E.*

Roots of Herbaceous Plants, Studies on. By T. Friedenfelt (*Flora*, vol. xci. pp. 115-208; figs. 1-20; t. xvi.-xix.). This is a very exhaustive treatise on a subject too little discussed, the relation of root habit to that of the plant as a whole and to external conditions. It well deserves translation *in extenso* into the pages of the Journal, but is unsuitable for abstracting.—*M. H.*

Rosa Wichuraiana and its Hybrids. By Philomel (*Garden*, No. 1,598, p. 7; 5/7/1902).—Description of type and hybrids. "The type is a creeping Rose, and most useful it is for covering a large area with its fast-growing, trailing shoots, plentifully clothed with the brightest foliage imaginable, and in August with immense bunches of single white flowers. But if used simply as a ground trailer much of its beauty is lost. The best plan is to place a few good-sized logs in the centre of a bed and allow the growths to creep over them, producing a lovely mound of snowy flowers when other Roses are fading." The hybrids bloom earlier than the type, and none possess the Ivy-like flat growth in the same degree.—*E. T. C.*

Roses, Attar of. Anon. (*Journ. Hort.* p. 293; September 25, 1902).—The production of this in Eastern Roumelia is yearly decreasing, and though Roses are more cultivated there than ever, the commercial value of the product diminishes rapidly.—*C. W. D.*

Rose, The true York and Lancaster. By W. R. Raillem (*Journ. Hort.* p. 512; June 12, 1902).—It is said that the two-coloured varieties of *Rosa gallica*, generally called York and Lancaster, are not the true plant, which is a variety of *R. damascena*, the Damask Rose, bearing self-red and self-white and variegated flowers on the same bush. Another instance of three varieties of colour on the same branch is *Daboëcia polifolia* var. *bicolor*).—*C. W. D.*

Roses of British Origin and their Originators. By D. R. Williamson (*Gard. Chron.* No. 809, p. 428 ; June 28, 1902).—The writer mentions that at one time nearly all the best Roses were of French origin, but things have changed comparatively recently, as the list of names of our most prominent Rose-growers and the charming varieties for which they are responsible shows most conclusively.—*G. S. S.*

Roses, British-raised (*Garden*, No. 1598, p. 5, 5/7/1902 ; No. 1,599, pp. 23, 24, 12/7/1902).—The first part of a list of British-raised Roses. The writer states that the list "will, perhaps, surprise those who imagined that we were largely indebted to other lands for new varieties."—*E. T. C.*

Roses, Hedges of. Anon. (*Journ. Hort.* p. 196 ; August 28, 1902). These are recommended for suitable positions, and the species recommended are *Rosa moschata*, used at Kew ; *R. setigera*, *R. multiflora*, and especially *R. rugosa*.—*C. W. D.*

Roses on own Roots (*Bull. Bot. Dep. Trin.* No. 33, p. 426 ; April 1902).—Tea, Noisette, and Bourbon Roses have been proved more suitable for tropical culture when on their own roots. Briar and Manetti stocks which withstand cold, and so are hardy in Europe, prove unsuitable and perish in the heat of the West Indies.—*E. A. B.*

Roses for Pergolas, Fences, and Arches. By "An Old Rose-grower" (*Garden*, No. 1,603, p. 100, 9/8/1902 ; No. 1,604, p. 110, 16/8/1902).—A list of the most easily grown and beautiful Roses for pergolas, fences, and arches, with notes as to pruning, &c. Illustrated by a photograph of Rose Blarii No. 2 on a pergola.—*E. T. C.*

Roses, Planting, too Deeply. By H. S. (*Journ. Hort.* p. 52 ; July 17, 1902).—A note points out that this is a very common cause of failure amongst amateur gardeners.—*C. W. D.*

Roses, Wild Chinese. By A. Henry (*Gard. Chron.* No. 809, p. 438, figs. 170 to 172 ; June 28, 1902).—The wild form of *Rosa indica* is not admitted by Hooker as a native of India, or by Matsumura as indigenous to Japan. The only wild specimens known were collected by Dr. Henry near Ichang in Central China, where, he says, he has no reason to doubt that they are really wild. This species, which is the one from which our Tea Roses originated, grows as a large shrub climbing over rocks. It has single flowers, as shown in the figure ; they are generally of a deep red colour, but occasionally they are pink. The leaflets are either three or five in number. *R. gigantea* is a native of the Burmese Shan States and Yunnan ; it is very like *R. indica*, but it may always be distinguished from it by its larger and white flowers, larger fruit, and the leaves, which are often seven-foliate. *R. Banksiæ* was introduced into England in 1807 by Kerr. This was the double white variety; the double yellow was not seen in this country until seventeen years later. This species grows wild in the western mountainous half of China, over a wide range of country, and shows considerable variation. This Rose has long been cultivated in China, and thence introduced into Europe and Japan. *R. microcarpa* very much resembles the last-mentioned species, but varies in certain particulars. *R. Colletti*, found in the Shan States of Burma, very much resembles *R. microcarpa*, and is apparently a tomentose geographical form of that species.—*G. S. S.*

Sabal Uresana, W. Trelease. By Dr. A. Ragionieri (*Bull. R, Soc. Tosc. Ort.* vi. p. 177 ; June 1902).—A new Palm discovered by Prof. W. Trelease in August 1900 on the plateau to the north of the city of Ures, the ancient capital of the Mexican State of Sonora. It forms open forests, and is a beautiful and elegant Palm Its glaucous foliage recalls two other beautiful species of the Sonora region, *Washingtonia Sonoræ*, Watson, and *Erithea armata*, Watson. The stem is 5 to 10 metres high and more than 30 cm. thick ; the leaf-blade is about a metre long, multifid, with large straw-coloured paleæ springing from the sinuses. Fruit with a single edible, green, globose carpel, which when dry is dark brown and somewhat polished, and the mesocarp cottony ; the endocarp is of a whitish straw-colour. The seed is shining, of a dark chestnut colour, and labyrinthically rugose, 12 × 7 millimetres.—*W. C. W.*

Sandringham, The Gardens at. Anon. (*Gard. Chron.* No. 808, p. 403 ; figs. 141 to 151 ; June 21, 1902).—This is an interesting article on the Royal gardens at Sandringham, illustrated with eleven admirable photographs of the house and gardens, &c.—*G. S. S.*

Scabiosa caucasica, A White-flowered. By S. Mottet (*Rev. Hort.* p. 347 ; July 16, 1902).—This variety besides being pure white is absolutely hardy, while the normal is scarcely so. It comes true from seed, and is extremely floriferous, blooming freely from mid-June until the October frosts. Highly recommended.—*C. T. D.*

Scale, Rose. By J. B. Smith (*U.S.A. Exp. Stn., New Jersey, Bull.* 159 ; 13/6/1902 ; 6 figs..)—The snowy-white scale (*Diaspis rosæ*, Bouché) which infests Rose trees in the shade is described and figured. The insect has proved a serious pest on Blackberries and Raspberries in New Jersey as well as on Roses. The remedial measures advised are the cutting out and burning of the badly infected shoots ; reasonable thinning of shoots ; the application of whale-oil soap, 1 lb. per gallon of water, in the autumn or early winter ; or a 10 p.c. mechanical mixture of kerosene and water ; another application of a weaker solution of soap in March to kill off the young hatched from the eggs.—*F. J. C.*

Scale, San José. By W. E. Britton (*U.S.A. Agr. Exp. Stn., Conn., Bull.* 135, December, 1901 ; 5 plates).—The spread of the insect (*Aspidiotus perniciosus*, Comst.) in Connecticut from August, 1893, onwards is shown, and the regulations enforced in order to check its spread are given. The insect and its life-history are both carefully described, and a list of forty-three plants upon which the scale is found, and most of which are commonly grown in this country, is given. The writer points out how the scale is carried from tree to tree by the nurseryman or on the feet of birds or of insects. He recommends the destruction of all badly infested trees. Spraying with crude petroleum or a kerosene-and-water mixture (20 to 25 p.c. kerosene), applied just before leaves are put out, is recommended. The crude oil must have a specific gravity not below 43 degrees (Beaumé). Whale-oil soap (2 lbs. soap to 1 gall. of water) is also a useful remedy, but expensive in large orchards.—*F. J. C.*

Scale, San José, Experiments with Insecticides for the. By S. A. Forbes (*U.S.A. Exp. Stn. Illinois, Bull.* No. 71; April 1902).—The "California wash" of lime, sulphur, and salt, and the "Oregon wash" of lime, sulphur, and blue vitriol, are claimed as the best winter washes for this pest in the South Pacific Coast area. The respective washes were prepared as follows:—

"For the California wash, fifteen pounds of stone-lime were slacked in a little very hot water, fifteen pounds of ground sulphur being slowly poured in during the slacking process, with constant stirring of the mixture. This was then boiled for an hour, after which fifteen pounds of salt were added and the boiling continued for fifteen minutes longer. The whole was then poured into a barrel through a strainer, and enough boiling water was added to make fifty gallons.

"In the preparation of the Oregon wash, a pound and a quarter of blue vitriol was used instead of the salt, the crystals of the blue vitriol being dissolved in hot water and the solution added slowly to the slacking lime."

Since the publication of the above a second "Bulletin" (No. 72) has been issued, in which it is claimed that the washes applied in the experiments were extremely efficient.—*R. N.*

Scale, the San Jose, in Japan. By L. Reh (*Zeit. f. Pflanz.* xii. 1902, pp. 101–107).—A discussion on the native country of this scale insect. Whether is it Japan, America, or (as the Japanese entomologists say) China? Kuwana's recent paper convinces the author that Japan has the preference (see Abstracts, xxvii. p. 348).—*W. G. S.*

Scale, San José, How to Control the. By C. L. Marlatt (*U.S.A. Dept. Agr. (Div. Ent.) Circul.* No. 42, pp. 1–6; May 1902). One of the main objects of the circular is to emphasise the importance and value of honest efforts to control this insect for the great majority of districts where it has established itself, rather than efforts at extermination, which will prove successful rarely at best, and will always be accompanied with great immediate loss. The other principal object is to designate briefly the means of controlling this scale insect which experience has shown to be of practical value. The "California wash" of lime, salt, and sulphur is given as effective, and its use is possible in all climates similar to those of the Pacific coast. The methods of control in the east of the United States, where the climate is moister and with more frequent rainfalls, are, in order of their importance, as follows: (1) The soap treat-

ment; (2) treatment with pure kerosene; (3) treatment with crude petroleum; (4) treatment with mechanical mixtures of either of the last two oils with water. In the main these are all winter treatments, and are applied at any time when the trees are in a dormant, leafless condition.
R. N.

Scale, The San José, Treatment for, in Orchards. II. Spraying with kerosene and crude petroleum. By F. A. Sirrine (*U.S.A. Exp. Stn. New York, Bull.* No. 213, pp. 1-51; April 1902).—The results of these tests, considered in connection with others previously reported by this and other stations, appear to indicate that spraying with kerosene or crude petroleum is safe and effective under the following conditions:—

"In using kerosene, only the best grades should be employed, as the lower grades are very liable to injure the trees.

"Mechanical mixtures ranging from 15 to 25 per cent. can be used on Apple and Pear while the trees are in full leaf with but slight injury to the trees; while mixtures of even less strength are liable to cause some injury to stone-fruits under the same conditions. Such dilute mixtures appear to be of value only against young insects unprotected by scales.

"A good grade of kerosene can apparently be applied to large, vigorous Pear and Apple trees while they are completely dormant and cause little injury; but not to such trees after the sap begins to flow. With stone-fruits, on the contrary, especially with Peach, dormant trees suffer even from dilute mixtures, but even pure kerosene may be applied to such trees while the buds are swelling but are still unopened.

"Peach and Plum can be sprayed quite safely with 25 per cent. mechanical mixtures of crude petroleum ($43\frac{1}{2}°$ to $44°$ Baumé, 0·77 sp. gr.) after buds commence to swell. If treated while dormant the trees are generally injured, often killed."

It is unsafe to treat Pear and probably Apple with crude petroleum of the strength given after buds have commenced to swell; but even 50 per cent. mechanical mixtures may be used on dormant Apple and Pear trees. Scale insects, even when fully exposed, were not all killed by the 15 per cent. strength of crude petroleum; though two applications of this strength were effective, or one of the 25 per cent. strength.—*R. N.*

Schizoglossum strictissimum. By Spencer Le M. Moore (*Journ. Bot.* 475, pp. 254-5; 7/1902).—Description of a new species of Asclepiad, collected by Dr. Rand, at Bulawayo, from specimens in the National Herbarium.—*G. S. B.*

School Gardens. By F. M. Powell (*U.S.A. Hort. Soc. Iowa*, 1901, p. 93; plates).—The writer of this article strongly advocates and explains the idea of gardens attached to lower schools. Froebel is quoted as follows: "Let your child plant his own garden, gather his own harvest of fruit and flowers, learn through his own small experience something of the influence of the sun, dew, and rain, and gain thereby a remote presentiment of the reciprocal energies of nature, and a reverent feeling for the divine life and law expressed in nature." Mention is made of many school gardens in the United States of America, and especially those established by the National Cash Registers Company at Dayton, Ohio. Two good illustrations of gardens, showing the school children at work, add greatly to the interest of the article.—*V. J. M.*

School Gardens in Germany (*Garden*, p. 209; 27/9/1902).—An article outlining the training of children in the agricultural districts in the intelligent cultivation of the land, as in Germany. A significant fact is worth noting, that those districts are most advanced and prosperous where some influential landowner, not necessarily connected in any way with school management, has been found to take a personal interest in the matter, a case in point being the mayor of a town in the neighbourhood of Geistingen, who began the work of reformation in fruit-growing in his own vicinity by himself planting, as a beginning, some 4,000 fruit-trees of good sorts after approved methods.—*E. T. C.*

Senecio (Ligularia) clivorum. By A. Henry (*Gard. Chron.* No. 821, p. 217, supp. plate; Sept. 20, 1902).—This fine plant is a native of Central and Western China and Japan; it has recently been introduced by Messrs. Veitch. It grows in open, moist, grassy spots on the mountains, and occasionally in woods; it is a tall, vigorous, succulent, perennial plant, growing to height of about 3 feet. The flowers are in loose corymbs of about ten or twelve blossoms, which are of an orange-yellow colour and 4 inches in diameter. Descriptions and notes are also given of five other nearly allied species.—*G. S. S.*

Senecio, Monograph of North and Central American Species of. By Jesse More Greenman (*Engl. Bot. Jahrb.* vol. xxxii. 1902, pp. 1–33; 13/5/1902).—The first part of the monograph only is here published. It comprises a general account of the morphology of the genus, a review of the systematic grouping of the species in sections and sub-genera, a nominal enumeration of the species in their respective sections, and an account of their geographical distribution. The second part, which is to follow, will contain the special systematic portion.

A. B. R.

Shortia uniflora. By W. T. Hindmarsh (*Gard. Chron.* No. 804, p. 337; fig. 116; May 24, 1902).—This charming little plant is said to be one of the most beautiful of rock plants, and to be very superior to *S. galacifolia.* It has very pale bluish-white or bright rose-coloured blossoms, about $1\frac{1}{2}$ inch in diameter. It appears at present to be a very rare plant in this country.—*G. S. S.*

Shrubs of Wyoming, The. By Elias E. Nelson (*U.S.A. Exp. Stn. Wyoming, Bull.* 54; illustrated).—An interesting account of the principal shrubs and small trees of Wyoming, some of which might be improved by cultivation and brought into gardens, either for ornament or for their fruits. Amongst the illustrations are those of 'Winter-fat on the Plains' (*Eurotia lanata*), which is good for forage, and greedily eaten by stock; 'Ninebark' (*Neillia Torreyi*, syn. *Opulaster monogynus*), belonging to the Rose family, as does also *Spiræa discolor* (syn. *S. dumosa, Holodiscus dumosus*), very pretty when in flower. The 'Riverbank Grape' (*Vitis vulpina*) has given rise to several cultivated varieties. The 'Buffalo

Berry' (*Shepherdia argentea*, syn. *Lepargyræa argentea*) is useful both for its fruits (which make excellent jelly) and for ornament, but unfortunately the branches are too thorny to allow of the fruit being readily picked. It is hoped that cultivation may obviate this difficulty.

C. H. C.

Shrubs, Pruning Hardy. By J. Clark (*Garden*, No. 1,595, p. 389, 14/6/1902; No. 1,596, p. 405, 21/6/1902; No. 1,597, p. 428, 28/6/1902).—The correct time to do this most important garden work is not widely known; it of course depends upon whether the shrub flowers upon the current year's growth or that of the past year. In this article instructions are given how to proceed with all the most important shrubs.

E. T. C.

Skimmias. By J. Clark (*Garden*, No. 1,589, p. 287; 3/5/1902).—Describing several varieties of this shrub. As a plant for town districts the *Skimmia* is not to be surpassed, as it withstands both smoke and dust well, and will flower and fruit freely under conditions which are very trying to many plants.—*E. T. C.*

Slugs, Detergent for (*Rev. Hort.* p. 249; June 1, 1902).—Wash walls with a solution of lime and sulphate of copper, and dust infested spots with lime in powder, or a mixture of sulphate of iron and sand or dry soil.—*C. T. D.*

Slugs that "Spin" Threads. By W. M. Webb (*Gard. Chron.* No. 821, p. 219, fig. 74; Sept. 20, 1902).—Many, if not all, of our British slugs have the power of letting themselves down from a height by means of a thread of the mucus which they so freely secrete, and they are also able to ascend by the same. The figure shows two slugs, one ascending and the other descending by means of a thread of mucus.

G. S. S.

Sophro-Cattleya × Nydia (Cogniaux in *Dict. Icon. Orch.*, *S.-C.* × pl. 1; 6/1902). A hybrid raised by Messrs. Charlesworth & Co., of Bradford, out of *S. grandiflora* by *C.* × *calummata*, and first flowered in 1901 Flowers deep rosy-carmine, faintly dotted with purple; habit of growth and form of flowers similar to the *Cattleya* parent.—*C. C. H.*

Spraying Orchards for the Codlin Moth. By Fabian Garcia (*U.S.A. Exp. Stn. New Mexico, Bull.* 41; March 1902).—In this region it is found that the worms enter the Apple from the side—unlike in the Eastern States, where they mostly enter at the calyx end. During good crop years it is found necessary to spray more than three times; it is found best to begin by spraying the topmost limbs, working down through the centre of the tree to the outer and lower limbs, especially in heavily foliaged trees. The tree should be wet all over, though not necessarily dripping. Of the nozzles the "Bordeaux" was found to give best satisfaction.

White arsenic, in the form of arsenite of lime and soda, is found to be a purer and cheaper poison than Paris green. Lime is used to keep it from burning the foliage.

Arsenite of soda = white arsenic 1 lb., sal soda (washing soda) 4 lb., water 2 gallons, are boiled together for fifteen or twenty minutes, when the arsenic will have dissolved; replace the water lost in boiling. With every fifty gallons of water use two quarts of the stock solution and two pounds of freshly slaked lime. Keep the stock solution covered to prevent evaporation.

To become acquainted with the moth, catch a few worms and put them into a bottle; put a few pieces of paper in with them and cover the bottle with some wire gauze. In about twelve or fifteen days some of the worms will have developed into small brownish moths, with very noticeable dark brown spots, streaked with bronze near the hind angle of the front wings.

The cost of the different spraying mixtures is given below per fifty gallons wash:—

White arsenic bought in	10 lb. lots	.	4*d*. per lb.
Paris green ,,	28 lb. lots	.	8*d*. per lb.
Sal soda ,,	125 lb. kegs	.	7*s*. per keg.
Lime	...	.	2*s*. per 100 lb.

Paris Green Mixture—

Paris green, 4 oz.	2*d*.
Lime, 1 lb.	$0\frac{1}{4}d$.
Cost per barrel . .	$2\frac{1}{4}d$.

Arsenite of Lime—

White arsenic, 4 oz.	1*d*.
Lime in stock solution, $\frac{1}{2}d$. per lb. . .	$0\frac{1}{8}d$.
Freshly slaked lime, 1 lb.	$0\frac{1}{4}d$.
Cost per barrel . .	$1\frac{1}{2}d$.

Arsenite of Soda—

White arsenic, 4 oz.	1*d*.
Sal soda, 1 lb.	$0\frac{3}{4}d$.
Freshly slaked lime	$0\frac{1}{2}d$.
Cost per barrel . .	$2\frac{1}{4}d$.

Cost of spraying a 30-acre orchard, first spraying:

	£	s.	d.
Four men, 5 days @ 3*s*. 2*d*. per day . . .	3	2	6
White arsenic, at 5*d*. per lb., 4 oz. per barrel, 90 barrels	0	9	6
Sal soda @ $1\frac{1}{2}d$. per lb., 1 lb. per barrel, 90 barrels	0	11	3
Lime at $\frac{1}{4}d$. per lb., 4 lbs. per barrel, 90 barrels .	0	7	6*
Total .	£4	10	9

The figures are not exact on account of rates of exchange, &c.

The second spraying was done with Gould's "Monarch Two-cylinder" spray pump, mounted on a 500-gallon tank, with two lines of hose. It took three men seven days, and cost 3*s*. 3*d*. more than the first spraying, the same amount of materials being used.

* Used 2 lbs. per barrel more than ordinarily.

Practically 50 per cent. of the fruit picked from unsprayed trees with a good crop is injured by the codlin moth. As a rule spraying tends to reduce the number of windfalls. Over 90 per cent. of the windfalls from unsprayed trees are wormy.

From the experiments one would be led to believe that during years of small crops one may expect poor results from spraying, except, perhaps, in the case where the spraying is done every week. When there is a good crop, the trees sprayed oftenest in each series show the largest percentage of sound fruit, while the trees receiving the least number of sprayings show the smallest percentage of sound fruit.

Early Apples appear to be less attacked by codlin moth caterpillars than late varieties.—*C. H. H.*

Squash Bug. By C. M. Weed and A. F. Conradi (*U.S.A. Agr. Exp. Stn., New Hampshire, Bull.* 89; 2/1902; 2 figs.).—This bug (*Anasa tristis*, De G.) attacks Squash, Cucumber, Pumpkin, Marrow, and Melon. The best account of the insect is that given in the U.S. Div. of Entomology, Bull. 19, by Mr. F. H. Chittenden, but the present paper gives an account of the life-history. The eggs are laid in clusters on the leaves in June and July, and hatch out within a fortnight. The bugs injure the leaves by sucking the sap, causing the leaves to dry up in patches. The bug is one-brooded, and hibernates in the adult stage among fallen leaves, &c. Its natural enemies in New Hampshire are a two-winged fly, *Trichopoda pennipes*, perhaps toads (which, however, are killed by the odour given off by the insects in a confined space), and a fungus which could not be determined. The chief remedies recommended are handpicking, clean, good culture, and spraying the ground with kerosene as soon as the first frost kills the vines.—*F. J. C.*

Sterilisation of Soil in Greenhouses for Fungous Diseases. By G. E. Stone (*U.S.A. Exp. Stn. Mass.; Pub. Doc.* 33; 1/1902; pp. 74–85).—Sterilisation of the soil has been recommended for the extermination of such fungous pests in the soil as cause drop in Lettuce, &c., "timber-rot" in Cucumbers, *Rhizoctonia*, and *Pythium De Baryanum*, and in part for stem-rot in Carnations; nematode worms which cause disease in Cucumbers, &c., aphis, red spider, and seeds of weeds are also killed.

Market growers are practising sterilisation of the soil in whole ranges of greenhouses, and find that not only does it rid the soil of certain disease germs, but also increases the crops. An experiment is detailed showing that Lettuce gained 33 per cent. in weight when grown in sterilised as compared with unsterilised soil, and 2·2 per cent. of this increase was water.

The sterilisation was effected either by hot water or by steam. The hot water method requires the treatment of the soil previous to the putting in of each crop, and only a few inches of surface soil are sufficiently heated by this method to kill the mycelium of the drop fungus.

The application of steam seems to be the most effective method of sterilisation. The best means of applying the steam to the soil seems to be through a system of perforated iron or galvanised-iron pipes. The tubes are made up into a framework so that a complete circulation of steam may be effected, or the appliance may be in sections easily put together or taken apart, and so constructed that they may be readily extended in length or width. Two-inch pipes with perforations $\frac{1}{8}$-inch in diameter, placed about one inch apart each way, or closer, are best.

If a bed twenty feet in diameter has to be sterilised, the framework of pipes, ten feet wide, is laid on the surface of the soil, and the soil from the sides of the bed to the depth of a foot placed on the framework; the steam is then passed through the pipes at high pressure (about thirty pounds to the inch) for about 1 hour to $1\frac{1}{2}$ hour. The soil is then replaced and the apparatus removed to the next part of the house, and so on.

The cost of sterilising 1,000 cubic feet of soil varied from \$2 to \$8.33 according to circumstances when iron pipes were used, and \$16 when porous tiles two inches in diameter were used; while the cost of removing the soil to the depth of one foot and replacing it with fresh soil was at the rate of \$37.50 per 1,000 cubic feet.*

Sterilising the soil for Onion growing outdoors is to be tried next year, as well as for other crops. It is hoped that such methods will have the effect of appreciably reducing the number of weeds, and thus lessening the cost of growing Onions.—*F. J. C.*

Stock (Six-week) 'Excelsior.' By S. Mottet (*Rev. Hort.* p. 346; one woodcut; July 16, 1902).—Very fine strain, raised by Vilmorin; compact, very double, with long inflorescence, in four colours: white, brown, pink, and violet.—*C. T. D.*

Strawberry Books. By C. Harman Payne (*Gard. Chron.* No. 816 p. 109, Aug. 16, 1902).—The writer in this article enumerates, with a short description of each, all the various books which deal primarily with the cultivation of this favourite fruit. The earliest was published in 1812 and was written by Thos. Haynes. American and Continental works on the same subject are also referred to. The article concludes as follows: "At any rate as a first contribution to the bibliography of a favourite and deservedly popular fruit, I think the present article may be of service, hence my desire to place what I know of it on permanent record in the columns of the *Gardeners' Chronicle.*"—*G. S. S.*

Strawberry Culture in Mississippi. By A. B. McKay (*U.S.A. Exp. Stn. Mississippi, Bull.* 75, illustrated).—Amongst fruits the Strawberry is particularly adapted for culture in Mississippi, for (1) it is the first fruit of the season; (2) results are obtained in less time than any other; (3) total failure seldom occurs. The Strawberry will adapt itself to any soil if well treated, but prefers clay.

Amongst varieties, 'Excelsior,' 'Hoffman,' 'Lady Thompson,' 'Cloud,' 'Klondyke' and 'Gandy' (given in the order of ripening) have proved reliable. There being sufficient potash in the clay soils of Mississippi to satisfy the demands of this fruit, it need only be applied to the sandy sections. If any fertiliser is required it would seem to be phosphoric acid.

* These results were furnished by market growers.

Mulching with cotton hulls, or other material failing this, is recommended to keep the berries clean, and to prevent caking of the soil by the treading incidental to picking.

The bulletin ends with a detailed description of some seven or eight kinds.—*C. H. C.*

Strawberry Mildew. By P. Hennings (*Zeit. f. Pflanz.* xii. 1902. pp. 16, 17).—Reports *Sphærotheca mors-uvæ* in Russia—near Moscow (see E. S. Salmon, JOURN. R.H.S. xxv. p. 132).—*W. G. S.*

Streptocarpus Mahoni. By Sir J. D. Hooker (*Bot. Mag.* tab. 7857).—Nat. ord. *Gesneraceæ*, tribe *Cyrtandreæ*. Native of British Central Africa. A stemless plant with a solitary leaf, and many scapes on the base of the costa of the leaf, with violet-blue flowers.—*G. H.*

Strophanthus, Nomenclature of. By James Britten (*Journ. Bot.* 474, p. 233; 6/1902).—A note showing that *S. sarmentosus*, var. *verrucosus* Pax., has priority as a varietal name over *S. Petersianus*, var. *grandiflorus* N. E. Brown, which Dr. E. Gilg has since raised to specific rank as *S. grandiflorus* (N. E. Brown), Gilg.—*G. S. B.*

Styraceæ, Notes on. By Janet Perkins (*Engl. Bot. Jahrb.* vol. xxxi. 1902, pp. 478–488; 2/9/1902).—Contains descriptions of some new species of *Styrax* from Tropical America and a list of all known Tropical Asiatic species of the genus arranged in clavis form. A few new species are described from China and Sumatra.—*A. B. R.*

Sugar Cultivation, Cost of. By Messrs. J. W. Mitchell and Muirhead (*Bull. Bot. Dep. Jam.* ix., Pt. 4, p. 56).—This deals with the experiences of every detail of cultivation on an estate in Vere, Jamaica, of 400 acres.—*G. H.*

Tapioca or Cassava. By A. J. Boyd (*Qu. Agr. Journ.* x., p. 384; May 1902).—After description of the two species of Sweet and Bitter Cassava, the mode of cultivation is described, the preparation of the farina, and the advantages of the crop.—*M. C. C.*

Tapioca or Cassava. Notes on the Cassava plant. By James Pink (*Qu. Agr. Journ.* x., p. 388; May 1902).—These notes embrace description of the varieties of *Jatropha* and the manufacture of the Cassava, concluding with the assertion that, "as a matter of fact, an acre of Cassava is worth more than an acre of Sugar-cane."—*M. C. C.*

Tobacco. How to secure and retain a good market for Queensland Tobacco. By R. S. Nevill (*Qu. Agr. Journ.* x. p. 273; April 1902).—This communication suggests "building better sheds and taking more care in curing the crop; and properly handling it after it is cured." Then follow the details for securing each desideratum as applied to the locality.
M. C. C.

Tobacco Cultivation and Curing. By T. J. Harris, Sup. of Exp. Stn. Hope (*Bull. Bot. Dep. Jam.*, vol. ix. Pt. 4, p. 49, and Pt. 5, p. 65;

1902).—This article deals with the nursery site, beds, burrning soil, sowing, &c.; the planting and details; the whole being "a brief outline of a plan that may be modified to suit varying conditions."—*G. H.*

Tobacco-growing under Shade in Connecticut. By E. H. Jenkins (*U.S.A. Exp. Stn. Connecticut, Bull.* 137; February 1902).—Experiments have been carried out with a view to ascertaining whether it is possible to grow the Sumatra type of Tobacco for leaf wrappers under artificial shade at a profit.

The cost of shade used at present is rather high. The means employed consists of a light wooden framework, covered with cheesecloth. The experimental plots in 1901 varied in area from one-twentieth of an acre to eighteen acres. Providing the cost of shading can be reduced, it is almost certain to turn out a financial success.—*E. F. H.*

Tobacco Soils, Willis and Huntsville. By H. H. Harrington and P. S. Tilson (*U.S.A. Exp. Stn. Texas, Bull.* 61, 1902).—The chemical composition and mechanical analysis of soils taken at various districts where Tobacco is grown, with an endeavour to show what type of soil is most suitable to produce the finest wrappers and seed.—*E. F. H.*

Tomato Culture. By Prof. E. E. Little (*U.S.A. Hort. Soc. Iowa,* 1901, p. 89).—This is a very interesting paper, and treats the subject more or less from a commercial standpoint. After commenting that the Tomato is the product of the century just closed, and that not until 1836 was the fruit sold in a general way for food, the author estimates that in the United States the canneries alone fill annually 5,500,000 cases of twenty-four cans each. The grower should not depend entirely upon the seedsmen for his varieties, but should select the fruit from the plant that comes nearest his ideal, and then save the seed of this variety. One should keep in mind the points most essential to a good variety, such as vigour of plant, habit of growth, size of fruit, form, colour, and solidity.

The plants need considerable moisture, and the houses in which they are grown (if not grown outdoors) should be light and tight, and sufficiently high to allow of the training of the plants to a height of at least five feet above the surface of the soil. Where the benches are, say, three feet wide, the plants should be eighteen inches apart in one row. Temperature should be about 60° for night and 75° for day. Good ventilation and rich soil are necessary. From the sowing of the seed to the beginning of the fruit is generally about five months. Pollination of the house crop requires some work on bright days.—*V. J. M.*

Trees and Shrubs for English Gardens. By W. J. Bean (*Garden,* No. 1,591, p. 323, 17/5/1902; No. 1,594, p. 380, 7/6/1902; No. 1,603, p. 100; 9/8/1902).—This series of articles deals at length with the various classes of trees and shrubs (many comparatively unknown and little used) which are available for the beautifying of our gardens. The best of the Conifers, deciduous and evergreen shrubs, ornamental flowering shrubs, &c., are each described, with cultural notes. Much valuable advice is given with respect to grouping.—*E. T. C.*

Trees and Shrubs in Poor Soils (*Garden*, No. 1,589, p. 281; 3/5/1902).—An interesting leading article in which the writer calls attention to the fact that some classes of trees and shrubs are especially successful on poor land. A list of suitable subjects is given.—*E. T. C.*

Trees, Young, and Sunstroke (*Garden*, p. 157; 13/9/1902).—A very interesting article upon a matter little noticed in gardens. The first marks of sunstroke are seen in the shape of longitudinal cracks in the bark, which is slightly browned and flattened, as if there were a hollow underneath. The part affected is from about one foot to three feet in length and from one inch to three inches in width. If the bark is cut away the wood beneath will be found perfectly firm, but hard and dry, more a piece of seasoned wood than part of a growing tree. Sunstroke must not be confounded with the ravages of the caterpillars of the goat moth and wood leopard moth, the external signs of which are much the same.—*E. T. C.*

Tulipa ingens. By J. Hoog (*Gard. Chron.* No. 811, p. 14; fig. 7; July 12, 1902).—This new Tulip is a native of the mountains of Bokhara. It has very large bright scarlet-vermilion blossoms, with petals nearly four inches in length, each marked with a black blotch at the base; the outer ones are marked externally with a broad, soft, yellowish band. The bulb is large; the outer coats are very thin and of a pale brown colour, covered on the inside with long silky hairs. It is nearest in botanical position to *T. altaica* of Pallas and *T. Eichleri*, Regel. A detailed description of the plant is given.—*G. S. S.*

Tulipa Wilsoniana. By J. Hoog (*Gard. Chron.* No. 813, p. 50; July 26, 1902).—Another new Tulip from the mountains in Central Asia. It was found in the neighbourhood of Askabad. Petals about two inches in length, and of a particularly deep and full vermilion-scarlet colour, with a black blotch at the base. The plant is fully described.—*G. S. S.*

Tulips, New (*Rev. Hort.* p. 223; May 16, 1902).—Two new introductions from Persia, *Tulipa Micheliana* and *T. Wilsoniana*, by M. Sintenis. Magnificent red flowers and longitudinal red lines in the foliage. Flowered by M. Micheli in the Crest gardens.—*C. T. D.*

Tulips, New Species from Central Asia. By J. Hoog (*Gard. Chron.* No. 805, p. 350; figs. 119 and 120; May 31, 1902).—In this article, which is not completed, two new species are described and figured, *T. nitida* and *T. Micheliana.* The first species is a native of the mountains near Bokhara; it has flowers of an intense and very brilliant vermilion-scarlet, with a small black blotch at the inner base of the segments. *T. Micheliana* grows on the Transcaspian steppes; its flowers are campanulate, and of a bright vermilion-scarlet colour, the three outer segments being tinged with lilac outside; the base of the segments is marked with black lanceolate blotches.

G. S. S.

Tulips of Long Ago. By B. Scotland (*Gard. Chron.* No. 801, p. 285; May 3, 1902).—The history of these well-known bulbs is told in a very interesting manner, and a considerable amount of information is given about the old names and the prices that some varieties were sold for.—*G. S. S.*

Turnip Sawfly. By E. Jacky (*Zeit. f. Pflanz.* xii. 1902, pp. 107–109).—Reports the spread of the insect in Switzerland in 1901. Observed to be most destructive from August to October. Methods of treatment reviewed.—*W. G. S.*

Tussock Moth, White-marked (*Orgyia leucastigma*). By Prof. A. L. Quaintance (*U.S.A. St. Bd. Agr., Maryland,* vol. iv., 1901, pp. 92–94; 1 fig.).—The larvæ caused defoliation of trees in August. Shade trees and orchard trees are attacked. The winter is passed in the egg state, the eggs being laid in white masses in September near or on the cocoon. The larvæ hatch in the spring, and feed on the leaves, often migrating to other trees. The female is wingless.—*F. J. C.*

Uredineæ in America. By J. C. Arthur (*Bot. Gaz.* xxxiv. No. 1, p. 1; with 4 figures).—The author describes in full the species occurring upon *Phragmites, Spartina,* and *Arundinaria,* on which there is one species of *Uromyces* and six of *Puccinia.*—*G. H.*

Vanda × confusa. By R. A. Rolfe (*Orch. Rev.* p. 196; July 1902). —Some interesting records of natural hybrid Vandas are entered upon.
H. J. C.

Vanilla. "Sur deux Maladies du Vanillier." Par M. le Dr. G. Delacroix (*Bull. Soc. Myc. Fr.* xviii. p. 274; 1902; with figs.).—This communication contains a description of the forms or stages in the history of *Calospora vanillæ* (Massee). It suggests that the conidial form, or *Glœosporium vanillæ* (Cooke), was described previously as *Vermicularia vanillæ* (Delacroix), and the name now proposed, as more accurate, should be *Colletotrichum vanillæ.* The author suggests that the species of *Gnomoniopsis* described by Miss Stoneman (*Botanical Gazette,* 1898, p. 110) is an immature condition of *Calospora vanillæ.*

Two other species of *Glœosporium* are said to occur on *Vanilla,* viz. *G. affine* (Sacc.) and *G. Bussei* (Henn), and doubts are expressed whether they and *G. macropus* (Sacc.) are different from the *Glœosporium* of *Vanilla.*

On the fruits of *Vanilla* from Tahiti a new species of *Uromyces* is described under the name of *Uromyces Joffrini* (Delacroix), of which the uredospores had been described by Cooke as *Uredo scabies* (*Grevillea,* xv. 1886, p. 18) on leaf of *Vanilla* from Colombia (with figs. 10 to 13).
M. C. C.

Vanilla Culture as practised in the Seychelles Islands. By S. J. Galbraith (*Bull. Bot. Dep. Jam.* ix., Pt. 8, p. 113; plate).—This describes method of culture, starting a vanillery, preparing the vines for cropping, and artificial fertilisation, curing the pods for market, and expenses, concluding with a summary.—*G. H.*

Vangueria Randii. By Spencer Le M. Moore (*Journ. Bot.* 475, pp. 252, 253; 7/1902).—Description of a new species collected by Dr. Rand at Bulawayo, from specimens in the National Herbarium.

G. S. B.

Vine, Grafting of the. By J. Zawodny (*Gartenflora.* p. 429; 6 figs.; 15/8/02).—Illustrations and description of a method of grafting the soft green shoots of the vine. (American vine as stock, European varieties as scions.)—*J. P.*

Violets, The Cultivation of. By Richard Parker (*Garden*, No. 1,586, p. 233, 12/4/1902; No. 1,587, p. 264, 19/4/1902; No. 1,593, p. 360, 31/5/1902).—A practical article giving full directions for cultivating the violet. The writer criticises the method commonly employed —*i.e.* dividing the old plants as they pass out of flower, and replanting directly in the summer quarters—and advances an alternative method.

E. T. C.

Viticulture: Pruning. By E. H. Rainford, Instructor on Viticulture (*Qu. Agr. Journ.* x. p. 454; June 1902; with plates).—Contains descriptions of short pruning (the bush system), long pruning, and mixed pruning, with their various systems. Illustrated by two plates.

Wasps and Fruit (*U.S.A. St. Bd. Hort. Missouri, Report* 1902, p. 97).—Planting honey-yielding flowers near fruit-trees is said to keep wasps from the fruit. Buckwheat is recommended.—*F. J. C.*

Water Famine, Providing against. By H. W. Ward (*Gard. Chron.* No. 813, p. 52; July 26, 1902).—The scarcity of water during the last three years renders it very necessary in some places to take every precaution against allowing any to run to waste. A great deal may be done in this direction by collecting the rain-water that falls on roofs of greenhouses and other buildings, and by forming ponds in places where surface-water, which would otherwise rush down roads and steep places, may be caught and stored. Directions are given for constructing tanks which are suitable for this purpose. Everyone knows that rain-water is far better for gardening purposes than that supplied from wells or water companies, so that for more reasons than one it is very desirable to store rain-water.—*G. S. S.*

Wild Garden, Autumn Flowers for. By Danske Dandridge (*Garden*, p. 177; 13/9/1902).—A charming contribution from an American writer. It deals with the Golden Rods, Asters, Snakeroots, and many other beautiful prairie flowers.—*E. T. C.*

Willows (*Garden*, p. 215; 27/9/1902).—A note about the importance of planting Willows, with an illustration of the trees by waterside. Reference is made to the coloured bark kinds, and a hope is expressed they will not be forgotten. The golden and red-barked varieties of *Salix vitellina* are charming for their winter colouring. These, though scarcely ever seen, are capable, when properly treated, of producing bright warm effects that are especially charming from November to February. When allowed to grow naturally this Willow—known popularly as the

Golden Osier—forms a graceful tree of large size. Its twigs have a golden or red tinge, according to the variety, but on fully-grown trees these twigs are not large. To obtain a bright patch of colour, plant these Willows in good-sized groups.—*E. T. C.*

Wineberry, The Japanese (*Rubus phœnicolasius*). Anon. (*Journ. Hort.* p. 290; September 25, 1902).—There is an engraving of this, which is said to be ornamental, and to produce fruit which makes excellent preserves; but though quite hardy and easily cultivated, it has not come into favour in English gardens.—*C. W. D.*

Xysmalobium gramineum. By Spencer Le M. Moore (*Journ. Bot.* 475, p. 254; 7/1902).—Description of a new species of Asclepiad, collected by Dr. Rand at Bulawayo, from specimens in the National Herbarium.—*G. S. B.*

Yucca, A Double-flowered. By Ed. André (*Rev. Hort.* pp. 329–30; one woodcut; July 16, 1902).—Among various hybrid Yuccas described, raised by M. L. B. Deleuil at Marseilles, one has produced an inflorescence consisting of a double flower from which a number of smaller flowers spring. Whether it is constant to this form appears to be somewhat doubtful.—*C. T. D.*

Zephyranthes flava. By James Britten (*Journ. Bot.* 479, pp. 391, 392; 11/1902).—An inspection of Ruiz and Pavon's herbarium in the British Museum shows that Herbert's three species *Pyrolirion flavum*, *aureum*, and *flammeum* do not differ.—*G. S. B.*

A B C

HYBRID LILAC.

The result of crossing *Syringa Josikæa* ♂ (A) with *S. Emodi rosea* ♀ (C). The hybrid (B) more resembles the male parent in colour and form of flower, but is nearer the female in foliage and branching habit of the inflorescence.

JOURNAL

OF THE

Royal Horticultural Society.

Vol. XXVII. 1903.

Part IV.

PESTS OF GARDEN VEGETABLES.

By M. C. Cooke, M.A., LL.D., A.L.S., F.R.H.S., V.M.H.

The majority of the pests which infest garden vegetables, salads, and sweet herbs, are specifically distinct from those which attack garden flowers, but are equally prevalent and destructive. As, however, they are closely allied, the treatment and remedies will be found to be, in most cases, the same. It cannot be urged too often that, as prevention is better than cure, the greatest care should be taken against the introduction of fresh diseases into the kitchen garden, and any encouragement to the permanency of old ones. Wild plants—or "weeds," as they are termed—are many of them subject to fungoid diseases, which may transfer themselves to kindred cultivated plants when growing in their vicinity. As a warning to careless cultivators, wild Cruciferous or Composite weeds should not be permitted to invade the garden or its borders. Furthermore, the "rubbish heap," in an out-of-the-way corner, should be dispensed with, because the resting spores, or the winter condition of some of the most troublesome pests, will be found in the stems or other dead parts which are usually consigned to a rubbish heap instead of being burnt; and consequently the "rubbish heap" becomes a teeming emporium for the dispersion of active spores in the spring, so that from this centre a very large area may speedily be infected.

Cabbage Leaf Spot.

Phyllosticta Brassicæ (Curr.), Pl. VII. fig. 95.

Cabbage leaf spotting is not a serious calamity, but it may become annoying when excessive. The most common spot is that above named, which occurs also on rape. The spots are generally rather large and bleached, becoming white on the upper surface. The receptacles are very small and numerous, chiefly towards the centre of the spots.

The sporules are ovoid, with two nuclei (5 μ long) expelled from the mouth of the receptacle, when mature, in small rosy tendrils.

It is known also to occur in France, Belgium, and Portugal.

Seldom of sufficient importance to demand a remedy, but in such case spraying of young plants might be beneficial.

Sacc. Syll. iii. 207.

Another species (*Phyllosticta Napi*) is known in France, but is very little different in appearance, and a slight difference in the form of the sporules.

A leaf spot with two-celled sporules (*Ascochyta Brassicæ*) is known on the Continent, forming large irregular bleached spots, on which the receptacles are densely crowded. The sporules are fusiform, septate and nucleate (15–16 × 3–4 μ).

Cabbage Anthracnose.

Glœosporium concentricum (Grev.), Pl. VII. fig. 96, sporules.

In 1851 attention was called to this parasite by a memoir in Journal of R.H.S., in which it was stated that the fungus was discovered by Dr. Greville thirty years previously, but never constituted itself a pest until the former year.

It forms on both surfaces of the leaves of Cabbage and Cauliflowers, roundish, often confluent, patches, consisting of little white specks disposed more or less concentrically, those of the centre frequently becoming yellow, and at length fading away.

The sporules are developed beneath the cuticle, and are oblong and cylindrical, often curved, containing two or three nuclei (about 20 × 7 μ) borne upon short delicate spore-bearers. These sporules are mixed with a viscid fluid, and in dry weather ooze out through the fissures in the cuticle as rude irregular tendrils. There is no trace of a perithecium, only a subcuticular cell, in which the sporules are developed. The tendrils are dissolved with moisture, and the sporules are disseminated over the leaves.

This fungus has also been found in Germany, but nowhere has it become a troublesome pest, and, as far as we can learn, is only an occasional visitor

Sacc. Syll. iii. 3665; *Journ. R.H.S.* vol. vi. 1851, p. 117, with fig.; *Cooke, Hdbk.* 1408.

There appears to be no chance of discovering what *Cercospora Bloxami* B. and Br. can be. It was imperfectly described, and the supposed original specimens have no fruit (Pl. VII. fig. 97).

Cabbage White Rust.

Cystopus candidus (Pers.), Pl. VII. fig. 98 *a*, *b*.

This is a very old and very common offender, and is not confined to Cabbages, but extends its ravages to almost any Cruciferous plant. It was described by Berkeley in 1848 as White Rust, and was then believed, and long afterwards, to be related to the ordinary rusts, but recently, when better known, it has found a place near the Rot Moulds.

The external appearance consists of swollen, convex, white pustules, sometimes in rings and patches, and sometimes scattered over all the green parts. At first the cuticle is shining and unbroken, but at length it is irregularly ruptured, to permit the spores to escape. The base of these pustules consists of a mass of irregular, thick, knotted, mycelium, from which arise club-shaped cells, bearing a chain of globose spores, slightly attached to each other, and forming a kind of necklace, the upper one falling away, and then the next, and so on in succession, as they become matured (12–18 μ diam.).

Each spore or conidium when placed in water or a damp situation undergoes just such a change as we have already described for the conidia of the Rot Moulds (see Introduction, p. 2). From five to eight zoospores are formed in the interior, and escape by rupture of the wall of the conidium. Thus each conidium produces from five to eight active zoospores, which finally serve to disseminate the parasite by infection.

In the same manner also as in the rot mould does the internal mycelium produce resting spores, which, after a period of rest, probably through the winter, develop numerous active zoospores in the spring.

In the present species the resting spores are globose (30–50 μ diam.), externally warted with large obtuse warts, and of a brown colour.

This pest is distributed throughout Europe, and many parts of Asia, Africa, and America. It may truly be said to be cosmopolitan.

Sacc. Syll. vii. 792; *Mass. Pl. Dis.* 59; *Smith, Field Crops*, 86; *Cooke, M. F.* figs. 198–200; *Cooke, Hdbk.* No. 1564; "*White Rust*," *Journ. R.H.S.* vol. iii. 1848, p. 265, with figs.; *Tubeuf, Dis.* 123.

Cabbage Black Mould.

Alternaria Brassicæ (Berk.).

This black mould was first described by Berkeley under the name of *Macrosporium Brassicæ*, and was found by him growing on cabbage leaves in company with the common *Cladosporium herbarum*, of which he considered it to be probably a condition. The conidia are clavate, and divided by from five to eleven septa, some of which have longitudinal divisions, and are of an olive colour (60–80 × 15–16 μ). Subsequent examination seems to have shown that the conidia are produced in short chains, attached end to end, as is the case in *Alternaria*, and hence the change of name.

It is evidently very rare as a garden pest, although it has also been found in France and Italy. The mould is developed on dry spots of dead tissue, on cabbage leaves, and may probably be only a saprophyte, which we have never seen, and probably it has not occurred in Britain again during nearly half a century.

Tubeuf, Dis. p. 518 ; *Cooke, Hdbk.* No. 1733 ; *Sacc. Syll.* iv. 2613.

Cabbage Rot Mould.

Peronospora parasitica (Pers.), Pl. VI. fig. 30.

Sometimes found in company with the "white rust," and often independently, on the leaves of many Cruciferous plants.

We have already introduced this mould in the "Pests of the Flower Garden," where it is far less troublesome and dangerous than here, and to that account we have nothing to add, beyond the intimation that this disease partakes essentially of the characters of the well-known Potato disease, and that whatever remedies may have been applied with success in one instance are likely to avail in the other.

The only fungicide which has been recommended for use in the early stages of this disease is diluted Bordeaux Mixture, but of course this will be of no avail where the mould is well established and the mycelium has penetrated deeply into the tissues of the host plant so that the resting spores are in course of formation. In such case the only alternative is to prevent the spread of disease by destroying all affected plants which may contain resting spores.

Known through the whole of Europe, the greater part of America, and in Asiatic Siberia.

For development of "rot moulds" see Introduction, p. 2.

Sacc. Syll. vii. 830 ; *Mass. B. F.* 119 ; *Mass. Pl. Dis.* p. 79 ; *Smith, Field Crops*, 86 ; *Gard. Chron.* Nov. 17, 1883, figs. 109–111 ; *Cooke, M. F.* f. 265 ; *Cooke, Hdbk.* No. 1778.

Damping off.

Pythium De Baryanum (Hess.), Pl. IX. fig. 99.

This disease affects seedlings of cress, mustard, &c., when the plants fall over and die off, as a result of the destruction of the fundamental tissues by the attack of this parasite. The stem fails just above the surface of the ground.

The mycelium is branched, with the lateral branches thin and reflexed. The conidia are globose, with thin walls, often terminating the lateral branches (20–30 μ). The resting spores, or oospores, are also globose, with a thick smooth outer coat (25–35 μ) resulting from the conjugation of a club-shaped cell or antheridium with the globose cell which afterwards becomes the resting spore (fig. 99 *a*).

In many features of their life-history these fungi, called *Pythium*, resemble the rot moulds, and especially in the production of zoospores. The resting spores, however, are produced externally, and not within the tissues of the host plant.

This disease only occurs in very damp situations, and should be prevented by good drainage.

Sacc. vii. 924 ; *Ward, Dis.* p. 33, figs. 5–9 ; *Mass. Pl. Dis.* 54, fig. 4 ; *Quart. Journ. Micr. Sci.* xxiii. p. 487, t. 24, f. 1–10 ; *Tubeuf, Dis.* p. 116.

Young Cabbage plants are often destroyed by *Olpidium Brassicæ* when growing in damp places. The fungus is a single cell or two or three, located in the cells of the host plant. From these imbedded cells a tube is projected through the tissue so that the zoospores may escape. Resting spores are formed within the substance of the host plant.

Mass. Pl. Dis. 53.

Cabbage Sphærella.

Sphærella brassicæcola (Duby.), Pl. VII. fig. 100.

This affection of the leaves is held to be the mature condition of the leaf spot, which occurs earlier in the year. The leaves are disfigured by large and rather rounded or irregular bleached spots, upon which the perithecia, or receptacles, are scattered, but larger in size generally. The fructification is more complex, since, instead of naked sporules, the receptacles enclose long transparent vesicles called asci, each one of which contains eight sporidia. In this species the sporidia are oblong, and divided in the centre into two cells (18×4 μ).

The mature stage of this pest, in the form of *Sphærella,* is not reached until the leaves have lain some time on the ground.

This condition of spot has also been found in France, Belgium, Germany, and Italy, but is nowhere very common.

It is scarcely likely to give more trouble than to pick off and burn the diseased leaves of the *Phyllosticta* form, as they appear.

Sacc. Syll. i. 1939.

Club Root.

Plasmodiophora Brassicæ (Wor.), Pl. IX. fig. 101.

Club Root is so well known, not only in Turnips but in Cabbages and other plants of the family, that no detailed description is necessary.

It is now admitted that the disease is caused by a kind of slime fungus, which occupies the club. It commences early in the growth of the plant affected. The rootlets are swollen in a spindle-shaped manner, usually with a smooth surface, and the plant presents a sickly appearance. At first the cells of the clubbed roots are filled with a yellowish slimy substance which is the early condition of the fungus. Later on this substance will be seen to have undergone a change into myriads of minute spherical spores. During winter these spores remain quiet, but in spring they ripen and prepare for germination. This is done by the gradual conversion of each spore into an active motile zoospore, and each atom, being free, is capable of moving as it pleases by aid of its whip-like tail in any film of moisture.

When the motion ceases, these bodies coalesce into a small slimy mass, which in turn coalesces with other masses until a large mass is formed. These viscid masses are washed out of the tissues by early rains, and move about in the moisture by pushing out little portions of their substance like legs. In this manner they come into contact with the roots of seedling plants, and the disease is communicated.

The application of quicklime destroys the germs in the soil. Thirty-five bushels per acre is enough to arrest the disease.

Sacc. Syll. vii. 1568 ; *Smith, Field Crops*, p. 94, figs. 34–39 ; *Ward, Dis. Pl.* p. 47 ; *Mass. Pl. Dis.* p. 334 ; *Journ. R.H.S.* xxvi. 1901, p. 190, xxvi. 1902, p. ccxix ; *Tubeuf, Dis.* p. 524.

Black Rot of Cabbage.

Pseudomonas campestris (Sm.).

This disease, long known in America, has now appeared in Britain. It may appear on the plant at any period of growth. Dwarfing, or one-sided growth of the heads, or absence of head is a symptom. If the stumps of affected plants are broken, a dark ring will be seen, corresponding to the woody part of the stem ; in bad cases this blackening may be traced upwards into the centre of the head. In the leaves the symptoms usually begin at the margins, with yellowing of all the affected parts except the veins, which become brown or black.

The disease is caused by a yellow bacterium, which enters the plant above ground, and usually at the margins of the leaves. Slugs and caterpillars may spread the disease by going from diseased to healthy plants.

Rotation of crops is recommended to rid the soil of the pest. Cruciferous weeds should not be permitted in the neighbourhood to harbour the disease. Removal of infected leaves in the early stages of the disease would be beneficial. It should be noted that when diseased cabbages have been converted into manure, such cabbages as have been manured with this material have exhibited the disease.

Smith, U.S. Dep. Agri. Bull. No. 68 ; *Mass. Pl. Dis.* 340.

Turnip White Mould.

Oidium Balsamii (Mont.), Pl. VII. fig. 102.

Turnip leaves, and other garden produce, suffer from the incursions of this white mould, which makes its appearance in the manner usual to all of its kind, by spreading a thin white film of mycelium and conidia over the subjects of its attack, like a hoar frost.

It first attracted attention on turnips in 1880, and since that time has not been uncommon. The lowermost leaves are those which are first attacked.

From the coating of white mycelium which soon covers both surfaces of the leaf arise the club-shaped branches, or fertile threads, the lower portion usually consisting of three superimposed cells, surmounted by the maturing conidium, or spore, which is of a barrel shape : that is to say, it is cylindrical, swollen a little in the centre, like a barrel, and truncate or flattened at the ends. When mature, this conidium falls, and, pursuant to the custom in this genus, the next joint pursues its growth and conversion into a conidium, in order to follow its predecessor.

These conidia germinate very readily when kept moist, the germ tube projecting at one angle. It is most common when a moist September follows a dry August.

Dusting with sulphur is one of the most effectual remedies in this kind of disease, which cannot but remind us of the *Oidium Tuckeri* of the vine.

Smith, Field Crops, 76, 77, figs. 27, 28 ; *Gard. Chron.* Sept. 25, 1880.

HORSERADISH LEAF SPOT.

Phyllosticta Armoraciæ (Cooke), Pl. VII. fig. 103.

A number of specimens of this parasite were collected in a garden, fully a quarter of a century ago, and distributed, under the name of *Septoria Armoraciæ*, when the distinctions between *Septoria* and *Phyllosticta* were not recognised. The spots and their disposal upon the leaves appear to be precisely the same as in *Septoria*.

The receptacles, or perithecia, are minute and immersed in the spots. The sporules are small, oblong, and colourless (6×3–4 μ), and are produced in great quantity.

It is uncertain where else this species has been obtained, as we know of no record beyond the specimens above named.

The external appearance of the affected leaves is the same in the three species of *Phyllosticta*, *Ascochyta*, and *Ramularia*, as visible to the naked eye.

Cooke, Fun. Ex. 32.

HORSERADISH LEAF SPOT.

Ascochyta Armoraciæ (Fckl.), Pl. VII. fig. 104.

As already stated, the leaf spots caused by this disease can scarcely be distinguished from those caused by the *Ramularia*, except possibly in the recognition of the minute dot-like receptacles which are seated upon the spots.

The sporules, which are produced within the receptacles, are oblong, obtuse at the ends, and divided transversely into two cells (18–20×3 μ), which is the only apparent distinction between *Ascochyta* and *Phyllosticta*.

This cannot be considered a dangerous or troublesome garden pest, but if its banishment is desired, it would be well to try spraying with one of the copper solutions.

The fungus is known in the Rhine Provinces, Holland, and Italy.

Sacc. Syll. iii. 294; *Fckl. Sym. Myc.* 388.

HORSERADISH SPOT MOULD.

Ramularia Armoraciæ (Fckl.), Pl. VII. fig. 105.

This little white mould is common enough on leaves of Horseradish; although it probably does no harm to the roots, still it makes the foliage look shabby enough.

The spots are at first ochrey-white, then pallid, and somewhat circular, until they run together into a larger blotch. The fertile threads arise from the buried mycelium in small tufts, and are erect and unbranched. The conidia, or sporules, grow singly at the tips of the threads, and are rod-shaped, sometimes a little thickened at the middle, and obtuse at the ends (20×4).

There is hardly any appearance of mould to the naked eye, or at most only a little mealiness on the spots. Finally many of the decayed spots drop out, leaving holes in the leaves.

There is so much external resemblance in the spots caused by this species, *Phyllosticta Brassicæ*, *Ascochyta Armoraciæ*, *Septoria Armoraciæ*, and *Sphærella brassicæcola*, that it is almost impossible to distinguish them one from the other by the naked eye, and all are liable to be found on Horseradish leaves.

If applications are considered desirable, then diluted Bordeaux Mixture may be used.

Sacc. Syll. iv. 978 ; *Sacc. Fun. Ital.* 986 ; *Grevillea*, iii. 65.

Bean Rust.

Uromyces Fabæ (Pers.), Pl. VII. fig. 106.

This extremely common parasite is found on the foliage, stems, and leaves of the Garden Bean (*Vicia Faba*), as well as the Horse Bean or Field Bean, covering them with a rust-coloured powder, which consists of the scattered uredo and teleutospores.

The uredospores are first produced, and are the most profuse, bursting through little rounded pustules which elevate the cuticle. They are globose or nearly globose in form, of a yellowish-brown colour, and a roughened or shortly spiny surface (20–30 × 17–20 μ).

These are ultimately succeeded by the teleutospores, which are of a darker colour, somewhat club-shaped, with the outer coat much thickened at the apex, and terminated by a depressed pore. They are longer and rather broader than the uredospores, and apparently smooth, with a colourless deciduous pedicel (24–27 × 17–30 μ).

This species is known in France, Belgium, Netherlands, Germany, Switzerland, Austria, Hungary, Bohemia, Italy, Finland, Siberia, South Africa, and North and South America.

It is difficult to suggest a remedy when none have proved really successful. How often the bean haulms covered with rust and teleutospores are left in heaps to rot, when it would be much more politic to burn them instead of leaving them to disseminate the disease!

Sacc. Syll. vii. 1921 ; *Mass. Pl. Dis.* p. 229 ; *Cooke, M. F.* 201 ; *Cooke, Hdbk.* No. 1512 ; *Plowr. Br. Ured.* 119.

French Bean Rust.

Uromyces Phaseoli (Pers.), Pl. VII. fig. 107.
Uromyces appendiculatus, DC.

Changes of names in the Uredines have been so numerous of late years that it would seem a relief to fall back on such an old name as *Uromyces appendiculatus* again if not forbidden.

This rust is found on the leaves of most kinds of garden beans ; whatever name the cluster cups may have had, we find the uredospores to be plentiful enough in rounded pustules, of a pale cinnamon brown. They are either round or shortly ellipsoid (24–33 × 16–20 μ), with a rough surface.

The teleutospores occur in darker, almost black, pustules to the eye, which are soon ruptured, and the powdery spores set free. These teleutospores are either subglobose or elliptical, with the spore-coat much

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thickened about the apex, surmounted by an obtuse hyaline wart or papilla. Externally the spores are smooth (26–35 × 20–26 μ).

It is recorded in France, Belgium, Netherlands, Germany, Switzerland, Austria, Hungary, Italy, Portugal, and North America.

Spraying with potassium sulphide solution should be commenced as early as possible after the manifestation of the disease, to be of any service. There is no hope with the uredines when firmly established and the mycelium permeates the host plant.

Sacc. Syll. vii. 1926 ; *Mass. Pl. Dis.* 230 ; *Cooke, M. F.* 211 ; *Cooke, Hdbk.* No. 1543 ; *Plowr. Br. Ured.* 122.

French Bean Anthracnose.

Colletotrichum Lindemuthianum (Sacc. and Mag.), Pl. VII. fig. 108.

This disease appears on the legumes of French Beans and Peas, while still living, and often before they are mature, giving them a very unsightly appearance. The spots are roundish, becoming brown, with a reddish margin. The pustules appear in the centre of the spots, raising the cuticle, so that it seems inflated, and then splitting it.

The conidia are produced at the tips of threads collected in little bundles, the threads being nearly three times as long as the conidia, which latter are oblong, either straight or curved, rounded at the ends, and granular within (15–19 × 4–5 μ).

The disease is very prevalent in the United States, where it is reported that "the young fruit is most subject to attack, and if the parasite gains a footing, it is very disastrous, as growth is checked, even when the pods are not conspicuously diseased." A favourable condition is dampness of soil and atmosphere, which seems to be more necessary to the development of this disease than in the majority of others. An airy dry situation for the plants is recommended as the best means of preventing an attack. The application of sulphur is said to check the disease somewhat.

Sacc. Syll. iii. 3747 ; *Mass. Pl. Dis.* p. 208 ; *Grevillea*, x. p. 48 ; *U.S.A. Rep. Agri.* 1887, p. 361, pl. vi. ; *Tubeuf, Dis.* 486, fig.

Pea Pod Spot.

Ascochyta Pisi (Lib.), Pl. VII. fig. 109.

This spot occurs sometimes upon the leaves but most commonly on the legumes of the Garden Pea, and was first called *Depazea concava* on account of the concave little spots on the pods.

The spots are round and yellowish, with a definite brownish margin in the centre of which nestle the small brown receptacles in which the sporules are produced. When mature these latter issue in a short thick reddish tendril from the mouth of the receptacle, and sometimes become confluent. When dissolved by moisture the sporules separate and flow over the matrix. They are oblong, divided in the centre into two cells, usually with a small nucleus in each cell (14–16 × 4–6 μ).

This disease is recorded in Belgium, Germany, Portugal, and Italy.

No experiments have been recorded on the treatment of this disease, but it has been recommended that Bordeaux Mixture should be tried if the affection should become troublesome.

Sacc. Syll. iii. 2197 ; *Berk. Ann. N. H.* No. 194, t. xi. f. 3 ; *Cooke, Hdbk.* No. 1355 ; *Mass. Pl. Dis.* 276, fig. 72 ; *Tubeuf, Dis.* 472.

Saccardo enumerates a species under the name of *Ascochyta pisicola*, on pea pods, but surely it can only be the above species, as no specimen can be found in the Kew Herbarium with the other name.

Garden Pea Rust.

Uromyces Pisi (Pers.), Pl. VII. fig. 110.

The pea rust is not so common as the " pea mildew " on garden peas, but it is developed in the tissues, and at length makes its appearance externally by bursting in little pustules through the cuticle of the leaves.

The earlier pustules are brown, of a paler colour than the later ones, powdery, and of a rust colour. These uredospores are rather globose, or a little elongated, with a roughened or minutely spiny surface (17 × 24).

The teleutospores are produced in similar pustules, but are darker, and of a brownish-black in the mass. They are broadly elliptical, with a suggestion of pear shape, being narrowed downwards into a long and colourless pedicel (20–32 × 17–21 μ) ; the apex of the spore has the coat, or tegument, a little thickened, and the whole surface is delicately punctate when fresh, but apparently quite smooth when old or dried. The uredospores are much more common on the garden pea than the teleutospores, which latter are comparatively rare.

Those who believe in heterœcism affirm that the cluster cups of this rust are produced upon the leaves of the wood spurge (*Euphorbia Cyparissias*).

This rust occurs in France, Belgium, Germany, Austria, Bohemia, Switzerland, Finland, Italy, Sicily, and Siberia.

Sacc. Syll. vii. 1941 ; *Cooke, M. F.* p. 212 ; *Tubeuf, Dis.* 334 ; *Plowr. Br. Ured.* 133.

Pea Mildew.

Erysiphe Martii (Lev.), Pl. VII. fig. 111.

Everyone with a garden knows the " pea mildew " too well. The whitened leaves, covered on both sides, as if with hoar frost or a thin coating of whitewash, showing the sickening yellowish leaves beneath. This mildew is very common, especially towards the close of the season, destroying the last crop. Seen by the naked eye the white coating is soon sprinkled with minute black dots which are the receptacles of the final stage.

The white coating consists of a rather dense mycelium of interwoven threads so compact as to choke up the stomates of the leaves. Here and there, scattered over the mycelium and projecting from it, are little suckers, or haustoria, which enable the mycelium to retain its hold. At first the threads of the mycelium, which arise as fertile branches, only produce conidia, in chains, of the kind known as *Oidium*. Afterwards the black dots appear, which are at first orange, then brown, and finally black, seated upon and scattered over the mycelium. These are the receptacles, which, when magnified, are seen to be globose bodies, held down by little root-like filaments at the base, while a circle of flexuous threads are disposed about the lower circumference. These receptacles contain the mature fruits of the parasite, which are small colourless, nearly elliptical sporidia, enclosed in transparent sacs or asci, of a somewhat pear-shape. Each receptacle holds from 4 to 8 of these asci, each of which encloses from 4 to 8 sporidia. When quite ripe the receptacles are split open and the sporidia escape, and perpetuate the species.

The hop mildew and the rose mildew belong to the same family of parasites.

These fungi are, in the first instance at least, true epiphytes, making their appearance on the surface of the leaves before there is any infection or disease of the host plant, and, as such, are more amenable to treatment.

Dry weather in the case of these fungi is usually considered as propitious to their development; hence it follows that wet checks development, and syringing or watering the leaves in dry seasons is the best moderator of its evil influence.

Sulphur is doubtless of considerable service, as it has been in the hop mildew.

Sacc. Syll. i. No. 73; *Smith, Field Crops*, p. 266; *Cooke, M. F.* 220, figs. 237–9.

Parsley Leaf Spot.

Septoria Petroselini (Desm.), Pl. VII. fig. 112.

The leaves of the Parsley and sometimes of the Celery are liable to become spotted with this disease. It shows itself scattered over the surface in little spots, which are at first brownish and then bleached, so as to become almost white in the centre. Scattered over these spots are the little dot-like receptacles, or perithecia, which contain the sporules, the spots being already permeated by the mycelium, which produces the discoloured spots.

The sporules are long and narrow, thread-like, with a row of small nuclei, and these escape when mature, like a small tendril from a pore at the apex of the receptacle ($35–40 \times 1–2\ \mu$).

When the leaves are moistened and the dew is upon them, the little tendrils ooze out and soon dissolve, so that the sporules may be disseminated over the leaf.

A shower of rain, or watering artificially, may transfer these sporules to other and healthy leaves.

This species is recorded as known in France, Belgium, Italy, Germany, and S. America.

Sacc. iii. 2876; *Mass. Pl. Dis.* 270.

Celery Brand.

Puccinia Apii (Corda), Pl. VII. fig. 113.

Sometimes the Celery rust finds its way into gardens, where it soon creates mischief, disfiguring the leaves and stunting the plant. It has been proved that it is capable of being introduced through the medium of seed obtained from diseased plants.

The appearance of this pest on the foliage is first detected by swollen paler spots, and soon afterwards the cuticle is broken irregularly over each of these spots or pustules, and the brown powdery spores escape from the fissures like snuff and become sprinkled over the leaves.

It is customary, in these latter days, to regard the above as one of the forms of *Puccinia bullata*, but we prefer to retain the above name as a distinction for a definite disease.

The uredospores are paler than the teleutospores, irregularly rounded, and rough ($23–38 \times 20–26\ \mu$).

The teleutospores are comparatively large, elliptical in outline but constricted in the middle, where they are divided into two cells. The lower cell is a little narrowed into the pedicel, which soon falls away. Externally the surface is smooth and of a dark brown colour ($30–56 \times 17–28\ \mu$).

The best plan is to eradicate all the plants as soon as the disease makes its appearance, to prevent the germination of the teleutospores and the dispersion of the rust.

Sacc. Syll. vii. 2211; *Cooke, Hdbk.* No. 1493; *Mass. Dis. Pl.* 250; *Plowr. Br. Ured.* 156.

Parsnip Rot Mould.

Plasmopara nivea (Ung.), Pl. IX. fig. 114.

This rot mould is similar in character and life-history to the other rot moulds of which we have given an outline (Introduction, p. 2). It first affects the leaves, and then the mycelium descends and forms resting spores in the stems and roots.

The white mouldy patches appear first on the under surface of the leaves chiefly, forming an internal mycelium from which the bundles of branched threads arise and appear on the surface. These threads are erect, rather shorter than in many species ($250\ \mu$ long), tapering upwards and mostly once or twice forked in the upper portion, rarely three-forked, with from one to four horizontal branches near the apex, forked at the extremity, with the forked spicules spreading, each point bearing a single conidium or spore. These are nearly globose or ovoid, with a very obtuse projection or teat at the apex ($20–25 \times 15–17\ \mu$), granular within and with a slightly tawny tinge.

This mould has appeared in France, Belgium, Holland, Germany, Sweden, Lapland, Tyrol, Italy, and N. America.

Sacc. vii. 807; *Smith, Field Crops*, 229; *Mass. B. F.* 113, figs. 66–70; *Cooke M. F.*; *Gard. Chron.* Dec. 5, 1884, figs. 124, 125; *Cooke, Hdbk.* No. 1775.

Celery Spot Mould.

Cercospora Apii (Fres.).

This black mould is known throughout Europe and North America on leaves of Celery and Parsnip causing leaf spots which are at first yellowish, then enlarging and turning brown. In this country it has not yet been developed into a pest.

Spots almost circular (4–6 mm. diam.) with the narrow margin slightly elevated. The mould developed on the under surface in small brown tufts. The hyphæ, or threads, are either continuous or sometimes with one or two divisions (40–60 × 4–5 μ). The conidia are thin, obclavate, or attenuated upwards, with from three to ten transverse divisions (50-80 × 4) almost colourless.

The variety on Parsnip is known in the United States and Siberia. That on Celery occurs also in Germany, Austria, Italy, and the United States.

Sacc. Syll. iv. 2125 ; *Tubeuf, Dis.* 514 ; *Sacc. Fl. Ital.* t. 667.

Lettuce Rot Mould.

Bremia Lactucæ (Regel.), Pl. IX. fig. 115.

The mould which causes this disease appears to have been known since 1843, but it was in 1846 that Berkeley first drew attention to the pest, and considered the mould to be the cause of the rot. Afterwards it came to be known under the name of *Peronospora gangliformis* which has since been abandoned in favour of the above name.

There is an abundant mycelium present in the leaves before the mould appears on the surface. This is thick and coarse, being furnished with a number of club-shaped suckers or haustoria. From the mycelium arise the erect fertile threads through the natural orifices of the leaves. These are flattened, and from two to six times forked, without cross partitions. The tips of the final branchlets are swollen in a peculiar manner, supposed to resemble "ganglia." These swellings are somewhat of a saucer-shape, with a single spicule in the centre and three or four more growing around the edge. Each spicule bears a nearly globose spore, with a very minute teat or papilla at the apex (16–22 × 16–20 μ).

The resting spores are produced in clusters, and are plentiful in old and decayed stems. They are nearly globose, not quite even, and of a tawny colour, exceeding in size the largest dimensions of the conidia (28–34 μ).

Found chiefly throughout Europe and in the United States.

For Lettuce rotting in greenhouses see *Journ. R.H.S.* xxvi. 1901, p. 558.

Sacc. Syll. vii. 243 ; *Cooke, M. F.* t. 14, f. 265 ; *Tubeuf, Dis.* p. 131 ; *Smith, Field Crops*, 289 ; *Mass. Pl. Dis.* 74 ; *Mass. B. F.* 115, figs. 64, 65 ; *Cooke, Hdbk.* 1777.

Lettuce leaf spots are known abroad, and anthracnose in the United States.

Potato Spindle Mould.

Fusarium Solani (Mart.), Pl. VIII. fig. 116.

Because this parasite was so commonly found upon Potatos in decay it was for a long time supposed that it was only a companion of the Potato murrain, or a consequence of decay. Latterly it has been closely watched, with the conclusion that it is really a destructive fungus on its own account, and will attack stored Potatos, whether bruised or not.

It grows either in company with the rot mould or also independently upon tubers which exhibit no trace of decay. The mycelium is similar in both, but the resulting moulds are different. The fruiting threads of the *Fusarium* or "spindle mould" are shorter, and for the most part unbranched, bearing at their tips the fusiform or spindle-shaped spores or conidia, which are a little curved, and set rather obliquely upon the threads ($40–60 \times 7–8\ \mu$). Each sporule is divided by transverse partitions into four cells, which remain for a long time attached to each other, but ultimately separate and each segment becomes practically a separate germ cell. Sometimes each of the four cells will commence germination while still attached to each other, but will ultimately fall away, and each cell, now almost quadrangular, will when free assume gradually a spherical shape. They do not always germinate at once, but seem to be capable of an interval of rest of from two to three months. Germination proceeds rapidly, and may be completed in six hours. The mycelium has a putrefactive action, breaking up the cells of the host and hastening decay.

Known in Belgium, Italy, and North America.

Sacc. Syll. iv. 3386; *Smith, Field Crops*, p. 32, figs. 10, 11; *Mass. Dis. Pl.* 333, 442; *Cooke, Hdbk.* No. 1870.

Potato Scab.

Sorosporium Scabies (Fisch.).

Nearly fifty years since Berkeley called the attention of the Horticultural Society to one of the causes of scab in Potatos, under the name of *Tubercinia Scabies*. But it was probably known to Martius three years previously.

There are some even now who think that Berkeley made a mistake. He attributed the fungus to be closely allied to the smuts, and described it as consisting of globose bodies, composed of minute cells, in such a manner as to form a hollow globe, with one or more lateral openings.

"The fungus grows beneath the cortex of the tuber, where it forms a thin dark greenish-brown stratum, often extending over the greater part of the external surface of the tuber."

It is said that no trace of the fungus is often to be seen at the time of harvesting, but frequently shows itself during winter in stored Potatos which on digging appeared to be quite sound. In bad cases discoloured spots first appear, and these increase in size and become confluent until at length the entire skin is discoloured. Then the cuticle bursts and the spores are set free.

We have ourselves met with such scabbed Potatos in greengrocers' shops, and obtained from them the hollow bodies described by Berkeley, the existence of which has been called in question.

Berk. Journ. R.H.S. 1846, p. 33, figs. 30, 31; *Sacc. Syll.* vii.; *Smith, Field Crops*, 35; *Mass. Pl. Dis.* 225; *Cooke, Hdbk.* No. 1536; *Plowr. Br. Ured.* 294.

American Potato scab caused by *Oospora Scabies* is quite a distinct thing.—*Mass. Pl. Dis.* p. 299.

Potato Tumour.

Œdomyces leproides (Trabut.).

This disease made its appearance in this country in 1901, when a whole crop of Potatos was destroyed by its ravages, and it has since appeared in other districts. At first it was called on the Continent by the name of *Chrysophlyctis endobiotica* (Schilbersky), and was supposed to be an entirely new type of disease, but afterwards when specimens were brought to the notice of Dr. Magnus, he determined that it was the same fungus as that which caused tumour on Beetroot, and hence should retain the name of *Œdomyces leproides*. The Potatos when attacked are soon either wholly or partially swollen on the surface in a tuberculose manner, turning blackish, and presenting in cells beneath the cuticle a mass of large oval conidia, of a brown colour, with a short hyaline pedicel, which is swollen about the centre. Altogether the disease presents the same features as when it occurs on Beetroot, and is, of course, liable to be transferred from one to the other.

Hitherto no remedy has been discovered, and wherever it appears it would be advisable not to plant another crop of Potatos on the same soil until after the cultivation of some intermediate crop of a different character, and the soil has been disinfected from any trace of the fungus.

For further notes see "Beetroot Tumour."

Potato Disease.

Phytophthora infestans (De Bary), Pl. IX. fig. 118.

So many volumes have been written in connection with the Potato disease that little remains for us to say. Unfortunately, its ravages are too well known to need description, and a patent universal remedy we have not yet found.

The mycelium of this rot mould is more slender than usual, and the fertile threads are also comparatively slender, being attenuated upwards. These threads are also sparingly branched in the upper portion, with a few slender tapering branches, which are either simple or sometimes divided. On the branches are scattered swollen processes, which correspond to the points of origin of the conidia. The latter are elliptical and colourless, with a prominent papilla or teat-like projection at the apex (25–30 + 15–20 μ).

The life-history of the rot moulds is given in the Introduction. The question of resting spores in this species must still be open to individual opinion upon the strength of the evidence afforded, to which we give references.

To a certain extent spraying with Bordeaux Mixture has been of service. A damp situation is favourable to the disease, and so is a wet season.

Sacc. Syll. vii. 802; *Cooke, M. F.* f. 264; *Cooke, Hdbk.* No. 1774; *Mass. Pl. Dis.* 62, fig. 7; *Mass. B. F.* p. 111, figs. 121–126; *Grevillea,* v. p. 18, pl. 70–73; *Ward, Dis.* p. 59; *Gard. Chron.* July 1875; *Smith, Field Crops*, 275; *Tubeuf, Dis.* p. 119.

Potato Sclerote.

Sclerotinia Sclerotiorum (Mass.), Pl. VII. fig. 119.

Curious hard fungoid bodies, having the nature and functions of a resting mycelium, are sometimes found within the tissues of various plants. These are called "Sclerotia," one form of which is known as "Ergot." They vary much in size and appearance, but are commonly oval or oblong with a dark outer coat, and an interior of compact cells.

Potato haulms, all the parts above ground, have been known to produce sclerotia in such numbers as to become a veritable pest. The whole plant becomes covered with a thick felt of white mycelium, within and without. The growth is very rapid, and ultimately numbers of small sclerotia are produced amid the felt, from the size of a pin's head to that of a bean. It was in 1883 that the ultimate development and destiny of these sclerotia were discovered.

When the sclerotia are placed in a favourable situation after a period of rest, they commence to germinate. In this case it was a small fungus called a *Peziza* which was produced. There was a cuplike or saucer-like head, from a quarter to half an inch in diameter, proceeding from a long slender flexuous stem, about two inches long, arising out of the sclerotium. The inside of the cup is the fertile portion, and here long cylindrical cells are closely packed side by side, each one enclosing eight spores or sporidia, which are ejected when mature. The cup or *Peziza* was called at first *Peziza postuma*, but has since acquired the name of *Sclerotinia.*

Fungicides are not likely to be of service, unless the disease is taken in a very early stage, but the precaution should be taken of burning up the diseased haulms to prevent the development of *Peziza* and spread of the germs.

Gard. Chron. Sept. 15, 1883; *Mass. Pl. Dis.* 150, fig. 32; *Tubeuf, Dis.* 263; *Smith, Field Crops*, 25, fig. 3 &c.

Potato Rhizoctonia.

A serious Potato disease is announced in North America, caused by *Rhizoctonia Solani* (Kuhn). It was first observed in Long Island in 1900, and afterwards in Colorado, and is increasing in extent, so that growers in Europe must be upon their guard.

It is reported that large vines gave promise of an abundant yield, but when digging time comes it is found that so few tubers have set that it does not pay to dig them. Many vines do not produce a single tuber. It is by no means an uncommon occurrence for the vines to set an abnormal number of small Potatos, or "little Potatos" as they are called. These often occur in compact clusters, and are so small as to be worthless. Another condition is the dying of Potato plants, all of which conditions may be produced by attacks of *Rhizoctonia.*

The hyphæ of the fungus are often found on the surface and in the scab ulcers of Potatos. These hyphæ give rise to irregularly shaped dark masses known as sclerotia, which vary in size from that of a mere speck to half an inch or more in diameter. These sclerotia resemble

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small bits of earth, but by placing the Potatos in water these bodies become black and quite conspicuous. Many of them adhere very firmly. The hyphæ spread through the soil in various directions; hence a single diseased Potato may be the means of infecting an area of considerable size.

Plants which are attacked when young, if not killed outright, are often dwarfed and frequently die long before the close of the season The parts below ground are thoroughly infected with the *Rhizoctonia.* In some cases the disease attacks the plant just below the surface of the ground, and under favourable conditions a stem rot called "Collar Rot" or "Black Ring" is produced. When the attacks on the stem are not so severe as to cause death the injuries may prevent the assimilated food from being stored in the subterranean portion of the plant, large tops are produced, and green tubers often form in the axils of the leaves (see also "Abstracts" in current JOURNAL R.H.S.)

POTATO BACTERIOSIS.

This has been described as occurring in Germany under the name of *Bacillus phytophthorus*, App.

Deut. Botan. Gesel. 1902, p. 128.

We do not apprehend any danger to Potatos from the fungus described under the name of *Phycomyces splendens*, for surely it can only be a veritable saprophyte (see *Gard. Chron.* June 26, 1886, p. 824).

POTATO SPOT MOULD.

There has been some consternation in Europe upon the appearance of a black mould (*Cercospora concors*) on living potato leaves, but it has not been heard of in Britain.

POTATO MACROSPORIUM.

Two species of *Macrosporium* have been described as affecting the leaves of plants of the Potato Family, but one of these is decidedly a saprophyte and only occurs on dead leaves. The other (*Macrosporium Cookei*) attacks the living leaves of *Lycopersicum esculentum* (*Solanum Lycopersicum*), in America, and has large conidia (60–70 + 10 μ) with from four to six transverse septa. The latter is not yet recorded as occurring in Europe.

TOMATO LEAF MOULD.

Cladosporium fulvum (Cooke), Pl. VIII. fig. 120.

This mould first made its appearance on leaves of the Tomato in the United States, and was described in 1883 from specimens received from South Carolina, since which time it has not only spread in America but made its appearance in England, where it was first recorded in 1887.

Brown felted spots of irregular size appear on the under surface of the leaves, as the first indication of this disease. The spots gradually spread, and the corresponding upper surface acquires a yellow colour.

It sometimes extends also to the fruit. On the leaves the spots soon darken, and the leaves shrivel and dry.

The mycelium consists of delicate colourless septate threads, which penetrate the tissue in all directions, and sometimes overrun the entire surface. From this mycelium arise erect fertile threads, which form dense tufts, simple or shortly branched, pointed and flexuous, with the joints swollen, and of a tawny colour. The conidia are produced at the tips of the threads, mostly elliptical, with one division in the centre, and pale brown (10–18 × 4–7 μ). Conidia may also be produced from the nodules or short branches and are sometimes met with in short chains of two to four attached end to end. They germinate readily in water by sending out germ tubes, which become interlaced in a mycelium Spores placed on wounded fruit will produce rot.

Two or three large cultivators have assured us that they have no difficulty with this mould so long as they control temperature and ventilation. Solution of sulphuret of potassium has been recommended for spraying.

Sacc. Syll. iv. 1731; *Mass. Pl. Dis.* 311, 435, fig. 83; *Gard. Chron.* Oct. 29, 1887; *U.S.A. Rep.* 1888, p. 347, pl. iv.; *Journ. R.H.S.* xxvi. 1902, p. 733, fig. 307.

Tomato Black Rot.

Macrosporium Tomato (Cooke), Pl. VIII., fig. 121.

This rot was also first observed in the United States before it became known in this country. It makes its appearance at the apex, or flower end of the fruit, when the latter is from half to two thirds grown. At first a small blackish spot is seen, either around the remains of the style, or on one side of it. This rapidly increases in size, but retains a more or less circular outline. As the disease progresses the tissues collapse quite regularly on all sides, and the berry becomes much flattened. There is usually a slightly raised narrow border surrounding the diseased parts, while just outside this the cuticle retains its normal healthy colour, but appears slightly wrinkled owing to the collapsed condition of the tissues beneath. Sections show that the black discolorations extend deeply into the tissues.

The principal cause of this disease is the black mould *Macrosporium*, the mycelium of which consists of rather large septate, thick-walled, and contorted threads, at first colourless, but eventually tinged with brown, permeating all the diseased and decaying parts, and easily traced into the sound tissue. Arising from the mycelium are the olive-brown fertile threads, of variable length, which bear the large compound spores or conidia. The latter are obclavate, attenuated above, and shortly stalked below, divided transversely and longitudinally into as many as fifteen almost cubical cells, after the manner of bricks in a wall, at first olive-brown, becoming almost black (100–120 × 20–22 μ).

All diseased fruit and old bines should be burnt. Suggestions have been made for spraying with sulphuret of potassium.

Sacc. Syll. iv. 2552; *Grevillea*, xii. 32; *U.S.A. Rep. Agri.* 1888, p. 339, pl. iii., iv.; *Mass. Pl. Dis.* 324, fig. 89.

Tomato Bacteriosis.

A bacterial disease of Tomatos has been destructive on the Continent, and since appeared in England. The fruit blackens and is at length wholly destroyed.

Another similar disease, if not the same one, has made its appearance in the United States, where it attacks the Tomato, Egg Plant, Potato, and species of *Petunia*. The disease causes the foliage to wilt, and, later on, the stem and branches become discoloured and die. In Potatos the disease passes down to the tubers, causing a brown or black rot. Possibly this may be the same as *Bacillus phytophthorus*.

Mass. Pl. Dis. 338, 342.

Sleeping Disease of Tomatos.

Fusarium Lycopersici (Sacc.).

This disease has been prevalent in Guernsey, and in other places in Britain. The leaves become dull and droop, and the stem collapses. The root is attacked first, gradually extending to the lower part of the stem. Shortly after the sleeping stage, the portion of the stem above ground is covered with a delicate white mould, of erect branched threads, which produce small two-celled conidia (*Diplocladium*). Afterwards, from the same mycelium, the spindle-shaped spores (*Fusarium*) are produced in immense numbers. Spraying appears to do no good.

Gard. Chron. June 8, 1895; *Journ. R.H.S.* xix., 1895, p. 20, figs. 1, 2, 3; *Mass. Pl. Dis.* 328.

Other Tomato Fungi.

After the attacks of *Macrosporium*, and sometimes meanwhile, the spindle mould (*Fusarium Solani*) will attack Tomatos as freely as Potatos, and complete the round of destruction.

The potato rot mould (*Phytophthora infestans*) will sometimes attack the tomato, but must be well guarded against, as it would be a fatal foe if once it came to be established.

Cultivators have been terrified by a long list of supposed tomato diseases, which has been thrust forward without any justification, except to alarm them. The majority of these are saprophytes, and only flourish at the expense of otherwise decaying vegetable matter. Such, for instance, are *Sporocybe Lycopersici* and *Dactylium Lycopersici*, which has a strong family likeness to *Tricothecium roseum*, and probably *Phoma destructiva* and *Sphæronema Lycopersici*. Doubtless they will all prove harmless enough for any other purpose than to allow the writer a remote chance of becoming immortal by means of strings of useless names. No fungicides will be required.

Mint Rust.

Puccinia Menthæ (Pers.), Pl. VIII. fig. 122.

All kinds of Mints are liable to infection from the common mint rust which is plentiful on wild Mints: in gardens mostly when in damp situations.

There is very little indication on the upper surface of the leaves, but the under surface is either sprinkled or closely beset with the roundish pustules, both of the uredospores and teleutospores, usually in company, the latter darker than the former, but both of them equally powdery. The cluster cups are rare.

The uredospores are one-celled, roundish, and of a cinnamon brown, the surface studded with minute spores (17–28 × 14–19 μ).

The teleutospores are nearly black in the mass, oval, divided across the middle into two cells, with a slight constriction at the suture. The apex of the upper cell is furnished with a small papillary tubercle; the lower cell is attached to a deciduous stem. The whole surface of the spore is covered with small warts (26–35 × 19–23 μ).

Possibly should a patch of Mint become diseased, it would be well to try cutting it down to the ground and burn it, since it may prove that the disease has not extended to the roots, and the new growths may be free, especially if cut down before the teleutospores have matured and fallen to the ground.

Common nearly throughout Europe, and in South Africa and North America.

Sacc. Syll. vii. 2180; *Mass. Pl. Dis.* 240; *Cooke, M. F.* p. 204, figs. 69, 70; *Cooke, Hdbk.* No. 1474; *Plowr. Br. Ured.* 157.

Rhubarb Cluster Cups.

Æcidium rubellum (DC.).

Rhubarb leaves in gardens are sometimes disfigured by the large patches of this parasite, although by no means commonly so. The same fungus is common on the leaves of various species of Dock, from which it may extend to Rhubarb.

It is very handsome, as far as appearance goes, and forms large crimson spots, nearly an inch in circumference, while in the centre of these spots the cluster cups are crowded and densely packed together. The white edges of the cup are torn like a fringe, and the æcidiospores, which occupy the centre of the cup, are produced in chains in the interior, and are nearly globose and rough.

No further development has been seen upon the rhubarb leaves, since it is affirmed that both the *Uredo* and *Puccinia* are developed upon another and quite a different species of plant, which in reality is one of the Grasses. But our disease now concerns only the rhubarb leaves.

Sacc. Syll. vii. 2204; *Cooke, M. F.* 194; *Cooke, Hdbk.* No. 1632.

Diseases of Beetroot will be better treated in connection with Field Crops.

Spinach Black Mould.

Heterosporium variabile (Cooke), Pl. VIII. fig. 124.

The fading leaves of Spinach are liable to be invaded by a species of black mould, similar to that which affects Carnations, which is by no means so harmless as black moulds often are. The threads of the mycelium take possession of the tissues, and the fertile threads finally burst through the cuticle of the leaves.

Definite rounded or irregular spots of a paler yellowish colour first appear upon the still green leaves, caused by the mycelium of the fungus. Then the surface of the spots becomes dotted with blackish points indicating the threads of the fungus bursting through the cuticle. These threads are flexuous, slender, knotted at the points and growing in small tufts. Conidia are produced at the tips of the threads, simple at first, then with one, two, or three divisions or septa (20–50 × 7–10 μ). The surface of the conidia is minutely rough with small spines. Threads and spores are of a pale olive colour.

When fully matured the conidia germinate freely at each joint, producing a slender thread.

Spraying with Bordeaux Mixture should be resorted to in order to prevent dissemination of fertile conidia.

Sacc. Syll. iv. 2310; *Grevillea*, v. 123.

Spinach Rot Mould.

Peronospora effusa (Rabh.), Pl. IX. fig. 125.

The mould which attacks Spinach is of the same kind as that which attacks Potatos, parsnips, and other vegetables. The pest appears upon the living leaves in greyish, rather dense velvety patches, sometimes an inch in diameter, and sometimes spreading widely over the leaf. The mycelium is present in the leaf before the mould makes its appearance on the surface. The threads are produced in abundance, issuing through the stomates. The stem is undivided below, but in the upper portion it is divided in a forked manner, from two to six or seven times, the final branchlets being somewhat awl-shaped and arched. The ellipsoid conidia occur singly at the tips of the branchlets (22–30 × 16–23 μ) with a dirty white or slightly violet membrane. When mature they fall off readily.

Resting spores are produced upon the mycelium within the tissues of the plant, and are variable in size, of a bright brown colour, which is irregularly furrowed and ribbed (25–38 μ diam.).

Known in France, Belgium, Germany, Scandinavia, Finland, Austria, Italy, and the United States.

Sacc. Syll. vii. 854; *Gard. Chron.* Ap. 11, 1885, fig. 87; *Cooke, M. F.* f. 214; 215, *Mass. Pl. Dis.* 79; *Mass. B. F.* 124; *Berlese, Icon.* xlvii.; *Cooke, Hdbk.* No. 1781.

Gourd Anthracnose.

Glœosporium orbiculare (B.), Pl. VIII. fig. 126, conidia.

This disease appears in orbicular spots on ripe gourds, melons, &c. The pustules are often run together and confluent, with a common pore or orifice. The conidia are small and oblong, tinged with pink (about 14 × 3½ μ), and are expelled in thin tendrils. The genus to which this species belongs is almost universally destructive, and affects various plants. The disease which is caused by them is known throughout the United States by the name of Anthracnose.

As to the specific differences between the two species recorded as *Glœosporium orbiculare* and *Glœosporium lœticolor* it is not of much practical importance, and some at least of American mycologists believe them to belong to the same species.

Recorded in Portugal as well as in Britain.

Every effort should be made to prevent the dispersion of the conidia of all species of *Glœosporium*, by spraying, and destruction of the affected parts.

Sacc. Syll. iii. 3759; *Cooke, Hdbk.* No. 1407; *Berk. Ann. N. H.* No. 106, t. vii. f. 6.

Cucumber Anthracnose.

Glœosporium lagenarium (Pers.), Pl. VIII. fig. 127.

To this fungus is attributed the fungus disease which attacked Cucumber plants in 1892 and 1893, but was previously known upon Gourds on the Continent. In this instance the leaves, some portions of the vines, and especially the ends of the young fruits, rotted and became pulpy. No distinct pustules could be detected, but the rotting parts contained fungus mycelium, and a great number of the sporules of the *Glœosporium*.

The pustules are disposed to occur in rings, and are rather small upon the fruits, and somewhat roseate; the conidia are ovate-oblong, often unequal-sided (16–18 × 5–6 μ), colourless, and without division, growing on pedicels nearly as long as the conidia, oozing out when mature. The habit is certainly different from that of *Glœosporium orbiculare*, and attacks also the stems and foliage.

Among the tissue of the surface of the fruits were found the fusiform curved conidia of another pest, *Fusarium reticulatum*, which are triseptate (40 μ long), and are constantly found in company with this *Glœosporium* upon gourds.

It is reported in France and Italy as a noxious pest.

Sacc. Syll. iii. 3757.

Another species, if really distinct, has been found on Gourds in Australia.

Cucumber White Mould.

Oidium erysiphoides (Link), Pl. IX. fig. 128.

This troublesome white mould is very apt to make its appearance on Cucumber or Melon plants in frames, or on Gourds in the open. It spreads in white blotches over the foliage and often covers the plant.

There is a profuse mycelium, and sometimes nothing more, from which arise short erect fertile branches, of a rather thick club-like shape, which are soon divided by transverse partitions into cells; each of these cells becomes a conidium and acquires a roundish or elliptical shape, and then falls away from its fellows. When quite mature they are capable of germination (30–40 × 15–20 μ).

The healthy action of the leaves is obstructed, and they soon acquire a sickly appearance, and the stems are apt to rot off at the base.

The only application which has proved effectual is that of "flowers of sulphur," as in this case the fungus is an epiphyte, and is open to similar treatment to that for the vine mildew.

Said to be common throughout the world.

Sacc. Syll. iv. 189.

Cucumber and Melon Rot Mould.

Plasmopara cubensis (B. & C.).

This rot mould was first discovered in Cuba, from whence it afterwards spread, until it was found on leaves of *Cucurbita* and *Cucumis* in Japan. More recently it became known in the United States, and afterwards in England.

It forms a delicate white mould on the under surface of the leaves. The erect branches are forked on the upper portion, with the ultimate branches straight, and not hooked as in some species. The conidia are oblong-obtuse at the ends (25 μ long).

It has been recommended to spray the under surface of the leaves with dilute Bordeaux Mixture, taking care that the under surface is reached and wetted.

Berk. and Curt. Cuban Fungi, No. 646 ; *Sacc. Syll.* vii. 872 ; *Mass. Pl. Dis.* 80.

Melon Spot Mould.

Cercospora Melonis (Cooke), Pl. VIII. fig. 129.

This disease made its first appearance on the leaves of Melons in 1896, and since that time it has been even more troublesome with Cucumbers, and may now be looked upon as a constant danger.

The leaves are spotted sometimes with rather small orbicular spots with a definite margin, and of the usual bleached dirty-white colour. At other times the spots are larger, one inch in diameter, and of a smoky-grey colour. The mould appears on these spots, but hardly distinguishable to the naked eye—save to slightly darken the centre of the spots.

The erect threads are few and slender (200 μ long) and of a decided olive colour. The conidia are robust for the genus to which they belong, either cylindrical, or slightly attenuated upwards, and divided by seven or more transverse septa (80–120 $\times$ 7 μ) and a little curved, but scarcely at all coloured.

Spraying with dilute Bordeaux Mixture will probably assist, but infected leaves should be picked off and burnt.

Gard. Chron. Sept. 5, 1896, p. 271.

A Musk Melon disease is attributed to a black mould (*Alternaria*) in N. America ; see *Journ. R.H.S.* 1901, xxvi. p. 563.

We know nothing whatever of the smut on Cucumber roots described under the name of *Ustilago Cucumis* in *Proc. Roy. Soc. Ed.* xv. 1887, p. 403.

Cucumber Sclerote.

Sclerotinia Libertiana, see Pl. VII. fig. 119.

Recently the stems of Cucumber plants have been submitted to us which called to mind very strongly a similar disease of Potato haulms. The stems contained a quantity of hard black sclerotia enclosed in a fluffy white mycelium, which caused the vines to bleed and rot. These hard substances were at first whitish, then turned brownish, and ultimately black. In all other particulars it closely resembles the Potato Sclerotium, except perhaps as to the consequences of a period of rest. We did not attempt to cultivate the sclerotia, but probably there also the results would have been the same.

This was the first time we were made acquainted with this disease on Cucumbers, but our correspondent stated that it had then been observed for three or four years, and it had been attributed in some measure to the soil and culture. Fresh soil and manure were employed in the cultivation, but the disease reappeared. We were assured that the only thing which kept the disease in check was air, and to use no more moisture than was absolutely necessary.

This disease is said to be known in the United States, where the Sclerotium has been called *Sclerotinia Libertiana*, and is closely allied to the Sclerotium of the Potato haulms, and indeed apparently the same, as it occurs also in other plants.

Sacc. Syll. vii. 798; *Mass. Pl. Dis.* p. 150.

Melon Bacteriosis.

Recently some important investigations have been made into the causes of a peculiar form of Melon disease which is not uncommon in the United States. We have grave doubts whether the same disease was not present in this country in 1890, attacking Gourds and other Cucurbitaceous plants. The attacked vines are said to have varied somewhat in their appearance, but generally there was a decay of the stem, in proximity to the root, and then the whole plant wilted and failed to grow.

It is reported that an examination showed that the decomposing tissues were teeming with bacteria. Inoculation of healthy plants was made, and it was found that, with no other fungus present, the germs obtained were abundantly able to introduce a rapid decay into Cucumbers, Melons, and Squashes, Cucumbers being the favourite, and in them the decay was most rapid, running through a four-inch fruit in a single day.

The next step was the application of these germs to healthy plants in the field. When the application was made near the end of a vine, the latter rotted away in from three to four days.

Numerous other experiments were performed, and all nearly equally successful in demonstrating that the diseased virus may be communicated by inoculation to healthy vines.

Journ. R.H.S. 1891, xxvi. p. 540 ('Cucumber Wilt').

PESTS—GARDEN VEGETABLES.

Onion Scab.

Vermicularia circinans (B), Pl. VIII. fig. 131.

During some seasons this disease is abundant, while in others it is scarcely known.

It attacks the outer coating of the bulbs of Onions, and does them very little injury so long as they are in the ground. It usually appears when the bulbs are nearly full grown, under the form of scattered black patches formed of small black velvety tufts, and these are arranged in concentric circles or in irregular wavy lines.

These tufts consist of quantities of erect threads, each bearing a long slender slightly curved and colourless conidium or spore at its tip. Besides which, the tuft is thickly studded with long black projecting spines which gives it the velvety appearance.

Has occurred in Germany and Italy as well as in Britain.

The bulbs should be dry before storing, and none of the tainted ones should be mixed. When the diseased bulbs are separated they may be tried with a fungicide.

Sacc. Syll. iii. 1376; *Mass. Pl. Dis.* 273, fig. 71; *Gard. Chron.* 1851, p. 595, figs.; *Cooke, Hdbk.* No. 1291.

Onion Spindle Mould.

Fusariella atro-virens (Berk.), Pl. VIII. fig. 132.

Berkeley has declared his opinion that the fungus above named is at least one of the causes of the mildew which is so destructive to onions just before they arrive at perfection. The disease originates in little dot-like spots with radiating threads, crowned with a greyish gelatinous mass; these at length unite, and the whole of the centre is occupied by the spores; the border keeps on increasing, and often quite fleecy, especially if it meets with any impediment, but at length the whole mass is greenish black, and the border becomes obliterated. The threads of the mycelium are white, and the spores are fusiform and curved, so as to form about one third of a circle. There is one peculiarity in moulds of this kind: that the spores seem to be held together for some time in a gelatinous heap, and do not separate until they are quite mature, and ready for diffusion. This peculiarity is rather an advantage, as it serves to localise the attacks.

Whatever fungicide is employed is of little import, so long as it will destroy the parasite without injury to the onion, and it is likely to prove beneficial. Very little has been known of this disease for many years.

Sacc. Syll. iv. 1876; *Cooke, Hdbk.* No. 1866.

Onion Rust.

Puccinia Porri (Sow.), Pl. VIII. fig. 133.

Occasionally, for many years, this rust has attacked plants of the Onion tribe and caused great trouble. In 1883 a crop of Chives was attacked at Shrewsbury and almost destroyed by its ravages. A public trial took place in Edinburgh where damage was sustained to a crop through this cause. At other times a limited number of plants have sustained injury in gardens.

There are declared to be, as usual, three stages in the history of this pest. First, the cluster cups or *Æcidium* form, which is by no means troublesome; and then the *Uredo* form, which occurs in small reddish-brown pustules either scattered over the leaves or collected in clusters. The uredospores are either nearly globose or elliptically so, very delicately spinulose (20–33 × 18–27 μ), of a pale orange colour.

The teleutospores are contained in flattened pustules of a darker colour, and are commonly of two kinds: one form is obovate and without any septa or division (25–36 × 15–23 μ) and the others are club-shaped, and divided into two cells (28–45 × 20–26 μ), of a chestnut-brown colour, and externally smooth, with a long slender pedicel. For this reason probably, this species has sometimes been called *Puccinia mixta*.

Possibly other rust will sometimes attack cultivated Onions, of which we are said to possess three species.

This is known, at any rate, in France, Germany, Finland, and Italy.

Sacc. Syll. vii. 2155, ; *Gard. Chron.* Oct. 15, 1891 ; *Plowr. Br. Ured.* 148 ; *Smith, Field Crops*, p. 39.

Onion Rot Mould.

Peronospora Schleideni (Unger), Pl. VIII. fig. 134.

Of all the destructive rot moulds scarce one is more destructive, or its attacks to be more deplored, than the present: which will fall upon a crop of young Onions and destroy them in an incredibly short space of time.

The mould forms broadly effused patches of greyish-lilac tufts, which sometimes entirely cover the leaves, so that in its early history it was known as *Botrytis destructor*.

The fertile threads arise from the mycelium in tufts, and are large and without septa or divisions. The upper portion is branched alternately, or in a forked manner, and is again and again divided until the final branchlets are strongly arched. The conidia are obovate or egg-shaped, with the apex obtuse, or a little acute, and of a pale dingy violet (45–55 × 22–25 μ).

The resting spores are produced on the mycelium as usual, and are broadly elliptical or globose, with a comparatively thin and smooth coating.

This is known in France, Belgium, Germany, Scandinavia, and North America.

It is recommended as a good plan to sow the Onions in the autumn, so that they are able to make a good growth before the appearance of the mould in the spring.

Berk. Ann. Nat. Hist. vi. p. 436, t. 13, f. 23 ; *Sacc. Syll.* vi. 857 ; *Cooke, Hdbk.* No. 1787 ; *Cooke, M. F.* fig. 263 ; *Mass. B. F.* p. 125 ; *Berlese, Icon.* xxv. ; *Mass. Pl. Dis.* 75 ; *Smith, Field Crops*, 45.

Onion Sclerote.

Sclerotinia bulborum (Wakk.), Pl. IX. fig. 135.

This pest is liable to infest the bulbs of Hyacinths, Onions, and perhaps other bulbs, and destroy a great number. Yellowish blotches appear on the foliage in spring or early summer. These spots are soon covered with an olive-brown mould. The mycelium passes down into the bulb, and there blackish sclerotia are formed, from the size of a mustard seed to that of a pea, within the scales of the bulb, and sometimes covering the surface.

During the following spring the sclerotia germinate and produce the *Peziza* or *Sclerotinia*, the sporidia of which are binucleate ($16 \times 8 \mu$).

It is recommended that the diseased bulbs should be burnt to diminish the chances of dissemination from the germinating sclerotia. The further measures recommended are spraying with Bordeaux Mixture diluted on the first appearance of the disease, or else the potassium sulphide solution.

The brownish tufts of mould are compact, the tips of the fertile branches spinulose, each spine bearing its conidium ($9–10 \times 7 \mu$).

Known hitherto in Germany.

See also "Garden Flowers" under "Black Smut of Hyacinths."

Gard. Chron. xvi. 1894, p. 160, fig. 25; *Mass. Pl. Dis.* p. 157, 380; *Sacc. Syll.* viii. No. 802.

Onion Mucor.

Mucor subtilissimus (Berk.), Pl. IX. fig. 136.

The fungus about to be described is one of the kind known as *Mucor*, of which a familiar example is known upon jams and decayed matter. It is very rarely that they become parasitic.

Many years ago Berkeley found on onions a diseased condition about the neck of the bulb, which was traversed by threads of mycelium, and among them minute black bodies like grains of gunpowder. These little bodies are compact, and of the nature of consolidated mycelium, which we have already alluded to under the name of Sclerotia. These sclerotia he found easy to germinate in water, and by this means he discovered that they would produce fertile branches supporting little globose heads. These heads are formed of a delicate membrane within which are clustered a number of minute oval spores, which when they are mature replace the membrane and escape. These spores themselves will also germinate and produce a mycelium, which will combine and form knots and become a new generation of sclerotia.

By this means the secrets of this disease were discovered and its cause attributed to the little *Mucor subtilissimus*, and the Sclerotium was known as *Sclerotium Cepævorum*.

Journ. Hort. Soc. iii. p. 98, figs. 1–5; *Cooke, Hdbk.* No. 1893; *Sacc. Syll.* vii. 625; *Mass. B. F.* p. 89; *Smith, Field Crops*, p. 51.

Of other Onion diseases we may name a Smut which has evidently escaped from North America and reached as far as France (*Urocystis Cepulæ*). It is similar in character to the *Urocystis* on the leaves of *Colchicum*, or rather perhaps on the bulbs of *Gladiolus*. The glomerules of spores (18-20 μ diam.) do not include many central fertile spores. It is recorded on *Allium Porrum* and *A. Cepa*.

Asparagus Rust.

Puccinia Asparagi (DC.), Pl. VIII. fig. 137.

This rust has been increasing to an alarming extent in North America, and every effort is being made to cope with it. The cluster cups are so rare with us that no one seems to have seen them.

The uredospores appear on the flowering stems in cinnamon-brown pustules, for a long time covered by the epidermis. They are either globose or elliptical (20-50 × 17–25 μ), delicately spinulose, pale brown.

The teleutospores occur in oblong or elongated pustules of a very dark brown colour. They are elliptical or clavate, long club-shaped, rounded above and below, divided across the centre into two cells (35–52 × 17–26 μ), smooth, chestnut-brown, with a rather long persistent pedicel.

In America it is the *Uredo* stage which causes the most mischief. It has been most experienced in dry sandy soils, while the beds on moist soils do not appear to have been injured.

The results from spraying were not encouraging. The best means suggested for controlling the rust is by thorough cultivation in order to secure vigorous plants, and in very dry seasons plants growing on very dry soil, with little water-retaining properties, should receive irrigation.

Sacc. Syll. vii. 2147; *Cooke, M. F.* 196; *Cooke, Hdbk.* No. 1467; *Journ. R.H.S.* 1901, xxvi. p. 501; *Plowr. Br. Ured.* 144.

Asparagus Copperweb.

Rhizoctonia Crocorum.

We have already referred to this disease, in its manifestations towards Crocus Bulbs (see "Pests of the Flower Garden"), hence repetition is unnecessary here.

MUSHROOM PARASITES.

This will, perhaps, be the most convenient place in which to refer to the diseases to which the cultivated Mushroom is liable.

Gard. Chron. Sept. 9, 1893, p. 299.

Mushroom Tuft Mould.

Gliocladium agaricinum (C. & M.).

The mysterious ailments of Mushrooms under cultivation are often the occasion of considerable annoyance, with little prospect of relief.

There is one not uncommon disease which causes the pileus or cap of mushrooms to crack into large frustular scales, which is now attributed to the parasitism of a mould. The tufts are hemispherical, or sometimes confluent, pallid, becoming white, at first gelatinous. The mycelium is branched and creeping, with erect fertile branches, the ultimate branches are produced in whorls of four, bearing clusters of conidia. The conidia themselves are nearly globose, produced in chains, and at first gelatinous (5–6 μ diam.).

Of course the mushrooms are destroyed, with no chance of recovery. The house should thereafter be thoroughly cleansed before use for the same purpose again.

Grevillea, xvii. p. 80.

Invading Agarics.

Agarics, other than the Mushroom, sometimes invade mushroom beds as unwelcome usurpers. Of these are *Clitocybe dealbata*, *Hebeloma fastibile*, and others.

Gard. Chron. Sept. 9, 1893, p. 299.

Mushroom Mould.

Mycogone alba (Letell.), Pl. IX. fig. 138.

This mould overspreads all parts of cultivated Mushrooms, and may possibly be the same as that which thickens and distorts the gills, and spoils a whole bed of mushrooms just as it is arriving at maturity. It spreads thinly over the surface, which the mycelium penetrates and distorts like a whitish bloom. The very short branches bear at their apex rather large obovate conidia divided into two cells, of which the upper is much the larger, and almost globose, except where it is flattened by junction with the lower cell ($30 \times 20\ \mu$). The surface of the upper cell appears to be somewhat rough, but not distinctly warted.

Very probably this is the early, or conidiiferous, condition of some species of *Hypomyces*, a genus of parasitic *Sphæriaceæ*.

Grevillea, xvii. p. 80; *Letell. Champ.* t. 667, f. 2; *Gard. Chron.* Sept. 9, 1893, p. 299; *Mass. Pl. Dis.* 133.

Mushroom Bed Sclerotium.

Xylaria vaporaria (Curr.).

The presence of sclerotia in mushroom beds was observed by Curry many years ago. In 1862 he planted some in damp sand and induced germination. Since that time they have been found perfecting themselves naturally.

The sclerotia are irregular, corky, rough, and black. They produce simple or branched stems, sometimes several inches in length, reaching to the surface of the soil. The tips of the stems are expanded into a somewhat conical head, in the lower part of which the perithecia are immersed, while the upper portion is barren and of a light brown colour, the lower half darker. The contents of the perithecia consist of long, cylindrical, transparent cells, or asci, each of which encloses eight dark-brown sporidia, of an almond shape (40-50 μ long).

It is not unusual to meet with these sclerotia in mushroom beds occasionally producing these stems, and sometimes only the thickened, club-

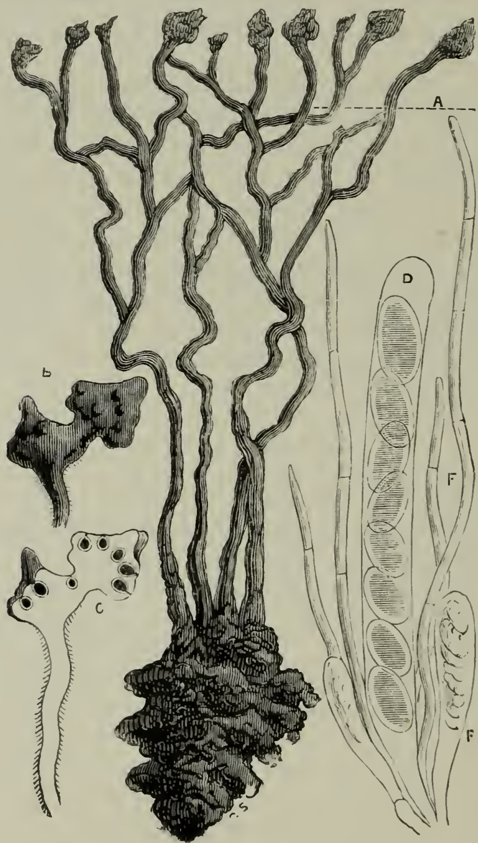


FIG. 189.—XYLARIA VAPORARIA. (*Gardeners' Chronicle.*)

A, complete plant; B, one of the fruit-bearing terminals; C, section of same showing perithecia; D, ascus with sporidia; E, young ascus; F, paraphyses.

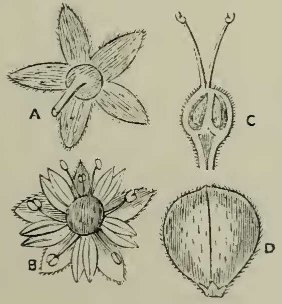
like sterile heads, they seldom being allowed to remain until the receptacles are fully developed.

Of course such beds have to be destroyed at once and the house disinfected before any attempt is made to grow mushrooms on the spot.

Sacc. Syll. i. 1292; *Curr. Linn. Trans.* xxiv. t. 625, f. 17, 26; *Cooke, Hdbk.* No. 2378; *Gard. Chron.* Dec. 20, 1879, p. 801, fig. 132.

EXPLANATION OF PLATES VII., VIII., IX.

FIG. 95.—*Phyllosticta Brassicæ*, Curr.—*a*, section; *c*, sporules ×
96.—*Glœosporium concentricum*, Grev.—*a*, sporules ×
97.—*Cercospora Bloxami*, Berk.
98.—*Cystopus candidus*, Pers.; *a*, condia, *b*, resting spore ×
99.—*Pythium DeBaryanum*, Hess.—*a*, formation of resting spore; *b*, resting spore ×
100.—*Sphærella brassicæcola*, Duby.—*a*, asci; *b*, sporidia ×
101.—*Plasmodiophora Brassicæ*, Wor.—Cell with sporules; *a*, zoospores ×
102.—*Oidium Balsami*, Mont.—conidia ×
103.—*Phyllosticta Armoraciæ*, Cke.—*a*, sporules ×
104.—*Ascochyta Armoraciæ*, Fckl.—*a*, sporules ×
105.—*Ramularia Armoraciæ*, Fckl.—*a*, hyphæ and conidia ×
106.—*Uromyces Fabæ*, Pers.—*a*, uredospores; *b*, teleutospores ×
107.—*Uromyces appendiculatus*, or *U. Phaseoli.*—*a*, uredospores; *b*, teleutospores ×
108.—*Colletotrichum Lindemuthianum*, Sacc.—*a*, section of pustule; *b*, conidia ×
109.—*Ascochyta Pisi*, Lib.—With sporules ×
110.—*Uromyces Pisi*, Pers.—*a*, uredospores; *b*, teleutospores ×
111.—*Erysiphe Martii*, Lev.—*a*, conceptacle with appendages, enlarged.
112.—*Septoria Petroselini*, Desm.—With sporules ×
113.—*Puccinia Apii*, Corda.—*a*, uredospores; *b*, teleutospores ×
114.—*Plasmopara nivea*, Ung.—*a*, threads with conidia; *b*, tip of thread with conidia ×
115.—*Bremia Lactucæ*, Regel.—*a*, threads with conidia; *b*, tip of thread with conidia ×
116.—*Fusarium Solani*, Mart.—Threads with conidia ×
118.—*Phytophthora infestans*, DBy.—Threads with conidium; *a*, ripe conidium separating; *b*, zoospores ×
119.—*Sclerotinia Sclerotiorum*, Mass.—*a*, sclerotia; *b*, cups n.s.; *c*, asci and sporidia ×
120.—*Cladosporium fulvum*, Cooke.—*a*, threads with conidia ×
121.—*Macrosporium Tomato*, Cooke.—Fruit with blotch, n. s.; *a*, conidium ×
122.—*Puccinia Menthæ*, Pers.—*a*, uredospores; *c*, teleutospores ×
124.—*Heterosporium variabile*, Cooke.—*a*, hyphæ and conidia ×
125.—*Peronospora effusa*, Rab.—threads with conidia ×
126.—*Glœosporium orbiculare*, Berk.—conidia ×
127.—*Glœosporium lagenarium*, Pers.—*a*, section of pustule; *b*, conidia ×
128.—*Oidium erysiphoides*, Link.—conidia ×
129.—*Cercospora Melonis*, Cooke.—*a*, thread with conidia ×
131.—*Vermicularia circinans*, Berk.—*a*, tuft of hairs, magnified; *b*, hair and conidia ×
132.—*Fusariella atrovirens*, Berk.—curved conidia ×
133.—*Puccinia Porri*, Sow.—*a*, uredospores; *c*, teleutospores ×
134.—*Peronospora Schleideni*, Ung.—thread with conidia ×
135.—*Sclerotinia bulborum*, Wakk.—asci and sporidia ×
136.—*Mucor subtilissimus*, Berk.—portion of thread: *a*, sporules ×
137.—*Puccinia Asparagi*, DC.—*a*, uredospores; *b*, teleutospore ×
138.—*Mycogone alba*, Letell.—hyphæ and conidia ×



NINTH ANNUAL EXHIBITION OF BRITISH-GROWN FRUIT.

Held at the Crystal Palace September 18, 19, 20, 1902.

The Autumn Show of British-grown Fruit was in 1902 fixed for the earliest date the Show has ever been held on. This was done in order that the earliest varieties of Apples and Pears and the Stone fruits, which have generally been more or less over by the date of the Show, might have an opportunity of being shown to the public. Unfortunately for the success of the experiment, not only was the Show the earliest of the whole series, but the season of 1902 was perhaps the latest experienced within living memory. The crop of fruit—particularly of Apples and Pears—was throughout the whole country remarkably short. Thus the lateness of the season made the Show quite a fortnight too early, even for the mass of the earlier varieties of Apples and Pears, and nothing really benefited save the Stone fruits, which were very strongly in evidence; indeed, but for them the Show would have been a very poor one indeed. It is as well to honestly record failures as well as successes for the sake of those that come after, and the season of 1902 has at least taught us this, that it is incurring an unwarrantable risk to have a Show of Hardy Fruit, in which Apples and Pears are mostly relied on, before quite the last week in September.

In 1903 September 29, 30, and October 1 are the days fixed upon, and the Show is to be held at Chiswick in order that Vegetables (which are not allowed at the Crystal Palace) may be shown at the same time. Chiswick is nearer to the centre of London and far more accessible from all parts than the Crystal Palace is. Full information of how to reach it is given at page 17 of the Society's Book of Arrangements, 1903.

With the addition of Vegetables this year it is calculated that the Show cannot cost less than £350 or £400, and it is earnestly hoped that all Fellows who are in any way interested in promoting the cultivation of Hardy British-grown Fruits and Vegetables, instead of our depending to so great an extent on foreign supplies, will at once come forward and subscribe towards the Prize Fund. Subscriptions may be sent to the Secretary, 117 Victoria Street, Westminster, who will most gladly acknowledge the same.

LIST OF SUBSCRIBERS TO THE PRIZE FUND OF 1902.

Donations to the Fund for 1903 are earnestly requested.

	£	s.	d.
Austin, J. E., St. James's Works, Kingston-on-Thames	0	10	6
Balderson, H., Hemel Hempstead	1	1	0
Basham, John, Bassaleg, Newport, Mon.	0	10	6
Blaker, Dr. Shaw, The Cedars, East Grinstead	0	10	6
Blenkinsop, B., J.P., Kenley, Surrey	0	10	0
Boyd, Mrs., Woodvale Lodge, Norwood Hill	0	5	0
Brocklehurst, Geo., Rock House, Sydenham Hill	1	1	0
Bunyard, Geo. & Co., Royal Nurseries, Maidstone	10	10	0

	£	s.	d.
Bythway, W., Warborough, Llanelly	1	1	0
Carpmael, Miss H., St. Julian's Farm Road, West Norwood	0	10	0
Challis, Thos., Wilton House Gardens, Salisbury	0	5	0
Cheal, J. & Sons, Crawley, Sussex	2	2	0
Clinch, T., Denaway, Key Street, Kent	0	2	6
Clout, Richard, West Malling, Kent	2	2	0
Cole, F., Swallowfield Park Gardens	0	7	6
Colman, Jeremiah, Gatton Park, Reigate	2	2	0
Coode, R. C., Polapit Tamar, Launceston	1	1	0
Crawford, Tyson, Sidcup, Kent	1	1	0
Cundey, Mrs., 2 Hyde Park Square, W.	2	2	0
Davies, Mrs., Whitford, Upper Deal	0	10	0
Day, James, Galloway House Gardens, Garliestown	0	7	6
Edwards, R., Beechy Lees, Sevenoaks	0	5	0
Fletcher, Chas. E., Kenward, Yalding, Kent	0	5	0
Fowke, Miss, Wellington, Salop	0	10	0
Fowler, J. Gurney, Glebe-lands, S. Woodford	2	2	0
Gabriel, J. T., Palace Road, Streatham Hill	1	1	0
Gardiner, John, Rudgeway, R.S.O., Glos.	1	1	0
Greaves, Ben, Broome Hall Gardens, Dorking	0	5	0
Harrowby, Countess of, Sandon Hall, Staffs	0	10	0
Heilbut, S., Holyport, nr. Maidenhead	1	1	0
Hill, Daniel, Herga, Watford	0	10	0
Hillier & Sons, Winchester	0	10	0
Horne, W., & Sons, Cliffe, Rochester	4	4	0
Hulse, Miss A., Boxgrove, Guildford	1	0	0
Hurnard, H. H., Hingham, near Attleboro'	1	1	0
Hutchesson, F., Queens' Road, Guernsey	0	5	0
Ince, Surgeon-Major, Swanley	0	10	6
Kay, P. E., Claigmar, Church End, Finchley, N.	1	1	0
Kemp, A., Coolhurst Gardens, Horsham	0	5	0
King, E. Powell, Wainsford, Lymington	0	10	0
Lawrence, Sir Trevor, Bart., K.C.V.O., V.M.H., 57 Princes Gate, S.W.	1	1	0
Leycester, E. G., Mobberley Old Hall, Knutsford	1	1	0
Lindley, Miss, Shooter's Hill Road, Blackheath, S.E.	2	2	0
Lloyd, F. G., J.P., Langley House, Bucks	3	3	0
Markendale, R. S., Bradford, Yorks	0	5	0
McIndoe, Jas., Hutton Hall Gardens, Guisboro'	1	0	0
McKenzie, J., Linton Park Gardens, Maidstone	0	10	0
McLachlan, R., Clarendon Road, Lewisham, S.E.	2	2	0
McLaren, Mrs. E., 56 Ashley Gardens, S.W.	1	1	0
Merryweather, H., Southwell . . . Prizes and	1	0	0
Mitchell, C. M., Wedderburn Road, Hampstead, N.W.	0	10	6
Monro, Geo., Covent Garden, W.C.	2	2	0
Munro, Miss Evelyn, 27 Eaton Place, S.W.	0	5	0
Nevill, Ralph, Banstead Place, Surrey	0	5	0
Neville-Grenville, Mrs., Butleigh Court, Glastonbury	0	5	0
Owen, Francis, Thorndon, Brentwood	0	10	0
Paulin, W. T., Winchmore Hill	2	2	0
Pearson, J. R., & Sons, Chilwell, Notts . . . Prizes and	1	10	0
Peed, John, & Son, Norwood Road, West Norwood	2	2	0
Potter, R., Kemsing, Sevenoaks	0	7	6
Poupart, W., & Sons, Marsh Farm, Twickenham	1	1	0
Pye-Smith, A., Willersley, Croydon	1	1	0
Richards, A., 26 Duke's Avenue, Chiswick	0	10	6
Rivers, T., & Son, Sawbridgeworth	5	5	0
Ross, Chas., Welford Park, Newbury	0	10	6
Rothschild, Leopold de, St. Swithin's Lane, E.C.	3	3	0
Rotton, Sir John, Frith Hill, Godalming	1	1	0
Routh, Mrs., The Stone House, Wandsworth Common	0	5	0
Savory, Rev. E., Binfield, Bracknell	1	0	0
Schröder, Baron, Staines	5	0	0
Sharpe, F., Sileby, Loughborough	0	5	0
Sherwood, N. N., Streatham Hill	1	1	0
Smith, James, Mentmore, Leighton Buzzard	1	0	0
Somes, Mrs., Annery House, Bideford	1	1	0
Southby, P., Bampton, Faringdon	0	5	0
Spooner, S., & Sons, Hounslow	1	1	0

	£	s.	d.
Sutton & Sons, Reading	5	0	0
Sydenham, Robert, Tenby Street, Birmingham	1	1	0
Thomas, W. F., Bishopshalt, Hillingdon	3	0	0
Turton, T., Sherborne, Dorset	0	10	6
Veitch, Jas. & Sons, Ltd., Royal Exotic Nurseries, Chelsea	5	0	0
Walker, J., Ham Common, Surrey	1	1	0
Wallace, L. A., 6 Hyde Park Gardens, W.	5	0	0
Wethered, H. L., Canynge Road, Clifton	0	5	6
White, Mrs., Walton Hall, Kelso, N.B.	1	1	0
Whiting, R. M., Credenhill, Hereford	0	10	0
Wigan, James, Cromwell House, Mortlake	0	10	0
Willard, J., Holly Lodge Garden, Highgate	0	10	6
Willmott, Miss, Warley Place, Essex	5	0	0
Woodward, G., Barham Court, Teston, Kent	1	0	0
Wyatt, A., Hatton, Middlesex	1	0	0

The following table may be interesting as comparing the number of dishes of each fruit exhibited in each of the nine years during which the Show has been held. Only exhibits under the Schedule have been included, it having been found impossible to enumerate everything shown not for competition.

Dishes of	1894	1895	1896	1897	1898	1899	1900	1901	1902
Apples	1,027	1,938	1,083	1,485	1,494	2,203	2,069	2,217	1,062
Apricots	2	1	1	1	1	—	—	—	1
Bananas	—	1	–	—	—	—	—	—	—
Blackberries	—	—	—	—	1	—	—	—	—
Bullaces	5	3	1	3	1	—	—	2	2
Cherries	7	12	6	1	1	2	5	2	1
Crab Apples	—	—	—	—	—	6	27	12	10
Currants	—	—	—	—	2	1	—	2	2
Damsons	6	18	4	5	15	13	10	5	5
Figs	4	9	7	26	10	9	9	6	9
Gooseberries	1	—	—	—	2	—	—	1	—
Grapes	105	97	135	120	115	83	113	68	69
Medlars	—	2	3	5	4	5	2	9	2
Melons	—	10	7	8	5	4	12	6	7
Mulberries	—	—	—	—	—	2	—	—	2
Nectarines	15	18	4	11	29	19	52	2	33
Nuts	—	26	19	10	14	10	14	7	10
Passiflora	—	—	1	1	—	—	—	—	—
Peaches	51	80	24	77	96	67	128	29	67
Pears	829	779	795	677	694	842	1,099	1,230	564
Pines	—	—	5	3	1	2	2	3	2
Plums	90	101	38	115	214	79	284	50	159
Quinces	6	14	17	1	2	5	3	10	1
Raspberries	—	–	—	—	2	1	2	4	2
Strawberries	—	—	—	—	2	—	4	3	1
Tomatos	—	67	2	3	6	5	6	9	—
Total	2,148	3,176	2,152	2,552	2,711	3,358	3,841	3,677	2,011
Entries for competition	1,301	1,783	1,234	1,329	1,332	1,297	1,505	1,306	629
Visitors	23,680	36,293	26,499	27,242	29,281	30,150	40,787	26,927	80,000

THE JUDGES.

The following ladies and gentlemen kindly acted as judges, and deserve the best thanks of the Society for their oftentimes very difficult work, viz.:—

Basham, J., Bassaleg, Newport, Mon.
Bates, W., Cross Deep Gardens, Twickenham.
Beckett, E., Aldenham House Gardens, Elstree.
Bunyard, G., V.M.H., Royal Nurseries, Maidstone.
Cheal, Joseph, Crawley, Sussex.
Coomber, T., The Hendre Gardens, Monmouth.
Crisp, Mrs., Warley Place, Great Warley, Essex.
Dawes, H., Ledbury Park Gardens, Ledbury.
Dean, A., 62 Richmond Road, Kingston.
Divers, W. H., Belvoir Castle Gardens, Grantham.
Douglas, J., V.M.H., Great Bookham, Surrey.
Earp, Wm., Shirley House Gardens, Croydon.
Fielder, C. R., North Mymms Park Gardens, near Hatfield.
Fyfe, W., Lockynge Park, Wantage.
Gleeson, M., Warren House Gardens, Stanmore,
Hudson, J., V.M.H., Gunnersbury House Gardens, Acton, W.
Hudson, Mrs., Gunnersbury House Gardens, Acton, W.
McIndoe, J., V.M.H., Hutton Hall Gardens, Guisboro'.
Markham, H., Wrotham Park Gardens, Barnet.
Mortimer, S., Farnham, Surrey.
Norman, G., V.M.H., Hatfield House Gardens, Hatfield.
Pearson, A. H., The Gables, Hucknall Road, Nottingham.
Pope, W., Highclere Gardens, Newbury.
Poupart, W., Marsh Farm, Twickenham.
Reynolds, G., The Gardens, Gunnersbury Park, Acton, W.
Rivers, H. Somers, Sawbridgeworth.
Salter, C. J., Woodhatch Gardens, Reigate.
Smith, J., V.M.H., Mentmore Gardens, Leighton Buzzard.
Walker, J., Ham Common, Surrey.
Ward, A., Stoke Edith Park, Hereford.
Willard, J., Holly Lodge Gardens, Highgate.
Woodward, G., Barham Court, Teston, Maidstone.

THE REFEREES.

The following gentlemen very kindly held themselves at the disposal of the Society to act as referees if required, viz.:—

Monro, G., V.M.H., Covent Garden, W.C.
Thomas, Owen, V.M.H., 25 Waldeck Road, West Ealing.
Tillman, H. E., Covent Garden, W.C.
Wright, J., V.M.H., Rose Hill Road, Wandsworth.
Wythes, G., V.M.H., Syon House Gardens, Brentford.

OFFICIAL PRIZE LIST.

(The address and the Gardener's name are entered on the first occurrence, but afterwards only the Owner's name is recorded.)

Division I.

Fruits, grown under Glass or otherwise.

Open to Gardeners and Amateurs only.

Note.—Exhibitors can compete in one Class only of Classes 1, 2; and of Classes 3, 4.

Class **1.**—Collection of 9 dishes of Ripe Dessert Fruit:—6 kinds at least; only 1 Pine, 1 Melon, 1 Black and 1 White Grape allowed; not more than 2 varieties of any other kind, and no two dishes of the same variety.

First Prize, Silver-gilt Knightian Medal and £4; Second, £4; Third, £2.

1. Earl of Harrington, Derby (gr. J. H. Goodacre).
2. The Hon. Sir C. Swinfen Eady, Weybridge (gr. J. Lock).
3. Earl of Sandwich, Huntingdon (gr. J. Barson).

Class **2.** Collection of 6 dishes of Ripe Dessert Fruit:—4 kinds at least; only 1 Melon, 1 Black and 1 White Grape allowed; not more than 2 varieties of any other kind, and no two dishes of the same variety. Pines excluded.

First Prize, Silver Knightian Medal and £3; Second, £2 10*s.*; Third, £1 5*s.*

1. J. W. Fleming, Esq., Romsey (gr. W. Mitchell).
2. Col. Archer Houblon, Bishop's Stortford (gr. W. Harrison).
3. Lady Tate, Streatham Common (gr. W. Howe).

Class **3.**—Grapes, 6 distinct varieties, 3 bunches of each; both Black and White must be represented.

First Prize, Silver Cup and £3; Second, £3.

1. Lord Hastings, Melton Constable (gr. W. Shingler).
2. Earl of Harrington.

Class **4.**—Grapes, 4 varieties, selected from the following: 'Madresfield Court,' 'Mrs. Pince,' 'Muscat Hamburgh,' 'Muscat of Alexandria' or 'Canon Hall' (not both), 'Mrs. Pearson,' and 'Dr. Hogg,' 3 bunches of each.

First Prize, £4; Second, £3; Third, £2.

No entry.

Class **5.**—Grapes, Black Hamburgh, 3 bunches.

First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*

1. J. W. Fleming, Esq.
2. Earl of Harrington.
3. Miss Ridge, Englefield Green (gr. G. Lane).

Class **6.**—Grapes, 'Mrs. Pince,' 3 bunches.
First Prize, £1. 10*s.*; Second, £1.
1. C. Bayer, Esq., Forest Hill (gr. W. Taylor).
2. No award.

Class **7.**—Grapes, Alicante, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. G. C. Raphael, Esq., Englefield Green (gr. H. H. Brown).
2. Lord Hastings.
3. C. Bayer, Esq.

Class **8.**—Grapes, 'Madresfield Court,' 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. J. W. Fleming, Esq.
2. Earl of Harrington.
3. C. Bayer, Esq.

Class **9.**—Grapes, any other Black Grape, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. Lord Hastings.
2. Miss Ridge.
3. J. W. Fleming, Esq.

Class **10.**—Grapes, 'Muscat of Alexandria,' 3 bunches.
First Prize, £2. 10*s.*; Second, £1. 10*s.*; Third, £1.
1. Sir E. Durning Lawrence, Ascot (gr. W. Lane).
2. The Hon. Sir C. Swinfen Eady.
3. Earl of Stanhope, Sevenoaks (gr. C. Sutton).

Class **11.**—Grapes, any other White Grape, 3 bunches.
First Prize, £1. 10*s.*; Second, £1; Third, 10*s.*
1. Miss Ridge.
2. C. Bayer, Esq.
3. Earl of Harrington.

Class **12.**—Grapes, 3 bunches of any Frontignan varieties.
First Prize, £1. 10*s.*; Second, £1.
No entry.

Class **13.**—Collection of Hardy Fruit, 30 dishes distinct, grown entirely in the open; not to include more than 12 varieties of Apples or 8 of Pears.
First Prize, The Hogg Medal and £3; Second, £2; Third, £1.
1. R. H. B. Marsham, Esq., Maidstone (gr. W. Lewis).
2. T. L. Boyd, Esq., Tonbridge (gr. E. Coleman).
3. T. Barnett, Esq., Chichester (gr. Mr. Berryman).

Class **14.**—Collection of Hardy Fruit, 12 dishes distinct, grown partly or entirely under glass to illustrate Orchard-house Culture; grapes excluded.
First Prize, £1. 10*s.*; Second, £1.
1. Earl of Harrington.
2. C. A. Morris-Field, Esq., Otford (gr. R. Edwards).

Division II.

Open to Nurserymen only.

Nurserymen must exhibit as individuals or as firms, and must have actually grown all they exhibit. Combinations of individuals or firms are not allowed, nor collections of produce from districts.

Nurserymen desiring to exhibit at this Show must make application for space as under Class 15, 16, or 17; and also for 18 if they wish to show fruit grown under glass. No other spaces than the above can be allotted to Nurserymen wishing to show fruit, whether for competition or not. Exhibitors can only enter in one of Classes 15, 16, and 17.

Nurserymen may adopt any method of staging they desire, subject to the following reservations: (*a*) The number of fruits is not limited, but the baskets or dishes must not exceed 15 inches in diameter if circular, or 19 × 15 if rectangular; (*b*) Duplicate trees are permitted, but not duplicate baskets or dishes of fruit; (*c*) Trees are not admissible in 15, 16, 17; (*d*) A decorative central trophy not exceeding 4 feet square at the base is allowed as an extra, and the fruit thereon will not be subject to the rule (*b*) as to duplicates.

No awards of any sort will be made to Nurserymen who do not conform to the above regulations.

Important.—Nurserymen having entered and finding themselves unable to exhibit are *particularly* requested to give three days' notice to the Superintendent, R.H.S. Gardens, Chiswick, London, W.

Allotment of table-space will be made to Nurserymen on the three following scales:—

For Fruit grown entirely out of doors.

Class **15.**—48 feet run of 6 feet tabling.

First Prize, Gold Medal; Second, Hogg Medal; Third, Silver-gilt Knightian Medal.

1. Mr. H. Berwick, Sidmouth.
2. Messrs. H. Cannell & Sons, Swanley.
3. No award.

Class **16.**—32 feet run of 6 feet tabling.

First Prize, Hogg Medal; Second, Silver-gilt Knightian; Third, Silver-gilt Banksian.

1. Messrs. J. Cheal & Sons, Crawley.
2. Messrs. J. Peed & Son, West Norwood.
3. No award.

Class **17.**—16 feet run of 6 feet tabling.

First Prize, Silver-gilt Knightian; Second, Silver-gilt Banksian; Third, Silver Knightian.

1. Mr. G. Mount, Canterbury.
2. Messrs. Spooner & Sons, Hounslow.
3. Messrs. J. Laing & Sons, Forest Hill.

For Orchard-house Fruit and Trees.

Class **18.**—32 feet run of 6 feet tabling.

First Prize, Gold Medal; Second, Hogg Medal; Third, Silver-gilt Knightian Medal.

No entry.

Division III.

Open to Market Growers only.

Exhibitors in Class 19 may not show in 21, nor may Exhibitors in 20 show in 22.

Gentlemen's Gardeners or Amateurs who sell surplus fruit, and Nurserymen, are excluded from this Division.

Market Growers must exhibit as individuals or as firms, and must have actually grown all they exhibit. Combinations of individuals or firms are not allowed, nor collections of produce from districts.

With the exception of Class 26, all fruits must be shown "as packed for travelling to Market," except that all lids, covering paper, and other surface packings are to be turned back (not removed), so as to display contents. *Boxes or Baskets piled up above the edge or rim will be considered "unsuitable for travelling," and will be disqualified.*

Other things being equal, a sieve or bushel of Apples or Pears will be considered to weigh *about* 42 lb., and a half-sieve or half-bushel 20 lb., or of Plums 28 lb., more or less.

The Judges will be men thoroughly conversant with the market, and in awarding the prizes they will be instructed to consider not only the quality of the fruit, but also the packing, the grading, and the suitability for travelling and for market purposes of the box, basket, or other receptacle in which the fruit is shown.

Class **19.** Apples, Cooking, 4 varieties, about 42 lb. net of each, in baskets or boxes.

First Prize, £1. 10*s.*; Second, £1.

1. Mr. H. T. Mason, Hampton Hill.
2. Mr. W. Poupart, Twickenham.

Class **20.**—Apples, Dessert, 4 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1. 10*s.*; Second, £1.

1. Mr. G. Chambers, Mereworth.
2. Mr. W. Poupart.

Class **21.**—Apples, Cooking, 2 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1; Second, 15*s.*

1. Mr. G. Chambers.
2. No award.

Class **22.**—Apples, Dessert, 2 varieties, about 20 lb. net of each, in baskets or boxes.

First Prize, £1; Second, 15*s.*

1. Mr. H. T. Mason.
2. Mr. A. Wyatt, Hatton.

Class **23.**—Apples, about 42 lb. net of any one variety, in any Improved Form of Package for market.

No prize will be awarded unless the Judges consider the box, basket, or other receptacle *superior* to those in ordinary use.

First Prize, £1; Second, 15*s.*

No award.

Class **24.**—Pears, 2 varieties, in 2 packages of about 20 lb. capacity each.

First Prize, £1; Second, 15*s*.

1. Mr. A. Wyatt.
2. Mr. G. Chambers.

Class **25.**—Pears, from 24 to 48 fruits, according to size, of any one choice dessert variety, suitably packed in one package for market.

First Prize, 15*s*.; Second, 10*s*.

1. Mr. W. Poupart.
2. Mr. A. Wyatt.

Class **26.**—Collection of 12 varieties of Apples and 6 of Pears, distinct, 18 fruits of each, to be laid flat on the table without dishes or baskets. Only vine or similar leaves allowed for decoration, and the space occupied must not exceed 16 feet × 3 feet.

First Prize, £3; Second, £2.

1. Mr. W. Poupart.
2. Messrs. W. J. Lobjoit & Son, Hounslow.

Class **27.**—Plums, Cooking, a basket or box of about 28 lb. capacity of any one variety.

First Prize, 15*s*.; Second, 10*s*.

1. Mr. W. Poupart.
2. Messrs. W. J. Lobjoit & Son.

Class **28.**—Plums, from 24 to 48 fruits, of any choice dessert variety, suitably packed in one package for market.

First Prize, 15*s*.; Second, 10*s*.

1. Messrs. W. J. Lobjoit & Son.
2. No award.

Class **29.**—Peaches, 24 Fruits of one or two varieties, packed in a suitable box for market.

First Prize, £1; Second, 15*s*.

1. Mr. John Gore, Polegate.
2. Mr. W. J. Noy, Brentford (gr. W. Buckingham).

Division IV.

Fruits grown in the Open Air.

Open to Gardeners and Amateurs only. Nurserymen and Market Growers excluded.

Exhibitors of Apples or Pears in Division IV. are excluded from Division VI.

Note.—Exhibitors can compete in one Class only of the Classes 30, 31, 32; of 35, 36, 37, 38; of 39, 40, 41; of 42, 43; of 44, 45.

Class **30.**—Apples, 24 dishes distinct, 16 Cooking, 8 Dessert. The latter to be placed in the front row.

First Prize, £3. 10*s*.; Second, £2; Third, £1. 10*s*.

No entry.

Class **31.**—Apples, 18 dishes distinct, 12 Cooking, 6 Dessert. The latter to be placed in the front row.

First Prize, £2. 10*s.*; Second, £1. 10*s.*; Third, £1.

No entry.

Class **32.**—Apples, 12 dishes distinct, 8 Cooking, 4 Dessert. The latter to be placed in the front row.

First Prize, £2; Second, £1; Third, 15*s.*

1. J. R. Brougham, Esq., Carshalton (gr. W. Jones). / R. H. B. Marsham, Esq. } Equal.
2. 3. } No award.

Class **33.**—Cooking Apples, 6 dishes, distinct.

First Prize, £1; Second, 15*s.*

1. Rev. O. L. Powell, Weybridge (gr. A. Basile).
2. No award.

Class **34.**—Dessert Apples, 6 dishes, distinct.

First Prize, £1; Second, 15*s.*

No entry.

Class **35.**—Dessert Pears, 18 dishes, distinct.

First Prize, £3. 10*s.*; Second, £2; Third, £1.

1. Sir Marcus Samuel, Maidstone (gr. W. H. Bacon).
2. 3. } No award.

Class **36.**—Dessert Pears, 12 dishes, distinct.

First Prize, £2; Second, £1; Third, 15*s.*

1. Rev. O. L. Powell.
2. 3. } No award.

Class **37.**—Dessert Pears, 9 dishes, distinct.

First Prize, £1. 10*s.*; Second, 17*s.* 6*d.*

1. J. R. Brougham, Esq.
2. No award.

Class **38.**—Dessert Pears, 6 dishes, distinct.

First Prize, £1; Second, 15*s.*

1. C. A. Morris-Field, Esq.
2. A. Benson, Esq., Merstham (gr. W. Mancey).

Class **39.**—Peaches, grown entirely out of doors, 6 dishes, distinct.

First Prize, £2; Second, £1.

1. O. E. Avigdor Goldsmid, Esq., Tonbridge (gr. C. Earl).
2. Earl of Harrington.

Class **40.**—Peaches, grown entirely out of doors, 3 dishes distinct.

First Prize, £1; Second, 15*s*.

1. J. B. Fortescue, Esq., Maidenhead (gr. C. Page).
2. R. Bedingfield, Esq., Roehampton (gr. J. Sparks).

Class **41.**—Peaches, grown entirely out of doors, 1 dish of one variety.

First Prize, 10*s*.; Second, 7*s*.

1. Earl of Chesterfield, Hereford (gr. W. Humphries).
2. { The Hon. Sir C. Swinfen Eady. / J. W. Fleming, Esq. } Equal.

Class **42.**—Nectarines, grown entirely out of doors, 3 dishes distinct.

First Prize, £1; Second, 15*s*.

1. O. E. Avigdor Goldsmid, Esq.
2. J. K. D. Wingfield-Digby, Esq., M.P., Sherborne Castle (gr. T. Turton).

Class **43.**—Nectarines, grown entirely out of doors, 1 dish of one variety.

First Prize, 10*s*.; Second, 7*s*.

1. The Hon. Sir C. Swinfen Eady.
2. Earl of Harrington.

Class **44.**—Plums, 9 dishes, 3 Dessert and 6 Cooking, distinct.

First Prize, £2; Second, £1.

1. Earl of Ashburnham, Battle (gr. G. Grigg).
2. Earl of Carnarvon, Newbury (gr. W. Pope).

Class **45.**—Plums, 6 dishes, 2 Dessert and 4 Cooking, distinct.

First Prize, £1 10*s*.; Second, 15*s*.

1. A. J. Barry, Esq., Battle (gr. H. Colegate).
2. J. K. D. Wingfield-Digby, Esq., M.P.

Class **46.**—Plums, 3 dishes of Gages, distinct.

First Prize, 15*s*.; Second, 10*s*.

1. Earl of Harrington.
2. No award.

Class **47.**—Plums, 1 dish of Dessert, of one variety.

First Prize, 7*s*.; Second, 5*s*.

1. J. K. D. Wingfield-Digby, Esq., M.P.
2. Lord Braybrooke, Saffron Walden (gr. J. Vert).

Class **48.**—Plums, 1 dish of Cooking, of one variety.

First Prize, 7*s*.; Second, 5*s*.

1. Earl of Ashburnham.
2. J. K. D. Wingfield-Digby, Esq., M.P.

Division V.

Special District County Prizes.

Open to Gardeners and Amateurs only.

(In this Division all fruit must have been grown in the open.)

N.B.—Exhibitors in Division V. must not compete in Divisions II. and III., or in Classes 1, 2, 3, 4, 30, 31, 32, 35, 36, 37.

Class **AA**.—Apples, 6 dishes, distinct, 4 Cooking, 2 Dessert.
1st Prize, £1 and 3rd class Single Fare from Exhibitor's nearest railway station to London ; 2nd Prize, 15*s*. and Railway Fare as above.

Class **BB**.—Dessert Pears, 6 dishes, distinct.
1st Prize, £1. 10s. and Railway Fare as above ; 2nd Prize, £1 and Railway Fare as above.

The two above classes, AA and BB, are repeated eleven times as follows, and Exhibitors must enter for them thus : "Class AA 49" or "BB 50," and so on, to make it quite clear whether they mean Apples or Pears.

Class **49**.—Open only to Kent Growers.

AA.—Apples.
1. T. L. Boyd, Esq.
2. C. A. Morris-Field, Esq.

BB.—Pears.
1. T. L. Boyd, Esq.
2. C. A. Morris-Field, Esq.

Class **50**.—Open only to Growers in Surrey, Sussex, Hants, Dorset, Somerset, Devon, and Cornwall.

AA.—Apples.
1. A. J. Barry, Esq.
2. J. K. D. Wingfield-Digby, Esq., M.P.

BB.—Pears.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. A. J. Barry, Esq.

Class **51**.—Open only to Growers in Wilts, Gloucester, Oxford, Bucks, Berks, Beds, Herts, and Middlesex.

AA.—Apples.
Col. Vivian, Trowbridge (gr. W. Strugnell).
2. J. B. Fortescue, Esq.

BB.—Pears.
1. Mrs. St. Vincent Ames, Westbury-on-Trym (gr. W. H. Bannister).
2. J. B. Fortescue, Esq.

Class **52**.—Open only to Growers in Essex, Suffolk, Norfolk, Cambridge, Hunts, and Rutland.

AA.—Apples. No entry.

BB.—Pears.
1. Col. Archer-Houblon (gr. W. Harrison).
2. No award.

Class **53**.—Open to Growers in Lincoln, Northampton, Warwick, Leicester, Notts, Derby, Staffs, Shropshire, and Cheshire.

AA.—Apples.
1. Duke of Rutland, Grantham (gr. W. H. Divers).
2. H. Knott, Esq., J.P., Stamford.

BB.—Pears. { 1. Duke of Rutland.
2. H. Knott, Esq., J.P.

Class **54**.—Open only to Growers in Worcester, Hereford, Monmouth, Glamorgan, Carmarthen, and Pembroke.

AA.—Apples. { 1. G. H. Hadfield, Esq., Ross (gr. J. Rick).
2. H. L. Lutwyche, Esq., Ross (gr. J. E. Jones).

BB.—Pears. { 1. G. H. Hadfield, Esq.
2. Earl of Chesterfield.

Class **55**.—Open only to Growers in the other Counties of Wales.

AA.—Apples. { 1. Col. Cornwallis West, Ruthin (gr. H. Forder).
2. Mrs. Davis-Evans, Llanybyther (gr. T. Fox).

BB.—Pears. { 1. Col. Cornwallis West.
2. Mrs. Davis-Evans.

Class **56**.—Open only to Growers in the Six Northern Counties of England, and in the Isle of Man.

AA.—Apples. { 1. J. R. Pease, Esq., Hull (gr. G. Picker).
2. Sir Joseph Pease, Guisboro' (gr. J. McIndoe).

BB.—Pears. { 1. Sir Joseph Pease.
2. J. R. Pease, Esq.

Class **57**.—Open only to Growers in Scotland.

AA.—Apples. { 1. Earl of Galloway, Garliestown (gr. J. Day).
2. No award.

BB.—Pears. { 1. Earl of Galloway.
2. No award.

Class **58**.—Open only to Growers in Ireland.

AA.—Apples. { 1. Viscount Duncannon, Piltown (gr. J. G. Weston).
2. No award.

BB.—Pears. No entry.

Class **59**.—Open only to Growers in the Channel Islands.
No entry.

Division VI.

Single Dishes of Fruit grown in the Open Air.

Open to Gardeners and Amateurs only. Nurserymen and Market Growers excluded.

Prizes in each Class (except 85, 89, 104, 105, 113 and 138), 1st, 7*s.*; 2nd, 5*s.*

Choice Dessert Apples.

Class **60**.—Adams's Pearmain.
1. F. W. Thomas, Esq., Polegate.
2. Jeremiah Colman, Esq., Reigate (gr. W. P. Bound).

Class **61**.—Allington Pippin.
1. Col. Archer-Houblon (gr. W. Harrison).
2. F. S. W. Cornwallis, Esq., Maidstone (gr. J. McKenzie).

Class **62**.—American Mother.
1. F. S. W. Cornwallis, Esq.
2. J. K. D. Wingfield-Digby, Esq., M.P.

Class **63**.—Benoni.
1. F. W. Thomas, Esq.
2. F. S. W. Cornwallis, Esq.

Class **64**.—Blenheim Orange. (See Class 88.)
Small highly coloured fruits which will pass through a 3-inch ring.
No award.

Class **65**.—Cardinal, *syn.* Peter the Great.
No entry.

Class **66**.—Claygate Pearmain.
1. F. H. Whitmore, Esq., Grays (gr. D. G. McIver).
2. A. J. Carter, Esq., Billingshurst.

Class **67**.—Cox's Orange Pippin.
1. Jeremiah Colman, Esq.
2. J. T. Charlesworth, Esq., Redhill (gr. T. W. Herbert).

Class **68**.—Devonshire Quarrenden.
1. Jeremiah Colman, Esq.
2. T. Lloyd Davies, Esq., Addlestone (gr. G. Crabb).

Class **69**.—Duchess' Favourite.
1. T. Lloyd Davies, Esq.
2. F. H. Whitmore, Esq.

Class **70**.—Egremont Russet.
1. F. S. W. Cornwallis, Esq.
2. O. E. Avigdor Goldsmid, Esq.

Class **71**.—Fearn's Pippin.
No award.

Class **72**.—Gascoyne's Scarlet. (See Class 95.)
Small highly coloured Fruits which will pass through a 3-inch ring.
1. O. E. Avigdor Goldsmid, Esq.
2. Mr. T. Clinch.

Class **73**.—Golden Reinette.
No entry.

Class **74**.—Irish Peach.
1. No award.
2. J. T. Charlesworth, Esq.

Class **75**.—James Grieve.
1. F. W. Thomas, Esq.
2. Col. Archer-Houblon (gr. W. Harrison).

Class **76**.—King of the Pippins.
1. The Hon. Sir C. Swinfen Eady.
2. O. E. Avigdor Goldsmid, Esq.

Class **77**.—King of Tomkins County.
1. Madame Stuart, Roehampton (gr. A. Smith).
2. Earl of Ashburnham.

Class **78**.—Lady Sudeley.
1. J. W. Fleming, Esq.
2. F. H. Whitmore, Esq.

Class **79**.—Lord Burghley.
1. Mr. A. J. Carter.
2. Col. Archer-Houblon, Newbury (gr. C. Ross).

Class **80**.—Mannington's Pearmain.
1. T. L. Boyd, Esq.
2. Col. Archer-Houblon (gr. C. Ross).

Class **81**.—Margil.
1. F. S. W. Cornwallis, Esq.
2. Col. Archer-Houblon (gr. C. Ross).

Class **82**.—Red Astrachan.
No entry.

Class **83**.—Ribston Pippin.
1. Earl of Ashburnham.
2. J. B. Fortescue, Esq.

Class **84**.—Worcester Pearmain.
1. Mrs. St. Vincent Ames.
2. G. H. Hadfield, Esq.

Class **85**.—Any other variety not named above.
Four Prizes, 7*s*., 6*s*., 5*s*., 4*s*.

An Exhibitor may only enter in one variety in Class 85.

In this Class 8 Fruits must be shown to a dish for the Judges to be able to taste two of them.

1. F. S. W. Cornwallis, Esq.
2. Madame Stuart.
3. Lord Poltimore, Exeter (gr. T. H. Slade).
4. O. E. Avigdor Goldsmid, Esq.

Choice Cooking Apples.

Class **86**.—Beauty of Kent.
No entry.

Class **87**.—Bismarck.
1. Madame Stuart.
2. F. S. W. Cornwallis, Esq.

Class **88**.—Blenheim Orange. Large fruits. (See Class 64.)
1. T. L. Boyd, Esq.
2. H. L. Lutwyche, Esq.

Class **89**.—Bramley's Seedling.

First Prize, 20*s.*; Second, 10*s.*; Third, 5*s.*

Prizes given by Messrs. H. Merryweather, The Nurseries, Southwell.

1. Rev. O. L. Powell.
2. R. H. B. Marsham, Esq.
3. No award.

Class **90**.—Cox's Pomona.

1. F. S. W. Cornwallis, Esq.
2. J. T. Charlesworth, Esq.

Class **91**.—Duchess of Oldenburgh.

1. Earl of Stanhope.
2. O. E. Avigdor Goldsmid, Esq.

Class **92**.—Ecklinville.

1. F. W. Thomas, Esq.
2. Madame Stuart.

Class **93**.—Emperor Alexander.

1. F. S. W. Cornwallis, Esq.
2. No award.

Class **94**.—Frogmore Prolific.

1. C. P. Wykeham-Martin, Esq., Maidstone (gr. D. McAinsh).
2. F. S. W. Cornwallis, Esq.

Class **95**.—Gascoyne's Scarlet. Large fruits. (See Class 72.)

1. F. H. Whitmore, Esq.
2. J. K. D. Wingfield-Digby, Esq., M.P.

Class **96**.—Golden Noble.

1. F. S. W. Cornwallis, Esq.
2. No award.

Class **97**.—Grenadier.

1. C. P. Wykeham-Martin, Esq.
2. F. S. W. Cornwallis, Esq.

Class **98**.—Hawthornden, New.

1. T. L. Boyd, Esq.
2. J. T. Charlesworth, Esq.

Class **99**.—Lane's Prince Albert.

1. Earl of Stanhope.
2. Col. Archer-Houblon (gr. C. Ross).

Class **100**.—Lord Derby.

1. Madame Stuart.
2. F. H. Whitmore, Esq.

Class **101**.—Lord Grosvenor.

1. A. J. Carter, Esq.
2. C. P. Wykeham-Martin, Esq.

Class **102**.—Lord Suffield.
1. Madame Stuart.
2. F. S. W. Cornwallis, Esq.

Class **103**.—Mère de Ménage.
1. F. S. W. Cornwallis, Esq.
2. No award.

Class **104**.—Newton Wonder.
First Prize, 20*s.*; Second, 10*s.*; Third, 5*s.*

Prizes presented by Messrs. J. R. Pearson & Sons, Lowdham, Notts.
Open only to Exhibitors living in Cardigan, Radnor, Shropshire, Stafford, Warwick, Northampton, Bedford, Cambridge, Essex, or Counties further north.

1. Duke of Rutland.
2. } No award.
3. }

Class **105**.—Newton Wonder.
First Prize, 20*s.*; Second, 10*s.*; Third, 5*s.*

Prizes presented by Messrs. J. R. Pearson & Sons, Lowdham, Notts.
Open only to Exhibitors living south of the before-named Counties.

1. F. W. Thomas, Esq.
2. W. Greenwell, Esq., Marden Park (gr. W. Lintott).
3. Rev. O. L. Powell.

Class **106**.—Peasgood's Nonesuch.
1. F. S. W. Cornwallis, Esq.
2. R. H. B. Marsham, Esq.

Class **107**.—Pott's Seedling.
1. C. P. Wykeham-Martin, Esq.
2. No award.

Class **108**.—Royal Jubilee.
1. Col. Archer-Houblon (gr. C. Ross).
2. Earl Stanhope.

Class **109**.—Sandringham.
1. Col. Archer-Houblon (gr. C. Ross).
2. Madame Stuart.

Class **110**.—Stirling Castle.
1. Jeremiah Colman, Esq.
2. Col. Archer-Houblon (gr. C. Ross).

Class **111**.—The Queen.
1. Jeremiah Colman, Esq.
2. Madame Stuart.

Class **112**.—Warner's King.
1. F. S. W. Cornwallis, Esq.
2. Madame Stuart.

Class **113.**—Any other variety not named above.

Four Prizes : 7*s.*, 6*s.*, 5*s.*, 4*s.*

An Exhibitor may only enter one variety in Class 113.

In this Class 8 fruits must be shown to a dish for the Judges to be able to taste two of them.

1. Madame Stuart.
2. F. S. W. Cornwallis, Esq.
3. Earl of Stanhope.
4. Col. Archer-Houblon (gr. C. Ross).

Choice Dessert Pears.

Class **114.**—Beurré d'Amanlis.
1. Rev. O. L. Powell.
2. W. Greenwell, Esq.

Class **115.**—Beurré Diel.
1. A. J. Carter, Esq.
2. No award.

Class **116.**—Beurré Dumont.
1. T. L. Boyd, Esq.
2. No award.

Class **117.**—Beurré Fouqueray.
1. T. L. Boyd, Esq.
2. Rev. O. L. Powell.

Class **118.**—Beurré Hardy.
1. G. H. Hadfield, Esq.
2. Mrs. St. Vincent Ames.

Class **119.**—Beurré Superfin.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. Mrs. St. Vincent Ames.

Class **120.**—Clapp's Favourite.
1. W. Greenwell, Esq.
2. Earl of Ashburnham.

Class **121.**—Comte de Lamy.
1. J. T. Charlesworth, Esq.
2. No award.

Class **122.**—Conference.
1. H. Partridge, Esq., Bletchingley (gr. J. W. Barks).
2. W. Greenwell, Esq.

Class **123.**—Doctor Jules Guyot.

No entry.

Class **124.**—Doyenné du Comice.
1. H. Partridge, Esq.
2. No award.

Class **125.**—Doyenné Boussoch.
1. G. H. Hadfield, Esq.
2. Rev. O. L. Powell.

Class **126.**—Durondeau.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. Mrs. St. Vincent Ames.

Class **127.**—Émile d'Heyst.
1. Lord Poltimore.
2. T. L. Boyd, Esq.

Class **128.**—Fondante d'Automne.
1. Lady Tate.
2. T. L. Boyd, Esq.

Class **129.**—Louise Bonne of Jersey.
1. F. W. Thomas, Esq.
2. C. P. Wykeham-Martin, Esq.

Class **130.**—Marguerite Marillat.
1. Lord Poltimore.
2. F. W. Thomas, Esq.

Class **131.**—Marie Louise.
1. G. H. Hadfield, Esq.
2. J. K. D. Wingfield-Digby, Esq., M.P.

Class **132.**—Pitmaston Duchess.
1. Col. Best, Salisbury (gr. T. Horsey).
2. H. Partridge, Esq.

Class **133.**—Seckle.
1. Col. Archer-Houblon (gr. C. Ross).
2. T. L. Boyd, Esq.

Class **134.**—Souvenir du Congrès.
1. G. H. Hadfield, Esq.
2. Rev. O. L. Powell.

Class **135.**—Thompson's.
1. J. B. Fortescue, Esq.
2. Mrs. St. Vincent Ames.

Class **136.**—Triomphe de Vienne.
1. J. K. D. Wingfield-Digby, Esq., M.P.
2. F. W. Thomas, Esq.

Class **137.**—Williams's Bon Chrétien.
1. G. H. Hadfield, Esq.
2. J. T. Charlesworth, Esq.

Class **138.**—Any other variety not named above.
Four Prizes: 7*s.*, 6*s.*, 5*s.*, 4*s.*

An Exhibitor may only enter one variety in Class 138.

In this Class 8 fruits must be shown to a dish for the Judges to be able to taste two of them.

1. T. L. Boyd, Esq.
2. Jeremiah Colman, Esq.
3. } No award.
4. }

Division VII.

Miscellaneous.

Any fresh fruits of *different kind* from those included in the previous Divisions may be shown here, and special prizes will be awarded to any exhibits considered to deserve them. Different *varieties* of the *same kind* of fresh fruit as any mentioned in the previous Divisions (as of Apples, Pears, Plums, Peaches, &c.) may *not* be shown in Division VII., with the exception of *outdoor grown* varieties of Grapes, which may also be shown in any convenient quantity. Dried or preserved fruits of *any* kind may be shown, subject to the condition of their being tested by the Judges.

Class **139.**—Home Preserved or Home Bottled British-grown Fruits. *Open.* This exhibit must not occupy a space greater than 8 feet by 6 feet, and must not be built up more than 2 feet high in the centre. Jams in clear glass jars or bottles; bottled fruits in clear glass bottles; small quantities of fruits, preserved, dried, or evaporated in any other way, may be included, but all alike must be British grown and British prepared.

First Prize, Gold Medal; other prizes at the discretion of the Council.

1. Messrs. Austin & Co., Kingston-on-Thames.
2. Britannia Fruit Works, Kelvedon.
3. Horticultural College, Swanley.
4. Lady Warwick Hostel, Reading.

Class **140.**—Home Preserved or Home Bottled British Fruits. *Wholesale firms excluded.* This exhibit *must* include both Jams and Bottled Fruits—from 12 to 18 1 lb. or 2 lb. clear glass pots or bottles of Jam, including at least four different kinds, and from 12 to 18 bottles of Fruit, including at least four different kinds. Small quantities from ½ lb. to 1 lb. of any British-grown fruit preserved at home in any other way may also be added. Any of the pots or bottles in each exhibit will be opened by the Judges at their own selection. Everything exhibited must have been preserved by the exhibitor.

First Prize, a Silver Cup, presented by the Countess of Warwick; Second, £3; Third, £1. 10*s*.

1. Horticultural College, Swanley.
2. Mrs. A. Bassnett, Shirley.
3. Lady Warwick Hostel.

Class **141.**—Exhibits of a dozen bottles of Bottled Fruits (including four different kinds at least), bottled and shown by exhibitors who do not sell their produce or in any way work for the trade (wholesale or retail), but only and entirely for their own household consumption.

First Prize, £3; Second, £2; Third, £1.

1. A. Bailey, Esq., Farningham (gr. W. Elliott).
2. J. Bushnell, Esq., Maidstone.
3. Mrs. Banks, Chesterfield.

Class **142.**—Miscellaneous.

Prizes according to merit. One Prize awarded, £1.

Mrs. W. H. Plowman, Beddington Corner.

GERMINATION IN AMARYLLIDS.

By A. Worsley, F.R.H.S.

The fig. 191, B, I have inserted to show that the apex of the original process issuing from the seed of Hymenocallids is not always simple. All drawings I have seen depict a single root in prolongation of the alleged cotyledon. Such is by no means always the case. Often *Crinum Moorei* seeds will show no signs of any root whatever until the young bulb is formed and the tissue of the seed quite dead. Shortly after this time (perhaps three months

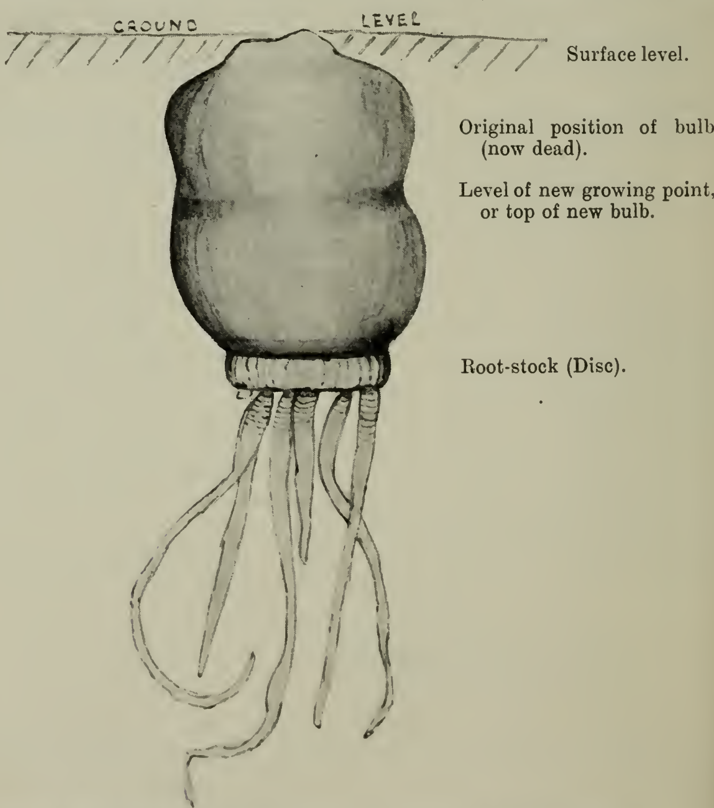


Fig. 190.—Ismene hybrida "sulphurea," showing Bulb-extension.

after germination) a number of roots will issue simultaneously. Even if it is true that at the moment of emission from the seed the original process is always simple, yet it may evidently become branched at a very early stage in its career, or become abortive. Yet in many *Liliaceæ*, many annuals, Palms, &c., this first root becomes one of the vital organs of the mature plant.

In fig. 191, C (*Ismene calathina*), the termination of this process has, five months after germination, become a true root, and shows no sign of decay. No leaves whatever have yet been emitted, but the seed is dead,

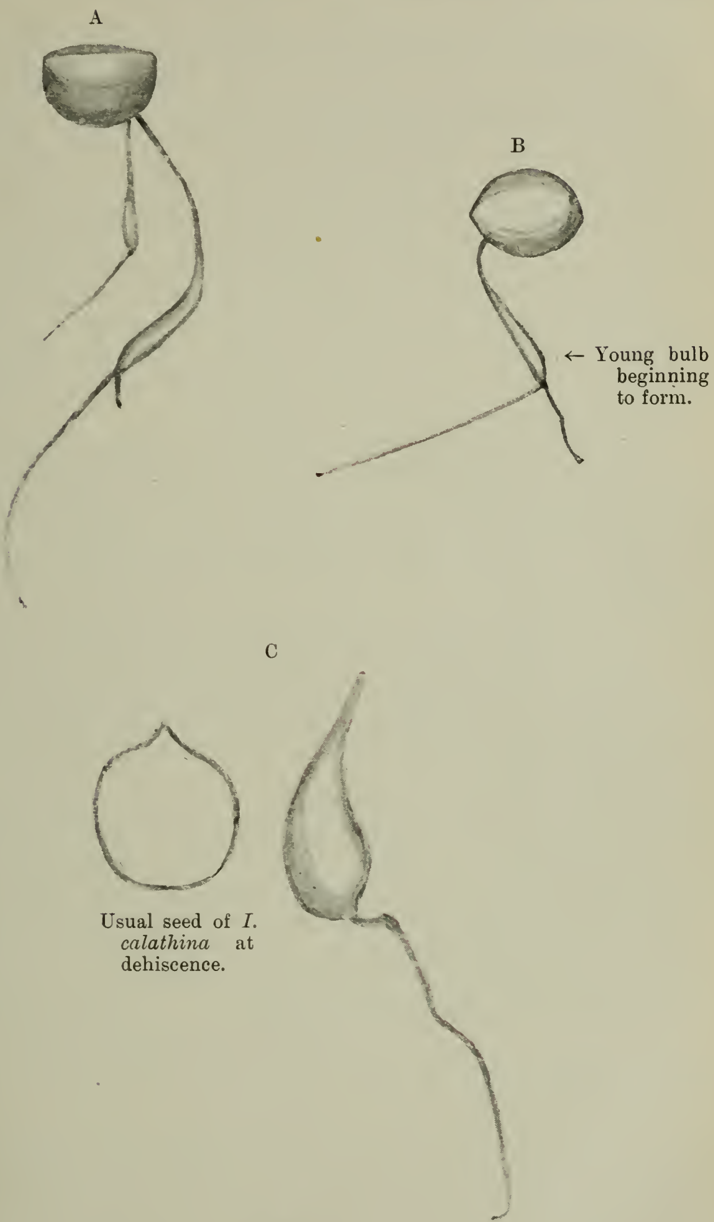


Fig. 191.

A.—*Hymenocallis concinna* [Baker, sp. nov.], showing seed a month after sowing. Two processes have issued from one seed, and are both forming bulbs, showing that two embryos may exist in one seed of this species.

B.—Another seed of same fruit showing two roots issuing during weaning period. The tissue of seed was not visibly atrophied at this period.

C.—Young bulb of *Ismene calathina* five months after germination. The seed is dead. No leaf-growth has taken place yet.

and a true bulb left alive. Considerable loss of weight has resulted. Ten seeds weigh one ounce, whereas it would take eighteen bulbs of this size to do so.

This loss of weight will continue until foliation begins, by which time the bulb will only weigh a quarter of the seed from which it sprang.

The drawing, fig. 191, A, shows that it is possible for two embryos to exist in one seed of *Hymenocallis concinna* [Baker, sp. nov.] Among the Amaryllids I have never previously noticed such an occurrence, and I believe it to be unique in the literature of these plants.

The arrangement of the ovules in *Hymenocallis concinna* is quite typical of the genus as described by Bentham and Hooker—a single pair of ovules lying at the base of each cell, or six ovules in all to each ovary.

The minute threads by means of which the ovules adhere to the placenta, and which constitute the only direct communication with the stigma, would seem to be so arranged that the whole of the ovules would become impregnated contemporaneously, on the adhesion of a sufficient number of virile pollen grains to the stigma.

Hence there does not appear at first sight to be any reason why each ovule should not produce a seed. Yet it is a fact that such sequence does not occur in the Amaryllids with bulbiform seeds. Such plants have a fixed number of ovules and a fixed number of seeds (subject to very small fluctuation); yet there is often a great dissimilarity between the number of seeds and of ovules.

In this *Hymenocallis* the difference is not great, four seeds being produced by the six ovules in the few fruits I have raised.

Although I believe that every ovule is impregnated simultaneously, yet the possibility of seed production must be held to be limited, and I believe that we must seek in the structure of the tissues *below* the ovary the cause of such limitations.

It would seem as though the carriage of nutriment to the embryo from the bulb of the parent was either limited by the structure of such tissues to a certain number of channels, or that all the nutriment became, after impregnation, quickly diverted to the strongest embryos, and that the rest suffered from strangulation or starvation. The appearance of the seeds in certain Crinums, Hippeastrums, &c. lends weight to this supposition, for we find in the same fruit seeds of varying sizes; some of great vitality, others of less; some in which the embryo is just alive, strong enough to germinate, but not to carry it through the weaning period; others in which the germ is already dead, but yet has evidently grown at one time out of the ovule stage.

If anyone feels inclined to deny the contemporaneous impregnation of all the ovules in one ovary, he is met by this difficulty, that if it were possible to effect partial impregnation it would also appear possible to effect diverse impregnation in the same flower; that is to say, that species "A," known to be virile under the pollen of species "B" and of species "C," could have one lobe of a stigma impregnated with "B" pollen, and another lobe with "C" pollen, and produce, in the same fruit, seeds of diverse hybrids.

My own experiments have satisfied me that in every case impregnation of all the ovules is contemporaneous. I have very often mixed the pollen from many Amaryllids and applied it to a stigma, but never with the result of effecting diverse impregnation.

From this it would appear as though a single pollen grain were capable of impregnating over one hundred ovules, such as exist in the ovary of *Hippeastrum*. Yet I do not think we are justified in asserting this to be an ascertained fact.

Certainly I have noticed that in making inter-generic and inter-specific pollenisations the number of seeds produced has always been much below the normal number ; that in the vast majority of cases no seeds were produced, the embryos having died, although evidence of their having lived and having passed beyond the ovule stage was in many cases incontestable ; in other cases there were no evidences of impregnation.

These experiments tend to suggest that, beyond the one act of excitation, or impregnation, of the female germs, there remains some further function for the male germs to perform, which is improperly, or only partially, done by foreign pollen grains.

To revert again to the seed of *Hymenocallis concinna* (fig. 191, A). In this instance the original process issuing from the seed is duplicated, and each process is terminated by a bulb in process of formation. I can only account for this by admitting the existence of two embryos within the one seed. These again can only trace their existence to the incidence of two germs within the one ovule from whence the seed sprang. Yet if two germs can exist within the one ovule, why not more than two ? Is Nature bound never to exceed the assigned number, or may we contemplate the possibility of erraticism ? And if we have this direct proof that in these Amaryllids more than one female germ may exist within one ovule, we must not exclude the possibility of the multiplication of male germs within the pollen grains. Nor can we altogether exclude the possibility that the male germ, in the process of absorptive growth which ensues when it is brought into contact with the saccharine matter of the stigma, and in the course of the somewhat obscure chemical changes which result, may not become increased by subdivision, or by gemmation, into numerous active units. Perhaps this may give an explanation of how one pollen grain may be able to impregnate many ovules.

To take a simile from chemistry, may we seek in the molecule and the atom, or in their organic counterparts, the wherewithal to construct the most probable, or the least improbable, theory reconcilable with facts no longer subject to direct and tangible proofs ?

I have noticed in the direction taken by the original process issuing from the bulbiform seeds of *Crinum* &c. a very adaptive sequence of events to ensure this process reaching the ground.

The shape of the seeds is such that it is impossible to foresee what side will, upon dehiscence from the fruit, ultimately rest upon the ground, and, as was pointed out in the first instance, I believe, by Salisbury, there appears to be no law governing the point of emergence of the original process from the bulbiform seed. Hence the same might be upwards or sideways, and the process might end, and the bulb be formed, in some position whence the roots (when emitted) might be unable to reach the mother earth.

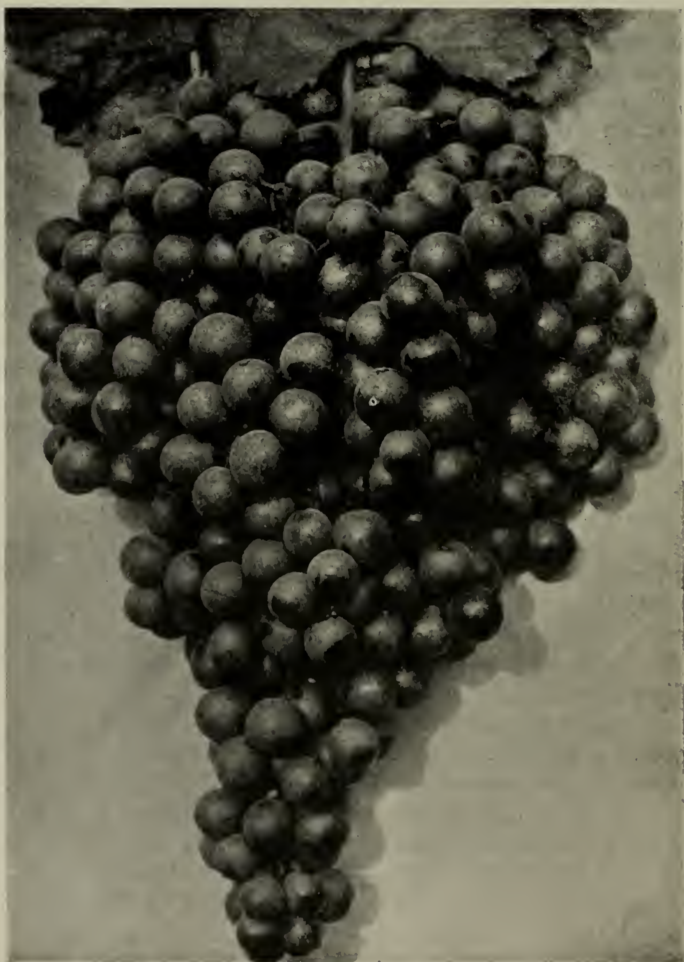
Those persons who recline upon the theory of gravitation to get them over every difficulty connected with the direction of root growth account for the curvature of this original process in their own way, oblivious of the fact that, whatever this original process may be, its principal function is not that of a root.

Yet we need not go so far for an explanation when one is ready to hand in progressive adaptation.

It must be evident that plants having such seeds and emitting a straight process would tend to become extinct, whereas the first one which emitted a curved process would, *in whatever position the seed fell*, shortly bury itself in the ground.

Hence the doctrine of "the survival of the fittest" is alone sufficient to account for the more perfectly adapted type of seed-producing plant outliving the imperfectly adapted type.

And by the slow steps of progressive adaptation we may trace the path leading up to this perfect and beautiful sequence of growth to which I have on other occasions drawn your attention.



GRAPE BARBAROSSA. *The Garden.*)

SOME LESSER-KNOWN JAPAN TREES AND SHRUBS.

By James H. Veitch, F.L.S.

[Delivered September 23, 1902.]

Although now nearly forty years since the flora of Japan first received serious attention from the gardeners of Europe and America, there are still, practically unknown outside botanical establishments, many trees and shrubs worthy of the best positions in our gardens, from the distinctive elegance of their foliage and habits, or from the profusion with which they produce their attractive flowers.

It is but natural that planters should be anxious as to the chances of successfully establishing and growing in Europe trees and shrubs coming from a country embracing such an unusual latitude, with a climate in its extreme north almost arctic, and in its most southern islands sub-tropical; with volcanic hills and mountains where rain falls pitilessly sometimes for days together, and plains but a few miles distant enduring in the summer months an almost torrid heat.

That many of these trees and shrubs can be established and cultivated with success may be seen by the photographs and branches cut from specimens shown in the Hall. These trees were planted about 1880 on Kingston Hill in Surrey, where for the past twenty years they have withstood winters of severity, and latterly summers of unusual drought.

To the uncertainty of the suitability of some of the inhabitants of the forests of Japan to our climate must be added (as a reason for their hitherto not having been more extensively planted) the time required for a full knowledge of a flora so rich and concentrated as that under consideration, due to the comparatively few years it has been possible to travel freely in all parts of the country.

So rich is this flora that Professor Sargent has been able to place on record that, in ascending a hill near Sapporo in the northern island only 500 feet above the sea-level, he noticed forty-six species and varieties of trees and shrubs, and, within a radius of five miles of this hill, several others, in all sixty-two species and varieties, probably a larger number than can be found in any other similar area outside the tropics.

How many of these trees and shrubs are actually peculiar to Japan will probably never be definitely ascertained, so largely have species introduced from China and Corea acclimatised themselves. In a general way this is well known, but having during the past summer had the opportunity of looking through several hundreds of dried specimens from the upper part of the Yangtsze Valley sent by a representative of my firm, E. H. Wilson, I was much struck with the great number of trees and shrubs of which he had secured specimens, and which are also found in Japan.

The argument one sometimes hears, that planting is not a hobby of the young, and that when its attractions become evident one is too old to plant and hope to live to enjoy the results, does not apply to many of the trees and shrubs of Japan, which flower in from ten to fifteen years after planting in this country, and attain in twenty considerable dimensions, as may be seen by reference to the photographs.

A warm corner or a gentle slope (preferably sheltered from the east), ample space, and reasonable care in planting are all that is required, and though severe frosts of May and June may in those seasons in which they unhappily occur cripple the flower or check the growth of a few of the trees, the danger is not sufficient to deter planters.

Amongst the Maples the forms of *Acer palmatum* and *Acer japonicum* are in general cultivation and hardly require mentioning; but such distinct species as *Acer carpinifolium*, *Acer distylum*, *Acer nikoense*, *Acer Miyabei* (recently found, and only named by Maximowicz in 1888) are hardly ever met with, nor are either, as much as they should be, *Acer diabolicum* (*pulchrum*), *Acer pictum*, *Acer cratægifolium*, *Acer rufinerve*, and *Acer capillipes*, common species in Japan, and long introduced to Europe.

Acer carpinifolium is evidently extremely rare in Japan, as is *Acer distylum*; of the first-named, during a stay of several months, I only saw three trees.

Acer nikoense is more common and is widely distributed, and though bearing the name of the beautiful district in which it was first found, is, I think, undoubtedly of Chinese origin. The peculiar thick ternate leaves—silvery beneath, and in autumn of a vinous red on the upper surface (unlike those of many trees, coloured on both sides)—coupled with its vigorous habit, render it a remarkable tree.

Acer carpinifolium (the Hornbeam-leaved Maple), first discovered by Siebold, is a most striking and interesting species peculiar in the form and veining of its leaves, and, unless seen in fruit or flower, closely resembling a Hornbeam at first sight.

Acer distylum is in this country a noble and handsome tree, producing foliage of great size, in colour rich and glossy. Like the two last named, it was introduced to gardens by Maries, has proved hardy and vigorous and superior to some species and varieties in common cultivation.

Acer Miyabei, resembling our *Acer platanoides*, has been known to science but a few years. It has successfully withstood the last five winters in this country, and promises well. Coming from the north island, it is accustomed to cold more severe than any experienced here, and at the same time to warmer and brighter summers. A rare tree in Japan, it may be in a few years' time, by its vigour and health, more plentiful in Europe than in its native home (fig. 192).

The only known Japanese Horse-Chestnut, *Æsculus turbinata*, though it has fruited in France and flowered in England, is hardly known as much as a tree so noble deserves to be. In general aspect it closely resembles our well-known species, but is remarkable for its fruits, which are about two inches in diameter, and lack the prickles distinguishing the true Horse-Chestnuts. It has been confused with *Æsculus chinensis*, but the true *Æsculus chinensis* is probably not to be found in cultivation in European countries. I have a vivid recollection of several isolated specimens on Mount Hakkoda: stately trees with stems three to four feet in diameter, and 80 to 90 feet high; usually at an elevation of 1,500

Fig. 192.—Acer Miyabei at Coombe Wood, Surrey.
Height, 12 feet; diameter, 6 feet.

to 3,000 feet. In this country the tree is quite hardy, and makes a graceful symmetrical specimen.

Japan, like America, has sent us the handsomest Dogwoods or Cornels, and there is reason to believe there is still something in this way to be obtained from China, where it is more than probable all those species first found in Japan are endemic.

Cornus macrophylla, said to be synonymous with *Cornus brachypoda*, is a handsome, graceful tree, and flowers well in England, though its cultivation in America has hitherto not met with success. Professor Sargent holds it to be one of the most beautiful of all Cornels, an opinion which can be endorsed from experience of the tree in this country. The pointed leaves are dark green on the upper surface, almost white beneath, borne thickly on branches at right angles to the main stem, forming flat tiers of foliage. It flowers with great freedom—as with many deciduous flowering Eastern trees in this country—every other year, unable apparently to annually sustain such an exhausting effort (fig. 193).

Under the name of *Cornus brachypoda*, my firm has a handsome Dogwood, some 15 feet high, clearly distinct from the above in several ways, but botanical authorities have difficulty in, as yet, determining its exact position in the family. Of this undetermined species a variegated form is unusually attractive.

Of the behaviour of *Cornus Kousa* under cultivation too much cannot be said. Though possibly its blossoms are individually not so large nor so handsome as those of the American *Cornus florida*, it succeeds on the whole better. It flowers freely, and has proved a striking and valuable addition to the deciduous trees worthy of a place in our gardens (fig. 194).

Clethra barbinervis (*C. canescens*), a beautiful small tree found all through the Far East from Java to Corea, grows well and produces freely in the early autumn its white-panicled racemes, often a foot in length.

The nearly allied *Enkianthus campanulatus*, much esteemed in Japan for its quaint beauty, flowers freely when left undisturbed in a sheltered corner.

Most of the Viburnums are well known, but the handsome *Viburnum dilatatum* should not be overlooked, and *Viburnum tomentosum Mariesii* (fig. 195), allied to *Viburnum plicatum*, from which it differs in its more graceful habit, its more hairy leaves, and in its sterile flowers being confined to the outer part of the inflorescence, is an unusually handsome shrub.

Styrax japonicum and *Styrax Obassia* are becoming known and are amongst the most ornamental of any trees found in British gardens. Though in the first-named the large dark green foliage of *Styrax Obassia* is missing, ample compensation is afforded by the extraordinary profusion with which the myriads of white bell-shaped flowers are produced. In Japan *Styrax Obassia* is certainly seen to greater advantage than in this country, its leaves often attaining a size of ten inches in diameter and blooming with greater freedom than in our gardens. On the other hand, *Styrax japonicum* is as much at home and as beautiful here as in China or Japan. In Surrey it seeds freely, the seed germinating in one or two years, though a large proportion lies three years before showing signs of life.

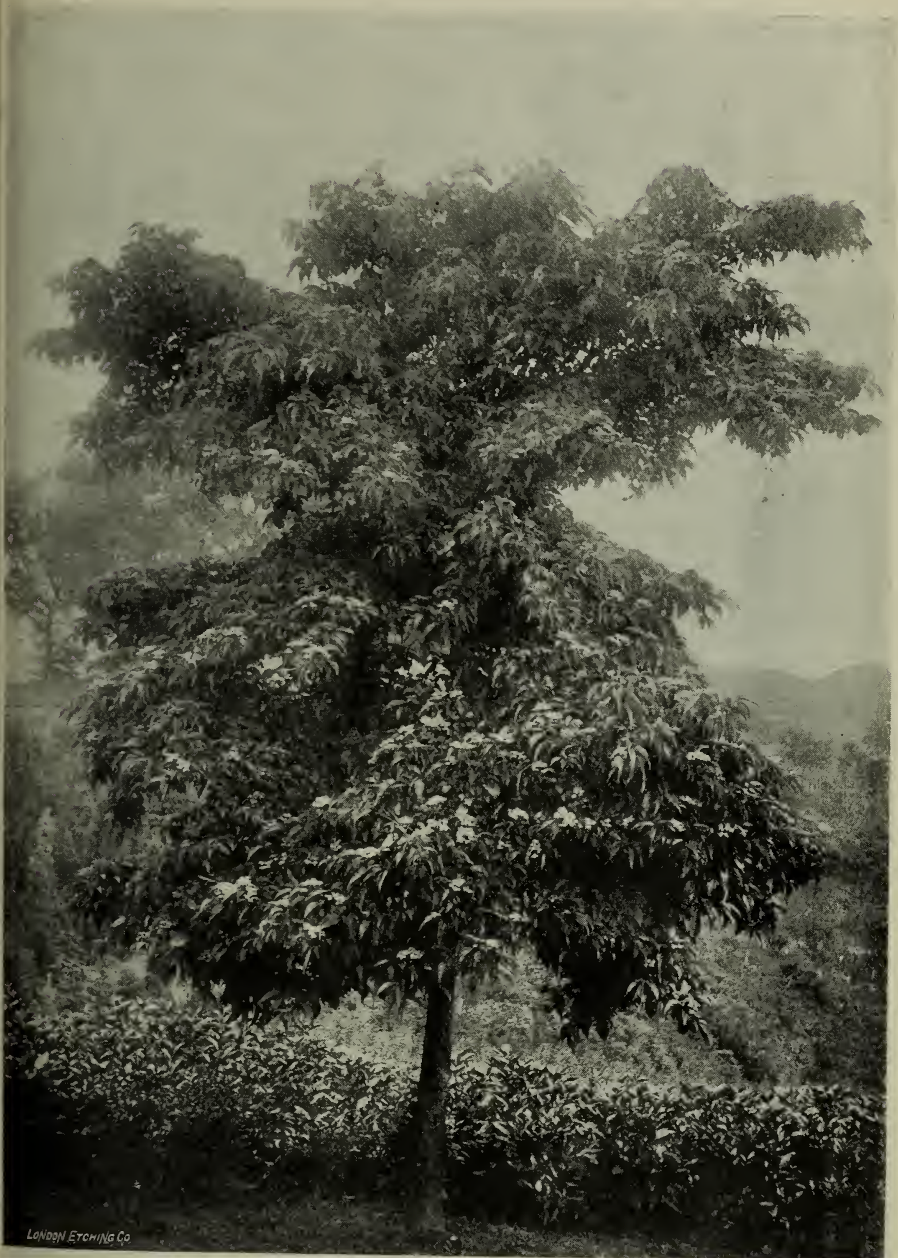


FIG. 193.—CORNUS MACROPHYLLA AT COOMBE WOOD, SURREY.
Height, 17 feet; diameter, 12 feet.

FIG. 194.—CORNUS KOUSA AT COOMBE WOOD, SURREY.
Height, 13 feet; diameter, 8 feet.

Fig. 195.—Viburnum tomentosum, var. Mariesii, at Coombe Wood, Surrey.
Height, 6 feet; diameter, 7 feet.

The rich forest flora of Japan contains several Birches and Hornbeams, some of interest, notably *Betula Maximowiczii* and *Carpinus cordata*, both finer representatives of their genera than are usually cultivated.

Betula Maximowiczii is at its best in Yezo, where it forms handsome trees eighty to ninety feet in height, noticeable for their smooth orange-coloured bark and large leaves, larger than those of any other species. I have had a tree under observation for several years in this country, and am inclined to think, if it does not actually attain the noble proportions characteristic of this fine Birch in its native home, it will prove better than anything we yet possess.

Betula Ermani and our own *Betula alba* are amongst the best known of several other Birches found in Japan.

What *Betula Maximowiczii* is to the Birches *Carpinus cordata* is to the Hornbeams, beyond question the most beautiful and boldest of the family. In its native forests and in this country its leaves are six to seven inches in length and three to four broad, the catkins five to six inches long and very beautiful in their autumn colouring. Though in England I know of no tree of a greater height at present than 14 feet, in Japan a height of 30 to 40 feet is not uncommon.

Carpinus laxiflora and *Carpinus Carpinus* are graceful trees, but will not compare from an ornamental standpoint with *Carpinus cordata*.

The Japanese forests are rich in Oaks, which in this country have not received the attention they deserve. That they will flourish, whether evergreen or deciduous, may be seen from photographs of two species in the Hall, of trees 20 feet and 25 feet high.

Quercus dentata, remarkable for its giant leaves on young vigorous growth ten to twelve inches in length and six to eight inches in width, has not been so successfully cultivated as one would wish, though the Dutch have obtained fair results. In the neighbourhood of Sapporo fine specimens 70 to 80 feet high are not uncommon, but unless our planters have greater good fortune than has hitherto attended their efforts, we shall never see in this country in anything like beauty one of the noblest of the Far Eastern forest trees.

Quercus serrata is a good tree—interesting from the fact that the Japanese feed silkworms on its foliage. The leaves bear a strong resemblance to those of the Sweet Chestnut, and in England are semi-deciduous. Widely distributed in Japan, it grows here with vigour.

It is, however, amongst the Evergreen Oaks we may look for the greatest additions to our gardens. Highly prized by the Japanese, they are largely planted in gardens and round temples, and in large centres are amongst the commonest trees.

Quercus cuspidata and *Quercus glauca* are both under cultivation, a variegated form of the first-named having met with some attention. *Quercus acuta* is, however, the species which seems most at home in this climate, and forms a stately column of lustrous dark green, twenty feet in height. It is a noble tree for which we are indebted to Maries. The Japanese call it the Red Oak, from the redness of its wood, which deepens often to a reddish-brown.

Though in actual size of flower China and Japan have sent us no Magnolia to compare with the American *Magnolia macrophylla*, no one who has seen *Magnolia hypoleuca* on its wcoded hill-slopes will easily forget the impression. It is one of the most striking of all trees in a country where the beauty of the inmates of the forests is not surpassed in any other part of the world. The long spreading branches on trunks often 80 to 100 feet high, the leaves twelve to fifteen inches in length and six to eight broad, of the palest green, the large creamy flowers six inches across when expanded, stamens with scarlet filaments, and in autumn the brilliant crimson cones of fruit, six to eight inches in height standing well above the leaves, surprise all who see them.

This tree requires age to flower, but should do so in this country in from 15 to 20 years after planting. It will probably prove more adaptable than its near allies, the American *Magnolia macrophylla* and *Magnolia tripetala.*

Magnolia Kobus is common in Japan, and makes a handsome symmetrical tree in England.

Magnolia stellata, Magnolia stellata rosea (fig. 196), *Magnolia Watsoni*, and *Magnolia parviflora* are well known.

Magnolia salicifolia, new to cultivation, has not yet flowered in Europe, nor are its blossoms known to botanists. My own seed, collected on Mount Hakkoda, failed to germinate ; but, thanks to the kindness of Professor Sargent, my firm now has a promising young tree, which it is hoped will flower in a few years' time. Though common in the district in which it is found, the position is not the most easily accessible, which, no doubt, accounts for the delay in introducing it to English gardens.

The large and interesting *Cercidiphyllum japonicum*, a member of the Magnolia family, does not seem to thrive with us as well as it does in New England where flourishing specimens are to be seen. Its bright pink spring foliage is attractive, and in its native forests the massive divided trunks give the whole landscape a peculiar appearance.

Nearly allied to the Magnolias are *Euptelea polyandra,* which has so far failed to establish itself, and that curious genus *Trochodendron*, containing but one species, *Trochodendron aralioides* (fig. 197). This is an evergreen tree with rich dark glossy leaves 4–5 inches in length, attaining in Japan a height of 20-25 feet ; extremely rare in a wild state, though much cultivated. In this country it is a handsome evergreen tree which on more than one occasion has flowered and fruited freely.

Amongst other trees and shrubs undoubtedly hardy in England which Japan has sent us and which repay the careful planter are *Stuartia Pseudo-camellia,* nearly allied to the *Stuartia* of America, but more suitable for our climate, and *Cæsalpinia japonica,* which flowered outside in England for the first time in 1887, though the genus is, generally speaking, a tropical one.

Clerodendron trichotomum, found all through the Far East and long known to science, is also a striking tree, the large almost tropical foliage of established specimens being literally hidden every second summer by scores of large umbels of carmine and white flowers (fig. 198).

Amongst the Witch-Hazels the distinct *Hamamelis mollis* is now recognised as the most beautiful of the genus, the flowers being larger and more richly coloured than those of the other species.

The thorny *Citrus trifoliata* may yet prove to be an excellent hedge

Fig. 196.—Magnolia stellata, var. rosea, at Coombe Wood, Surrey.
Height, 7 feet; diameter, 6 feet.

Fig. 197.—Trochodendron araliioides at Coombe Wood, Surrey.
Height, 7 feet; diameter, 6 feet.

FIG 198.—CLERODENDRON TRICHOTOMUM AT COOMBE WOOD, SURREY.
Height, 12 feet; diameter, 12 feet.

plant. It certainly is impenetrable, and has the additional advantage of bearing in late spring a profusion of large white flowers, a month before the leaves appear.

As a striking Pillar plant *Polygonum multiflorum* (fig. 199), which makes 20-25 feet of growth in one season, is invaluable, and the long undistinguished *Vitis Thunbergii* has proved superior from a gardening standpoint to *Vitis Coignetiæ*, which in general aspect it resembles. It may be distinguished by its leaves being hairy beneath, of thicker texture, and assuming a richer hue in the autumn.

Nearly allied to the Japanese Hollies, of which the most beautiful is *Ilex latifolia*, is *Hovenia dulcis*, introduced to European gardens some ninety years since. In England it has attained a height of 20 feet, but in its native habitat, extending from the Himalayas to Japan, it attains nearly double these proportions, as it does under cultivation in Australia, where it forms a symmetrical if not ornamental specimen. The thickened flower-stalks, somewhat insipid, but not unlike a pear in flavour, are said to have medicinal properties.

Among evergreen shrubs there should not be overlooked *Photinia serrulata*, the Linderas, and *Daphniphyllum glaucescens* (fig. 200). *Photinia serrulata* (figured in the "Botanical Magazine" as *Cratægus glabra*) is one of the best of our seaside shrubs, individual specimens attaining a great diameter.

Not less than twenty species of *Lindera* are found in the Far East, by far the handsomest being *Lindera obtusiloba*, attaining in Japan a height of 20–30 feet. In Surrey a promising specimen is already 12 feet in height, its foliage assuming annually the characteristic clear yellow autumn tint. *Lindera sericea*, found further north than is *Lindera obtusiloba*, is equally hardy. *Daphniphyllum glaucescens* is a singularly handsome shrub, far too little known. In this country the female plant grows luxuriantly and seeds profusely, the seed germinating freely, unlike consignments received from the native forests, probably due to their passage through the tropics. Professor Sargent states it is of Malayan origin, though apparently acclimatised in Japan.

LIST OF DRIED SPECIMENS COLLECTED IN JAPAN BY JAMES H. VEITCH AND EXHIBITED IN CONNECTION WITH THE LECTURE.

Name of Specimen.	Locality.
Abies Mariesii	Hakkoda.
,, *Veitchii*	Lake Chujenji.
Acer carpinifolium	Nikko.
,, *cratægifolium*	,,
,, *capillipes*	Hakkoda.
,, *diabolicum*	Nikko.
,, *cissifolium*	Chokaizan.
,, *Miyabei*	Swamazu.
,, *nikoense*	Nikko.
,, *pictum*	Tumoto.
,, *rufinerve*	Chujenji.
,, *tataricum*	Sapporo.
Actinodaphne lancifolia ?	Fukura (near temples).
Alnus firma multinervis	Nikko.
,, *viridis*	Hakkoda.

Fig. 199.—Polygonum multiflorum at Coombe Wood, Surrey.
Height, 30 feet.

FIG. 200.—DAPHNIPHYLLUM GLAUCESCENS, HORT., AT COOMBE WOOD, SURREY.
Height, 7 feet; diameter, 8 feet.

Name of Specimen.	Locality.
Berberis Sieboldii	Fukura.
Berchemia racemosa	Chujenji.
Betula carpinifolia	Tumoto.
,, *Ermani*	Hakkoda.
Carpinus cordata	Sapporo Hill.
,, *japonica*	Chujenji.
,, *laxiflora*	Nikko.
,, *yedoensis*	Yeddo.
Celastrus articulatus	Fukura.
Cercidiphyllum japonicum	Tumoto.
Cladrastis amurensis	Junsu-numa.
Clerodendron trichotomum	Sapporo Hill.
Clethra barbinervis	Sakunami.
Cornus Kousa	Nikko.
Corylus rostrata	Chujenji.
Daphniphyllum glaucescens	Hakkoda.
Dioscorea sp.	Chokaizan.
Diospyrus Lotus	Near Amomori.
Elliottia paniculata	Nikko.
Enkianthus nikoensis	,,
Euonymus alatus	,,
,, *nipponicus*	Hakodate.
,, *oxyphyllus*	,,
Euptelea polyandra	Nikko.
Fraxinus mandshurica	Swomori.
Halesia corymbosa	Nikko.
Hamamelis arborea	Hakkoda.
,, *japonica*	Chokaizan.
Hydrangea involucrata	Nikko.
,, *scandens*	Tumoto.
Ilex crenata	Hakkoda.
,, *macropoda*	Chokaizan.
Juniperus chinensis	Mori.
,, *litoralis*	Fukura.
Lindera obtusiloba	Nikko.
,, *sericea*	Chokaizan.
Litsea glauca	Botanical Garden, Tokio.
Magnolia hypoleuca	Hakkoda.
,, *Kobus*	Fukura.
,, *salicifolia*	Hakkoda.
Mallotus (*Rottlera*) *japonicus*	Fukura.
Marlea begonifolia	,, and near temples, Nikko.
Meliosma myriantha	Chokaizan.
Pertya scandens	Nikko.
Photinia villosa	,,
Pinus pentaphylla	Kakkumu.
Pueraria Thunbergiana	Sendai.
Pyrus Aria	Nikko.
,, *Aucuparia*	Hakkoda.
,, *Sieboldi* (*Toringo*)	Chujenji.
Quercus crispula	Hakodate.
,, *dentata*	Fukura.
,, *glandulifera*	Near Mowri.
,, *gilva*	Nikko.
,, *grosseserrata*	Junsu-numa.
,, *phillyræoides*	Botanical Garden, Tokio.
,, *pinnatifida*	Tokio.
,, *variabilis*	,,

Name of Specimen.	Locality.
Rhamnus japonica	Chokaizan.
Rubus phœnicolasius	Chujenji, Tumoto.
Rhynchospermum tomentosum . . .	Tokio (nursery).
Salix Caprea	Hakkoda.
Smilax China	Fukura.
Styrax Obassia	Nikko.
Stuartia Pseudo-camellia	,,
Tilia cordata var. *japonica*	,,
Viburnum erosum	,,
,, *furcatum*	Chokaizan.
Vitis Coignetiæ	Tumoto.
,, *heterophylla*	Sendai.

LIST OF LIVING SPECIMENS OF JAPANESE TREES AND SHRUBS SHOWN.

Acer carpinifolium
,, *distylum*
,, *japonicum laciniatum*
,, ,, *microphyllum*
,, ,, *vitifolium*
,, *Miyabei*
,, *nikoense*
,, *palmatum*
,, ,, *palmatifidum*
,, ,, *septemlobum*
Æsculus turbinata
Betula Maximowiczii
Cæsalpinia japonica
Carpinus cordata
Cerasus sinensis fl. pendula rosea
Chionanthus retusa
Citrus trifoliata (*Ægle sepiaria*)
Clerodendron trichotomum
Clethra canescens
Cornus brachypoda
,, ,, *variegata*
,, *Kousa*
,, *macrophylla*
Daphniphyllum glaucescens
Enkianthus campanulatus
Hamamelis japonica var. *Zuccariniana*
,, *arborea*
,, *mollis*
Koelreuteria japonica
Lindera obtusiloba
,, *sericea*
Magnolia Kobus
,, *stellata rosea*
,, *Watsoni*
Meliosma myriantha
Polygonum multiflorum
Quercus acuta
,, *serrata*
Stuartia Pseudo-camellia
Styrax japonicum
,, *Obassia*
Trochodendron aralioides
Viburnum dilatatum
,, *tomentosum Mariesii*
Vitis Coignetiæ
,, *flexuosa major*
,, *Thunbergii*

LIST OF PHOTOGRAPHS OF JAPANESE TREES AND SHRUBS EXHIBITED.

The dimensions given below are those of specimens growing in the Coombe Wood nursery (1902), and from these the photographs were obtained.

	Circumference of stem 3 ft. from ground	Height	Diameter of head
	inches	ft.	ft.
Acer carpinifolium	9	12	9
,, *distylum*	12	16	12
,, *japonicum laciniatum*	—	9	5
,, ,, *vitifolium*	—	12	18
,, *microphyllum*	—	10	10
,, *Miyabei*	5	12	6
,, *nikoense*	22	20	20
,, *palmatum*	17	20	25
,, ,, *atropurpureum*	—	7	7
,, ,, *dissectum*	—	8	7
,, ,, *septemlobum*	—	9	9
Æsculus turbinata	12	16	12
Betula Maximowiczii	5	14	6
Cæsalpinia japonica	—	5½	14
Carpinus cordata	—	14	9
Cerasus sinensis fl. pendula rosea	13	8	10
Chionanthus retusa	14	16	12
Citrus trifoliata	—	7	7
Clerodendron trichotomum	18	12	12
Clethra canescens	—	9	6
Cornus brachypoda	18	18	12
,, ,, *variegata*	14	18	12
,, *Kousa*	—	13	8
,, *macrophylla*	17	17	12
Daphniphyllum glaucescens	—	7	8
Enkianthus campanulatus	—	6	3
Hamamelis arborea	—	6	4½
,, *japonica Zuccariniana*	—	7	5
,, *mollis*	—	4	2
Hovenia dulcis	16	20	12
Koelreuteria paniculata (*japonica*)	—	9	—
Lindera obtusiloba	—	12	8
,, *sericea*	—	9	6
Magnolia Kobus	7	13	6
,, *stellata* var. *rosea*	—	7	6
,, *Watsoni*	—	7	6
Meliosma myriantha	—	7	8
Photinia Benthamiana	—	7	5
,, *serrulata*	—	9	6
Polygonum multiflorum	—	30	—
Quercus acuta	—	20	20
,, *serrata*	27	25	12
Rhus Toxicodendron	—	7	6
Stuartia Pseudo-camellia	—	12	5
Styrax japonicum	11	15	12
,, *Obassia*	14	7	12
Trochodendron aralioides	—	6	6
Viburnum tomentosum Mariesii	—	8	7
,, *dilatatum*	—	20	6
Vitis Coignetiæ	—	20	—
,, *flexuosa*	—	12	—
,, *flexuosa* var. *major*	—	20	—
,, *Thunbergii*	—	20	—

FIG. 201.—KOELREUTERIA PANICULATA (K. JAPONICA, HORT.) AT COOMBE WOOD, SURREY.
Height, 9 feet.

MENDEL'S PRINCIPLES APPLIED TO WHEAT HYBRIDS.

By Charles C. Hurst, F.L.S., F.R.H.S.

In 1899 Prof. W. J. Spillman, of Washington, U.S.A., commenced a series of experiments in the hybridisation of two species of Wheat, *Triticum vulgare* and *T. compactum*, his primary object being to raise new varieties of good quality adapted to the climate of Eastern Washington. These experiments were continued in 1900 and 1901, and the results submitted to the Annual Convention of American Agricultural Colleges and Experiment Stations held at Washington, D.C., November 12 to 14, 1901.

The proceedings of this Convention were published in 1902, and have been kindly brought to my notice by our discerning and indefatigable Secretary, the Rev. W. Wilks, to whom I am indebted for the opportunity of making the following notes.

As will be seen hereafter, Prof. Spillman's paper is of great biological and practical importance, and as the medium through which it has been presented to the world is not very accessible to the majority of the readers of this Journal, I therefore venture to quote in full Prof. Spillman's tables of facts, together with his description and interpretation of them, after which I shall add a few notes of my own, showing how faithfully Prof. Spillman's facts seem to follow the Principles of Mendel. The experiments, on the whole, seem to have been admirably designed and carefully carried out, especially having regard to the large numbers used; the examination and classification of many thousands of individual characters must have entailed a vast amount of labour and care, for which we are duly grateful to Prof. Spillman and his associates. It seems fitting that this important paper should be published in the same Journal that first published an English translation of Mendel's original paper.

"Quantitative Studies on the Transmission of Parental Characters to Hybrid Offspring.

By Prof. W. J. Spillman, of Washington, U.S.A.

Beginning in 1899, we made 14 crosses, securing, in most instances, several grains of each cross. From these grains 215 mature plants were harvested in 1900. With a few exceptions noted below, those plants of the same breeding were similar and intermediate in character between the parent forms. A head from each was preserved for future reference, the remainder of the seed being sown. The seed of each plant was kept separate, thus giving 215 plats. Of these, 149 proved to be true hybrids;

the remainder were identical with the female parent, thus showing that the flowers had been self-fertilised. This is made evident by the results below.

"In each case one of the parents was of the club type (*Triticum compactum*), the other of the common type (*T. vulgare*). As above stated, no important variations occurred in the first generation except as noted below; but when the heads appeared on the second generation, a remarkable state of affairs was seen to exist. At the first glance it appeared that each of the hybrids had split up into all sorts of types. But closer inspection showed that in every case but one, which is noticed later, the forms in each plat were simply combinations of the characters of the parent forms. Further inspection revealed the fact that in plats of similar breeding exactly the same types were present. This suggested the idea that perhaps a hybrid tended to produce certain definite types, and possibly in definite proportions. Accordingly, all the hybrid plats were assorted into types, and the proportion of each type determined. When these results were classified, they confirmed the above suggestion; and if similar results are shown to follow the crossing of other groups of Wheats, it seems possible to predict, in the main, what types will result from crossing any two established varieties, and approximately the proportion of each type that will appear in the second generation. With the exceptions already referred to, the second generation consisted of the two parent types and of all the intermediate types possible between them. For instance, when one parent had long bearded heads, and the other short beardless heads, the plat could be divided into six types: two of these had long heads like one of the parents, two others short heads like the other parent, and two were intermediate; and one each of these three groups had beards, while the others had none. In some of the crosses the parent of the common form had velvet chaff, but no beards. Here a similar set of six types appeared, the velvet replacing the beards. When one parent had velvet chaff of dark brown colour, twelve types were possible, and were actually found; six of these were similar to the six above, and the six others were like them except that they had brown chaff. As might be expected, many plants occurred more or less intermediate between these types, and it required considerable care to assort the types satisfactorily.

"Appended hereto are tables showing the percentages for all the plats that were assorted with sufficient care to be included here. To show the close agreement frequently found in the proportions in which the same types occurred in different plats, let us examine the figures for three plats of the same breeding. Type I., which was like the female parent, constituted 6 per cent. of one plat, 6·6 per cent. of another, and 6·9 per cent. of another. The percentages for the other types were as follows: II., 17·7, 17·9, and 19·1; III., 12·7, 12·4, and 13·1; IV., 40·5, 38·8, and 37·2; V., 5·7, 4·9, and 7·3; VI., which was like the other parent, 16·4, 19·5, and 19·9. The agreement is not usually so close as this, but it is fair to assume that the discrepancies are partly due to the small number of plants in each plat. They are also partly due to the fact that not a few plants were more or less intermediate between the types, and these were sometimes placed in one group and sometimes in another.

"It has been stated by nearly all investigators that there is a tendency, in the second and later generations, to revert to the parent forms. It seems possible that there is a more accurate way of stating this. The types that tend to occur in the second generation, as indicated by our results, include all possible combinations of the characters of the two parents. This, of course, includes the parent forms themselves, and we find the parent forms repeated in the second generation, constituting, apparently, certain definite portions of this generation.

"Another important fact that is clearly revealed by the tables of percentages is that the type that is most abundant in the second generation is the same as the first generation type, whether the latter is of the usual intermediate type or otherwise (see below). The exceptions to this were so rare as to render them doubtful.

"It was stated above that the first generation tends to be the same in similarly bred hybrids, and is intermediate between the parents. Let us consider the exceptions that occurred. In eleven of the fourteen crosses there were no noticeable exceptions. In one case one of four hybrids (first generation) resembled the male parent closely, and 66 per cent. of the next generation was like it (Table III.) In another case, one out of nine in the first generation differed from its fellows only in having no velvet on the chaff. In the second generation there were, in general, twelve types in these hybrids (Table XI.), six with velvet and six without. The plant that was devoid of velvet in the first generation produced only the six types without velvet in the second generation. In another cross, which was the reciprocal of the last-mentioned (Table XII.), nine out of twenty-seven hybrids were more or less irregular in one or both generations. Five of the first generation were more like the female parent, and one more like the male parent than usual. In each of these cases only a few of the possible types appeared in the second generation, and the type most like the previous generation was in great excess. In two other cases the only irregularity was the unusual preponderance of the first generation type in the second generation (Plats G 19 and G 22), and the absence of several of the possible types. In five plats of this breeding bearded forms appeared, though neither parent had beards. In every case the beards appeared on heads having the form of the parent belonging to *T. vulgare*. This probably indicates the presence of bearded parents in the ancestry of the variety used [Farquahar].

"Three of the fourteen crosses were reciprocals of three of the others; *e.g.* in one case Farquahar pollen was used on Little Club (Table XI.), and in another, Little Club pollen on Farquahar (Table XII.) Other cases are shown in Tables I. and IX., and Tables IV. and XIII. The same types appeared whichever parent furnished the pollen, and in approximately the same proportions.

"While the results here reported are not sufficient to justify the positive assertion that certain quantitative laws govern the transmission of parental characters to hybrid offspring, yet they point so strongly in this direction that we may state some of these laws provisionally, looking to future investigation for their confirmation, modification, or rejection.

"That similarly bred hybrids tend to be alike in the first generation, and to be intermediate between the parent forms, and that rarely an individual resembles one parent more or less closely, has been stated by others. We may add to this, provisionally at least, the following :

" (1) In the second generation of hybrids of similar breeding (with close fertilisation) the same types tend to occur, and in definite proportions ; two of these types are like the parents, the others include all possible intermediate forms.

" (2) With few exceptions the most abundant type in the second generation is the same as the type found in the first generation, whether the first generation was strictly intermediate between the parents or not.

" The seed has already been sown that these studies may be continued in the third and later generations. It is hoped by continuing them to later generations to learn a good deal of a quantitative character regarding the transmission of parent characters to hybrid offspring in Wheats.

" Explanation of Tables.

" The tables give the percentage of each type found in all plats in which this was determined. The first column gives the series and number of the plats. Type I., in each case (except Table XII.) is that of the parent belonging to *T. vulgare*. The last type is that of the club parent. The types are all based on certain obvious characters of the parents. In Table XII., Type IV. is that of the *T. vulgare* parent, the first four types in this cross being bearded and, in this respect, unlike either parent. The figures in heavy type represent the proportion of that type most closely resembling the first generation.

" Abbreviations.

" In describing the types, the following abbreviations are used : l=heads long (*T. vulgare* type) ; s=heads short (*T. compactum* type) ; sl=semi-long=intermediate between *T. vulgare* and *T. compactum ;* be=bearded ; ba=bald (not bearded) ; br=brown chaff ; li=light-coloured chaff ; v=velvet chaff ; g=glabrous chaff ; m=male parent ; f=female parent.

Table I.

M.—Emporium ; l, br.
F.—Little Club ; s, li.

Types .	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Plat No.	l be br	l be li	l ba br	l ba li	sl be br	sl be li	sl ba br	sl ba li	s be br	s be li	s ba br	s ba li
A3 . .	11·3	0·9	13·3	6·8	4·3	2·1	5·1	1·5	17·4	7·7	**20·9**	8·9
A4 . .	4·0	1·0	16·2	5·8	3·3	4·3	15·2	3·0	9·9	3·7	**32·8**	8·0

Table II.

M.—Jones Winter Fife; l, ba, v, li.
F.—Little Club; s, ba, g, li.

Types.	I	II	III	IV	V	VI
Plat No.	l v	l g	sl v	sl g	s v	s g
B5	20·3	6·9	**39·1**	12·4	15·8	5·5
B6	23·7	3·9	**40·5**	10·6	15·7	6·7
B7	25·6	5·2	**29·2**	9·3	13·9	16·7
B8	15·9	6·5	**36·0**	22·7	17·5	1·4
B11	24·2	8·4	**37·3**	6·9	16·7	6·5
B12	22·7	5·9	**33·0**	10·0	17·2	11·2
C1	26·4	8·8	**31·2**	12·0	15·0	6·6
C4	17·5	7·9	**36·6**	14·6	16·3	7·3
C5	11·2	4·3	**42·5**	15·1	21·8	6·1
C2	22·0	7·0	35·0	9·0	17·0	10·0
J16	18·7	6·2	**34·0**	10·3	24·6	6·8
J17	17·0	6·3	**29·8**	14·4	21·2	10·6
K1	19·3	8·1	**36·8**	11·7	17·1	6·7
K2	19·0	7·1	**39·9**	13·6	16·2	4·1
K3	22·9	9·1	**32·0**	14·3	16·7	4·7
K4	19·8	6·5	**31·1**	10·8	26·3	5·3
K5	21·3	6·8	**29·0**	15·0	21·8	6·0
K6	18·9	8·3	**35·1**	16·1	18·6	3·8
K8	22·4	5·7	**29·2**	12·5	24·5	5·7
K11	19·1	8·0	**37·4**	9·8	19·9	5·8
K13	18·8	7·4	**39·4**	13·8	14·8	5·8
L1	17·4	4·1	**35·3**	9·3	21·2	12·2

Table III.

M.—White Track; l, ba, g, li.
F.—Little Club; s, ba, g, li.

<table>
<tr><th>Types</th><th>I</th><th>II</th><th>III</th><th>IV</th></tr>
<tr><td>Plat No.</td><td>l</td><td>ls-l</td><td>sl-s</td><td>s</td></tr>
<tr><td>C7</td><td>66·0</td><td>5·5</td><td>18·3</td><td>8·9</td></tr>
<tr><td>C8</td><td>30·9</td><td>7·7</td><td>45·7</td><td>16·4</td></tr>
<tr><td>C11</td><td>22·6</td><td>5·9</td><td>52·8</td><td>18·7</td></tr>
<tr><td>C12</td><td>27·1</td><td colspan="2">47·5</td><td>25·4</td></tr>
</table>

Table IV.

M.—Valley; l, be, g, li.
F.—Little Club; s, ba, g, li.

Types	I	II	III	IV	V	VI
Plat No.	l be	l ba	sl be	sl ba	s be	s ba
C16	3·4	39·0	2·4	**37·6**	8·2	8·8
C18	8·5	11·9	12·7	**40·6**	6·0	19·5
C21	14·3	23·8	16·6	**38·0**	5·0	2·4

TABLE V.

M.—White Track; l, ba, g, li.
F.—Red Chaff; s, ba, g, br.

Types	I	II	III	IV	V	VI	VII	VIII
Plat No.	l br	l br-li	l li	sl br	sl li	s br	s br-li	s li
C10. . .	4·4	20·6	9·5	**38·4**	11·1	5·0	3·2	7·0
C13. . .	12·0	5·8	8·8	**18·0**	31·1	10·4	4·1	9·8

TABLE VI.

M.—McPherson; l, ba, g, li.
F.—Red Chaff; s, ba, g, br.
Colour of chaff disregarded in sorting.

Types	I	II	III
Plat No.	l	sl	s
E1	23·6	21·6	**55·0**
E9	22·8	**40·0**	37·3
E10	25·1	**35·9**	39·0
E11	33·0	29·7	**37·3**
E13	22·9	**49·0**	28·1
E14	25·0	**34·0**	**41·0**

TABLE VII.

M.—Jones Winter Fife; l, ba, v, li.
F.—Red Chaff; s, ba, g, br.
Colour disregarded in sorting.

Types . .	I	II	III	IV	V	VI
Plat No.	l v	l g	sl v	sl g	s v	s g
E21 . .	15·7	10·2	**50·5**	11·6	11·6	0·7
E22 . .	20·0	8·0	37·0	11·3	17·4	6·3
E24 . .	15·6	9·9	**33·1**	19·2	6·3	13·5
E25 . .	16·5	9·7	**37·0**	14·5	16·5	8·7
F2. . .	25·7	6·9	**41·6**	13·2	8·4	4·3
F3. . .	20·6	8·1	**34·9**	13·7	16·2	6·5
F11 . .	17·3	6·8	**41·4**	11·7	18·4	4·5

TABLE VIII.

M.—Farquahar; l, ba, v, br.
F.—Red Chaff; s, ba, g, br.

Types . .	I	II	III	IV	V	VI
Plat No.	l v	l g	sl v	sl g	s v	s g
F23 . .	23·4	8·1	41·6	12·2	11·8	5·4

Table IX.

M.—Little Club ; s, ba, g, li.
F.—Emporium ; l, be, g, br.

Types .	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Plat No.	l be br	l be li	l ba br	l ba li	sl be br	sl be li	sl ba br	sl ba li	s be br	s be li	s ba br	s ba li
F26 . .	1·0	3·5	8·5	5·7	3·4	0·0	**34·1**	7·4	11·9	3·4	**11·9**	9·1
F30 . .	4·8	1·6	16·0	3·2	9·2	2·4	**19·2**	2·8	9·2	2·8	**20·0**	5·2
F31 . .	·7	0·0	11·6	8·1	7·0	1·0	**10·5**	5·8	0·0	14·0	**21·1**	14·0
F32 . .	2·7	4·9	15·0	5·5	7·0	1·0	**13·1**	7·2	10·4	0·0	**23·7**	9·7
G1 . .	10·4	·8	10·4	6·4	8·0	0·0	**6·4**	5·6	0·0	0·0	**20·0**	20·8
G3 . .	8·3	2·9	10·7	7·8	3·3	1·6	**19·0**	4·6	1·0	6·9	**29·0**	5·0

Table X.

M.—Lehigh ; l, be, g, li.
F.—Red Chaff ; s, ba, g, br.

Types	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Plat No.	l be br	l be li	l ba br	l ba li	sl be br	sl be li	sl ba br	sl ba li	s be br	s be li	s ba br	s ba li
F13 . .	1·7	3·9	13·8	0·0	12·1	1·3	**38·0**	19·0	3·5	0·0	5·2	1·7
F15 . .	2·0	4·5	13·5	1·5	7·7	5·0	**26·3**	12·7	6·4	4·7	7·0	4·7
F17 . .	5·0	1·0	13·5	5·2	10·0	10·0	**37·5**	3·8	0·0	0·0	5·0	3·0

Table XI.

M.—Farquahar ; l, ba, v, br.
F.—Little Club ; s, ba, g, li.

Types	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Plat No.	l br v	l br g	l li v	l li g	sl br v	sl br g	sl li v	sl li g	s br v	s br g	s li v	s li g
I6 . . .	17·7	6·9	7·2	2·3	**35·3**	10·8	10·9	0·0	6·8	0·0	3·5	0·0
I7 . . .	18·2	11·3	0·0	4·5	**31·3**	11·3	4·5	0·0	9·1	9·1	0·0	0·0
I8 . . .	16·4	4·8	2·4	1·2	**40·8**	8·4	8·4	1·2	3·6	4·8	0·0	7·2
I12 . . .	13·4	2·4	0·0	3·7	**35·4**	6·1	9·8	0·0	11·0	6·1	7·3	4·9
I16 . . .	18·0	5·6	7·0	0·0	**34·7**	5·6	9·7	0·0	13·8	1·4	4·2	0·0
I17 . . .	11·7	2·6	10·4	3·9	**32·5**	5·2	15·6	1·3	11·7	1·3	3·9	0·0
I15 . . .	—	15·9	—	7·3	—	**47·6**	—	19·5	—	4·9	—	4·9

Table XII.

M.—Little Club; s, ba, g, li.
F.—Farquahar; l, ba, v, br.

Types	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI
Plat No.	l be br v	l be br g	l be li v	l be li g	l ba br v	l ba br g	l ba li v	l ba li g	sl ba br v	sl ba br g	sl ba li v	sl ba li g	s ba br v	s ba br g	s ba li v	s ba li g
G4 .	—	—	—	—	21·0	6·6	5·6	1·0	**25·1**	7·0	9·6	1·3	15·7	3·0	3·5	0·8
G5 .	—	—	—	—	17·0	3·0	4·1	2·4	**36·3**	1·0	13·0	—	6·5	1·0	4·7	—
G13 .	—	—	—	—	15·6	5·2	4·7	—	**30·2**	7·8	8·3	4·7	12·0	3·1	6·3	—
G14 .	—	—	—	—	20·0	6·7	13·3	—	**23·3**	—	13·3	—	13·3	—	10·0	—
G16 .	—	—	—	—	15·8	7·3	6·0	—	**29·0**	8·7	9·9	·8	14·1	—	3·8	1·0
G18 .	—	—	—	—	13·9	5·1	—	4·2	**32·2**	8·3	11·0	4·9	13·4	2·9	3·9	—
H2 .	—	—	—	—	12·8	4·0	5·6	2·4	**38·4**	16·0	9·6	4·8	3·2	3·2	—	—
H6 .	—	—	—	—	15·1	4·0	1·0	3·0	**24·2**	11·1	10·1	5·0	10·1	4·0	9·0	3·0
H7 .	—	—	—	—	16·3	4·6	1·0	1·8	**32·0**	11·0	7·1	2·8	10·3	7·8	1·4	1·0
H8 .	—	—	—	—	22·1	7·0	4·5	—	**26·6**	15·0	8·1	2·3	11·0	3·4	—	—
H9 .	—	—	—	—	20·3	—	5·1	—	**33·0**	—	9·4	2·5	9·4	16·1	2·1	1·0
H10 .	—	—	—	—	11·3	4·2	3·4	2·3	**28·2**	11·7	7·7	2·8	16·2	5·4	4·8	1·7
H11 .	—	—	—	—	12·7	5·9	3·6	—	**28·2**	13·2	12·7	3·6	9·5	3·2	6·4	1·0
H12 .	—	—	—	—	13·5	5·4	3·4	1·3	**30·2**	7·4	9·1	1·7	16·6	6·8	1·3	1·7
H14 .	—	—	—	—	15·1	3·2	8·7	·8	**16·6**	4·7	11·1	1·5	**23·8**	10·3	2·3	1·5
H15 .	—	—	—	—	17·0	6·5	7·0	—	**25·0**	7·5	6·0	2·5	7·0	4·0	13·0	4·0
H16 .	—	—	—	—	12·2	2·0	6·1	2·0	**23·0**	16·9	10·1	2·0	16·2	4·7	4·1	·7
H17 .	—	—	—	—	14·7	3·5	5·6	1·3	**18·8**	—	—	6·3	**27·2**	11·2	7·0	—
G20 .	—	—	1·4	1·0	1·0	8·5	19·3	2·4	**29·2**	11·6	13·2	4·8	7·2	1·8	2·4	—
G7 .	1·0	30·2	—	—	**53·6**	16·2	—	—	—	—	—	—	—	—	—	—
G9 .	14·0	8·0	—	—	**61·0**	12·0	—	—	1·0	—	—	—	—	—	3·8	—
G15 .	—	—	—	—	**56·7**	11·2	21·9	6·5	—	—	—	—	1·0	—	2·7	—
H1 .	—	—	—	—	**68·7**	—	—	—	18·7	6·2	6·2	—	—	—	—	—
G11 .	27·3	1·0	1·0	—	1·0	16·6	**53·4**	1·0	—	—	—	—	—	—	—	—
G22 .	—	—	—	—	25·0	—	—	—	**75·0**	—	—	—	—	—	—	—
G19 .	—	—	—	—	1·0	1·0	22·0	—	**76·0**	—	—	—	—	—	—	—
G21 .	—	—	1·7	—	27·9	—	1·0	—	—	—	—	—	—	1·0	**68·3**	—

Table XIII.

M.—Little Club; s, ba, g, li.
F.—Valley; l, be, g, li.

Types . . .		II	III	IV	V	VI
Plat No.	l be	l ba	sl be	sl ba	s be	s ba
J6 . . .	6·6	17·9	12·4	**38·8**	4·9	19·5
J7 . . .	7·7	22·7	13·4	**37·4**	3·0	15·5
I19 . . .	5·4	20·9	10·1	**50·0**	2·1	11·4
J3 . . .	4·7	18·1	10·0	**31·8**	11·5	23·6
J4 . . .	6·9	17·7	12·7	**40·5**	5·7	16·4
J8 . . .	6·0	19·1	13·1	**37·2**	7·3	19·9
J9 . . .	4·2	14·5	8·4	**36·0**	10·8	**25·3**
J10 . . .	3·7	13·7	17·5	**36·2**	3·7	**25·0**
J12 . . .	12·5	8·3	20·8	**37·4**	8·3	12·5
J13 . . .	5·4	21·9	7·1	**29·6**	7·1	28·5
J14 . . .	5·5	22·2	11·1	**31·0**	7·7	22·2

TABLE XIV.

M.—Turkey; l, be, g, li.
F.—Little Club; s, ba, g, li.

Types . . .	I	II	III	IV	V	VI
Plat No.	l be	l ba	sl be	sl ba	s be	s ba
D2 . . .	8·3	19·6	26·2	20·2	6·1	19·6
D8 . . .	5·6	17·4	8·3	29·7	12·2	16·6
D9 . . .	5·2	18·4	17·5	43·3	4·4	11·4
D10 . .	10·2	23·4	15·4	35·7	2·1	13·2
D11 . .	3·1	21·6	21·8	39·3	3·8	10·5
D15 . .	9·0	17·9	19·0	22·8	8·6	22·6
D16 . .	2·6	12·2	17·7	31·0	8·8	26·7

MENDEL'S PRINCIPLES APPLIED TO PROF. SPILLMAN'S TABLES.

A glance at Prof. Spillman's tables at once suggested to me a probable confirmation of the Mendelian Principles, and a detailed analysis proved this beyond doubt.

It will be noted that in Tables III. and IV. Prof. Spillman takes into consideration a single character only, while in the remaining tables two or three characters are taken together. From the Mendelian point of view this is rather complicated. In order to simplify matters, I will first take each single character separately through the whole of the experiments, making a separate table for each character, and at the same time showing the percentage results as given by Prof. Spillman in his tables, with cross references thereto in the margin.

In this way complicated calculations will be avoided at the outset, and a simple result will be attained which will clearly illustrate the Mendelian Principles. The way will then be cleared for an examination of Prof. Spillman's original tables in which two and three characters are taken together.

TABLE A.

("Velvet" × "glabrous") × self.

Spillman's Table No.	Plat No.	"Velvet"	"Glabrous"
II . . .	B5	75·2	24·8
	B6	79·9	21·2
	B7	68·7	31·2
	B8	69·4	30·6
	B11	78·2	21·8
	B12	72·9	27·1
	C1	72·6	27·4
	C4	70·4	29·8
	C5	75·5	25·5
	C2	74·0	26·0
	J16	77·3	23·3
	J17	68·0	31·3
	K1	73·2	26·5
	K2	75·1	24·8
	K3	71·6	28·1
	K4	77·2	22·6
	K5	72·1	27·8
	K6	72·6	28·2
	K8	76·1	23·9
	K11	76·4	23·6
	K13	73·0	27·0
	L1	73·9	25·6

TABLE A—*continued.*

Spillman's Table No.	Plat No.	"Velvet"	"Glabrous"
VII	E21	77·8	22·5
	E22	74·4	25·6
	E24	55·0	42·6
	E25	70·0	32·9
	F2	75·7	24·4
	F3	71·7	28·3
	F11	77·1	23·0
VIII	F23	76·8	25·7
XI	I6	81·4	20·0
	I7	63·1	36·2
	I8	71·6	27·6
	I12	77·9	23·2
	I16	87·4	12·6
	I17	85·8	14·3
XII	G4	80·5	19·7
	G5	81·6	7·4
	G13	77·1	20·8
	G14	93·2	6·7
	G16	78·6	17·8
	G18	74·4	25·4
	H2	69·6	30·4
	H6	69·5	30·1
	H7	68·1	29·0
	H8	72·3	27·7
	H9	79·3	19·6
	H10	71·6	28·1
	H11	73·1	26·9
	H12	74·1	24·3
	H14	77·6	22·0
	H15	75·0	24·5
	H16	71·7	28·3
	H17	73·3	22·3
	G20	73·7	30·1
	G7	54·6	46·4
	G9	76·0	23·8
	G15	82·3	17·7
	H1	93·6	6·2
	G11	82·7	18·6
Total	60	4492·5	1490·8
Average	=	74·8 :	24·8
Actual ratio = 3·01 : 1		Mendelian ratio = 3 : 1	

In the original cross, varieties of *T. vulgare* with "velvet chaff" were crossed with varieties of *T. compactum* with "glabrous chaff," the result being sixty-three plants with "velvet chaff" and one plant only with "glabrous chaff." In Mendelian terms the "velvet" character is Dominant, and the "glabrous" Recessive. In the next generation sixty of the "velvet" hybrids self-fertilised produced sixty plats of hybrids each containing two types, viz. Dominant and Recessive. Table A gives the approximate percentages of each type found in each plat, and it will be seen that the figures agree well with the Mendelian expectation of three Dominants to one Recessive, *i.e.* 75 % "velvet" + 25 % "glabrous." The average percentage of the sixty plats works out approximately 74·8 Dominants to 24·8 Recessives, *i.e.* a ratio of 3·01 : 1, being a very close approximation to the Mendelian ratio of 3 : 1. The three remaining "velvet" hybrids proved exceptional, inasmuch as, when self-fertilised, they produced practically all the same Dominant "velvet" type again (see Table XII., Plats G22, G19, G21), there being only 1% or less of the Recessive "glabrous" form. It would be interesting to know whether these forms retained their characters in future generations.

TABLE B.

("Brown" × "Light-coloured") × self.

Spillman's Table No.	Plat No.	"Brown"	"Light"
I . . .	A3	72·3	27·9
	A4	81·4	25·8
V . . .	C10	71·6	27·6
	C13	50·3	49·7
IX . . .	F26	70·8	29·1
	F30	78·4	18·0
	F31	50·9	42·9
	F32	71·9	28·3
	G1	55·2	33·6
	G3	71·3	28·8
X . . .	F13	74·3	25·9
	F15	62·9	33·1
	F17	71·0	23·0
XI . . .	I6	77·5	23·9
	I7	90·3	9·0
	I8	78·8	20·4
	I12	74·4	25·7
	I16	79·1	20·9
	I17	65·0	35·1
	I15	68·4	31·7
XII . . .	G4	78·4	21·8
	G5	64·8	24·2
	G13	74·5	24·0
	G14	63·3	36·6
	G16	74·9	21·5
	G18	75·8	24·0
	H2	77·6	22·4
	H6	68·5	31·1
	H7	82·0	15·1
	H8	85·1	14·9
	H9	78·8	20·1
	H10	77·0	22·7
	H11	72·7	27·3
	H12	79·9	18·5
	H14	73·7	25·9
	H15	67·0	32·5
	H16	75·0	25·2
	H17	75·4	20·2
	G20	59·3	44·5
	G9	96·0	3·8
	G15	68·9	31·1
	H1	93·6	6·2
	G19	78·0	22·0
Total	43	3176·0	1096·0
Average	=	73·8	25·4
Actual ratio = 2·9 : 1		Mendelian ratio = 3 : 1	

In the original cross, varieties with "brown chaff" were crossed with varieties with "light-coloured chaff," the result being forty-five hybrids with "brown chaff" and two with "light-coloured chaff." In this case the "brown" character is Dominant and the "light" Recessive. In the next generation forty-three of the "brown" hybrids self-fertilised produced forty-three plats of hybrids, each containing two types, viz. Dominant and Recessive. Table B gives the approximate percentages of each type found in each plat, and it will be seen that the figures, though not so regular as in Table A, fairly agree with the Mendelian expectation of three Dominants to one Recessive, *i.e.* 75 % "brown" + 25 % "light."

It seems probable that the individual plat figures are not so regular as in Table A because the character of "brown" and "light" is not so distinctly differential as "velvet" and "glabrous," and consequently more difficult to classify. However, this does not appear to have affected the average percentage of the forty-three plats, which works out approximately 73·8 Dominants to 25·4 Recessives, *i.e.* a ratio of 2·9 : 1, being a close approximation to the Mendelian ratio of 3 : 1.

The two remaining "brown" hybrids proved exceptional when self-fertilised, inasmuch as they produced the same Dominant "brown" type again, with no trace of the Recessive "light" form (see Table XII., Plats G7, G22).

It will be noted that Plat G22 was also one of the exceptions under Table A.

TABLE C.

("Bald" × "bearded" heads) × self.

Spillman's Table No.	Plat No.	"Bald"	"Bearded"
IV	C16	85·4	14·0
	C18	72·0	27·2
	C21	64·2	35·9
IX	F26	76·7	24·2
	F30	66·4	30·0
	F31	71·1	22·7
	F32	74·2	26·0
	G1	69·6	19·2
	G3	76·1	24·0
X	F13	77·7	22·5
	F15	65·7	30·3
	F17	68·0	26·0
XIII	J6	76·2	23·9
	J7	75·6	24·1
	I19	82·3	17·6
	J3	73·5	26·2
	J4	74·6	25·3
	J8	76·2	26·4
	J9	75·8	23·4
	J10	74·9	24·9
	J12	58·2	41·6
	J13	80·0	19·6
	J14	75·4	24·3

Table C—*continued.*

Spillman's Table No.	Plat No.	"Bald"	"Bearded"
XIV	D2	59·4	40·6
	D8	63·7	26·1
	D9	73·1	27·1
	D10	72·3	27·7
	D11	71·4	28·7
	D15	63·3	36·6
	D16	69·9	29·1
Total	30	2162·9	795·2
Average	=	72·1	26·5
Actual ratio = 2·7 : 1		Mendelian ratio = 3 : 1	

In the original cross, varieties with "bald heads" were crossed with varieties with "bearded heads," the result being thirty hybrids with "bald heads" and none with "bearded heads." In this case the "bald" character is Dominant and the "bearded" Recessive. In the next generation the thirty "bald" hybrids self-fertilised produced thirty plats of hybrids, each containing two types, viz. Dominant and Recessive. Table C gives the approximate percentages of each type found in each plat, and it will be seen that, with a few exceptions, the figures fairly agree with the Mendelian expectation of three Dominants to one Recessive, *i.e.* 75 % "bald" + 25 % "bearded."

The average percentage of the thirty plats works out approximately 72·1 Dominants to 26·5 Recessives, *i.e.* a ratio of 2·7 to 1, which is approximate to the Mendelian ratio of 3 : 1.

That the average result in this case is not so close to Mendel as in the two former tables is probably due to the smaller number of plats involved.

There are apparently no exceptions in regard to the Dominance of "bald" in the original cross, though it is interesting to note that in Table XII., where two "bald" varieties are crossed together, giving twenty-seven "bald" hybrids, these hybrids self-fertilised produced a small percentage of "bearded" hybrids in five plats out of the twenty-seven, thus suggesting that one of the varieties used in this cross was not pure and constant. If this be so, it may possibly explain the few exceptions noted under Tables A, B, and D, as these all apparently occur in that particular cross (Table XII.)

In the original cross, varieties of *T. vulgare* with "long heads" were crossed with varieties of *T. compactum* with "short heads," the result being ninety-seven "intermediate" or "semi-long," six "long," and five "short." This result, it is important to notice, differs from Mendel's experiment with Peas, inasmuch as the first generation is "intermediate" between the parents, with no Dominance of either parent. But, as will be seen in the above table, in the second generation the Mendelian Principles work out admirably.

In the second generation, ninety-five of the intermediate hybrids self-fertilised produced ninety-five plats of hybrids, each containing three

TABLE D.

("Long" × "short" heads) × self.

Spillman's Table No.	Plat No.	"Long"	"Intermediate"	"Short"
II	B5	27 2	51·5	21·3
	B6	27·6	51·1	22·4
	B7	30·8	38·5	30·6
	B8	22·4	58·7	18·9
	B11	32·6	44·2	23·2
	B12	28·6	43·0	28·4
	C1	35·2	43·2	21·6
	C4	25·4	51·2	23·6
	C5	15·5	57·6	27·9
	C2	29·0	44·0	27·0
	J16	24·9	44·3	31·4
	J17	23·3	44·2	31·8
	K1	27·4	48·5	23·8
	K2	26·1	53·5	20 3
	K3	32·0	46·3	21·4
	K4	26·3	41·9	31·6
	K5	28·1	44·0	27·8
	K6	27·2	51·2	22·4
	K8	28·1	41·7	30·2
	K11	27·1	47·2	25·7
	K13	26·2	53·2	20·6
	L1	21·5	44·6	33·4
III	C8	30·9	53·4	16· 4
	C11	22·6	58·7	18· 7
	C12	27·1	47·5	25· 4
IV	C16	42·4	40·0	17·0
	C18	20·4	53·3	25·5
	C21	38·1	54·6	7·4
V	C10	34·5	49·5	15·2
	C13	26·6	49·1	24·3
VI	E9	22·8	40·0	37·3
	E10	25·1	35·9	39·0
	E13	22·9	49·0	28·1
	E14	25·0	34·0	41·0
VII	E21	25·9	62·1	12·3
	E22	28·0	48·3	23·7
	E24	25·5	52·3	19·8
	E25	26·2	51·5	25·2
	F2	32·6	54·8	12·7
	F3	28·7	48·6	22·7
	F11	24·1	53·1	22·9
VIII	F23	31·5	53·8	17·2
IX	F26	18·7	44·9	36·3
	F30	25·6	33·6	37·2
	F31	20·4	24·3	49·1
	F32	28·1	28·3	43·8
	G1	28·0	20·0	40·8
	G3	29·7	28·5	41·9
X	F13	19·4	70·4	10·4
	F15	21·5	51·7	22·8
	F17	24·7	61·3	8·0

TABLE D—*continued.*

Spillman's Table No.	Plat No.	"Long"	"Intermediate"	"Short"
	I6	34·1	57·0	10·3
	I7	34·0	47·1	18·2
	I8	24·8	58·8	15·6
XI . .	I12	19·5	51·3	29·3
	I16	30·6	50·0	19·4
	I17	28·6	54·4	16·9
	I15	23·2	67·1	9·8
	G4	34·2	43·0	23·0
	G5	26·4	42·3	12·2
	G13	25·5	51·0	21·4
	G14	40·0	36·6	23·3
	G16	29·1	48·4	18·9
	G18	23·2	56·4	20·2
	H2	24·8	68·8	6·4
	H6	23·1	50·4	24·1
	H7	23·7	52·9	20·5
XII . .	H8	33·6	52·0	14·4
	H9	25·4	44·9	28·6
	H10	21·4	50·4	28·1
	H11	22·2	57·7	20·1
	H12	23·6	48·4	26·4
	H14	27·8	33·9	37·9
	H15	30·5	41·0	28 0
	H16	22·3	52·0	34·7
	H17	25·1	25·1	45·4
	G20	33·6	58·8	11·4
	J6	24·5	51·2	24·4
	J7	30·4	50·8	18·5
	I19	26·3	60·1	13·5
	J3	22·8	41·8	35·1
	J4	24·6	53·2	22·1
XIII . .	J8	25·1	50·3	27·2
	J9	18·7	44·4	36·1
	J10	17·4	53·7	28·7
	J12	20·8	57·4	20·8
	J13	27·3	36·7	35·6
	J14	27·7	42·1	29·9
	D2	27·9	46·4	25·7
	D8	23·0	38·0	28·8
	D9	23·6	60·8	15·8
XIV	D10	33·6	51·1	15·3
	D11	24·7	61·1	14·3
	D15	26·9	41·8	31·2
	D16	14·8	48·7	35·5
Total . .	95	2519·9	4585·4	2330·4
Average		26·5	48·2	24·5
Mendelian ratio		25 :	50 :	25

types, viz. "long," "intermediate," and "short," *i.e.* the two original forms and intermediate forms, the last being twice as numerous as either of the others. Table D gives the approximate percentages of each type found in each plat, and it will be seen that with a few exceptions the figures fairly agree with the Mendelian expectation of A + 2Aa + a, *i.e.* 25 %

"long" + 50 % "intermediate" + 25 % "short." The average percentage of the ninety-five plats works out approximately 26·5 "long" + 48·2 intermediate + 24·5 "short," being a close approximation to the Mendelian ratio of 25 : 50 : 25.

This case is peculiarly interesting from the practical point of view, as it shows that normal intermediate hybrids of the blended type of inheritance also separate their characters in accordance with the Mendelian Principles, thus confirming what the writer has already shown in orchid hybrids (JOURNAL R.H.S. xxvii. pp. 614–624), viz. that Mendel's Principles do not depend at all upon the question of Dominance in the first generation, which latter is merely a phase of inheritance, the actual causes of which are at present not quite clear, though it seems probable that there is some connection between inbred races and Dominance.

Formerly it was thought that the Mendelian Principles were only applicable to Dominant hybrids and crosses, but now that intermediate hybrids are being brought into line, and as they appear to be generally more numerous than Dominant hybrids, it seems likely that the Mendelian Principles will ultimately be extended to cover all the phenomena of hybridisation and cross-breeding. At the same time it should be clearly recognised that there are undoubtedly many complications existing which were not fully known to Mendel, and which future experiments alone can unravel.

The remaining two intermediate hybrids, when self-fertilised, proved slightly exceptional inasmuch, as they produced no "short" forms at all, but simply 75 % intermediate and 25 % "long" (see Table XII., Plats G22 and G19). It will be noted, again, that the exceptions only occur in one cross, Table XII., and that Plat G22 is exceptional in all three characters, while Plat G19 is exceptional in two characters out of three, all of which lends colour to the suggestion made under Table C, that one of the varieties of this cross is not truly pure and constant in its characters.

Having dealt with the behaviour of all the "Dominant" hybrids, we now come to the consideration of those few forms which in the original cross showed the "Recessive" form rather than the usual "Dominant." In other words, the "Recessive" becomes Dominant, and the "Dominant" Recessive. This may at first sight appear to be a small matter, and one which Mendel does not seem to have experienced, but it appears to me to be of great importance, as it touches the vital question of *individual* versus *ancestral* inheritance.

In Prof. Spillman's experiments, there appear to have been fourteen cases in the four characters, out of a total of 249, and these when self-fertilised seem to have given two different results : viz. in six cases the "Recessive" character was again reproduced almost pure, and in the remaining eight cases in the approximate proportion of 75 % "Recessive" to 25 % "Dominant." (For details see Table I., Plats A3, A4 ; III., C7 ; VI., E1, E11 ; XI., I15 ; XII., G7, G9, G15, H1, G11, G21.)

It will again be noted that all the six cases in which the Recessive remained almost pure occurred in the same cross (Tables XI. and XII.) which gave the exceptions to the Mendelian cases. Disregarding these, therefore, and looking at the remainder of Prof. Spillman's facts, it would appear that *the Mendelian Principles are followed in every case,* *but that the second generation tends to repeat in Mendelian proportions whatever is shown by the first generation, whether "Dominant," Intermediate, or "Recessive."*

That is to say, if the individuals of the first generation are of the "Dominant" type, they will reproduce that type in the second generation in the ratio of 3 D : 1 R; but if they happen to be of the "Recessive" type they will reproduce that same type in the second generation in the ratio of 3 R : 1 D; while if the individuals of the first generation are of the Intermediate type, they will reproduce that type in the second generation in the ratio of 1 D : 2 DR : 1 R.

If future experiments confirm this, it will be an important advance in our knowledge of heredity, and to the practical hybridist the information will be invaluable, as he will be able to select whatever he wants in the first generation, whether it happens to be "Dominant," Intermediate, or "Recessive," and by the aid of the Mendelian Principles he will be able to calculate the result beforehand.

Having dealt hitherto simply with single characters, and found them to be strictly Mendelian, we now proceed to the much more complicated question of two and three characters taken together. For this purpose Prof. Spillman's tables are admirable and require no analysis; we can take them as they stand in his original paper.

Firstly we will take those tables in which two characters are considered together.

In Tables II., VII., and VIII., varieties with "long heads" and "velvet chaff" were originally crossed with varieties with "short heads" and "glabrous chaff," the result being thirty hybrids with "Intermediate heads" and "velvet chaff." These thirty hybrids, self-fertilised, produced thirty plats, each containing six types, on the average in the following proportions, viz.:—19·9 (l + v) + 7·2 (l + g) + 36·2 (sl + v) + 12·7 (sl + g) + 17·2 (s + v) + 6·8 (s + g).

Now, if we take the Mendelian formulæ for the two single characters, we get for the one 1 l + 2 sl + 1s, and for the other 3 v + 1 g.

Now the possible combinations between them would be six, in the following proportions, viz.:—3 (l + v) + 1 (l + g) + 6 (sl + v) + 2 (sl + g) + 3 (s + v) + 1 (s + g), the approximate percentage of which would be respectively 18 + 6 + 36 + 12 + 18 + 6.

This Mendelian expectation agrees well with the actual percentages respectively of Prof. Spillman's experiments given above, viz.:—19·9 + 7·2 + 36·2 + 12·7 + 17·2 + 6·8.

In Tables IV., XIII., and XIV., varieties with "long" and "bearded heads" are crossed with varieties of "short" and "bald heads," the result being twenty-one hybrids with "intermediate bald heads." These twenty-one hybrids, self-fertilised, produced 21 plats, each containing six types, on the average in the following proportions, viz.:—6·6 (l + be) + 19·1 (l + ba) + 14·0 (sl + be) + 35·4 (sl + ba) + 6·5 (s + be) + 17·7 (s + ba). The Mendelian formulæ for the two single characters are respectively, 1 l + 2 sl + 1 s and 3 ba + 1 be, and the possible combinations between them would be six, in the following proportions, viz.:—1 (l + be) + 3 (l + ba) + 2 (sl + be) + 6 (sl + ba) + 1 (s + be) + 3 (s + ba), the approximate percentages of which would be respectively 6 + 18 + 12 + 36 + 6 + 18.

This Mendelian expectation agrees well with actual percentages respectively of Prof. Spillman's given above, viz.:—6·6 + 19·1 + 14·0 + 35·4 + 6·5 + 17·7. It is quite evident, therefore, that the Mendelian Principles apply to two characters taken together as well as to single characters taken separately, though the expression of them is naturally more complicated.

Secondly, we will consider the still more complicated case of three characters taken together. In Tables XI. and XII. a variety with "long heads" and "brown velvet chaff" is crossed with a variety with "short heads" and "light-coloured glabrous chaff." The result is twenty hybrids with "intermediate heads" and "brown velvet chaff." These twenty hybrids self-fertilised produced twenty plats containing twelve types, on the average in the following proportions, viz.:—16·1 (l + br + v) + 5·1 (l + br + g) + 4·4 (l + li + v) + 1·6 (l + li + g) + 31·3 (sl + br + v) + 8·3 (sl + br + g) + 9·8 (sl + li + v) + 1·9 (sl + li + g) + 10·8 (s + br + v) + 4·1 (s + br + g) + 3·8 (s + li + v) + 1·6 (s + li + g). The Mendelian formulæ for the three single characters are respectively 1 l + 2 sl + 1 s, 3 br + li, and 3 v + 1 g, and the possible combinations between these would be 9 (l + br + v) + 3 (l + br + g) + 3 (l + li + v) + 1 (l + li + g) + 18 (sl + br + v (+ 6 (sl + br + g) + 6 (sl + li + v) + 2 (sl + li + g) + 9 (s + br + v) + 3 (s + br + g) + 3 (s + li + v) + 1 (s + li + g), the approximate percentages of which would be respectively 13·5 + 4·5 + 4·5 + 1·5 + 27·0 + 9·0 + 9·0 + 3·0 + 13·5 + 4·5 + 4·5 + 1·5.

This Mendelian expectation agrees fairly with the actual percentages respectively of Prof. Spillman's given above, viz.:—16·1 + 5·1 + 4·4 + 1·6 + 31·3 + 8·3 + 9·8 + 1·9 + 10·8 + 4·1 + 3·8 + 1·6. It is quite evident, therefore, that the Mendelian Principles apply equally to three characters taken together as well as to two characters and to single characters, though the expression is necessarily much more complicated.

Prof. Spillman's facts, on the whole, as he himself says, prove to the practical hybridist that in the self-fertilisation of first-crosses between constant varieties it is possible to know beforehand exactly what types will be obtained, and further to calculate the average percentage of each. It reflects the greatest possible credit on Prof. Spillman that he should have arrived at this result independently, not having apparently heard of Mendel's work on similar lines, and the thanks of all hybridists are due to him for his independent confirmation of Mendel's Principles.

Since the above paper was sent to the press Mr. Bateson has kindly drawn my attention to a further paper by Prof. Spillman in "Science," 1902, xvi. p. 794, in which he himself clearly notes the Mendelian significance of his experiments.—C. C. H.

HARDY SUMMER- AND AUTUMN-FLOWERING BULBS.

By P. Rudolph Barr, F.R.H.S.

[Delivered October 21, 1902.]

I propose in this paper to pass in review those bulbous plants which may be recommended chiefly for their decorative character in the flower garden and their easy culture, and also to give short practical notes on the treatment of each. I take the word *bulb* in its popular rather than botanical sense, as otherwise many beautiful flowers would have to be excluded which cannot be scientifically designated as bulbous, as some of them form *corms*, some *tubers*, some *rhizomes*, and so on. Thus, the Gladiolus makes a *corm*, while the Alstrœmeria forms *tubers* ; nevertheless, they all serve the same purpose to the flower as does a bulb to the Hyacinth, and they are generally all classed by amateurs under the term *bulbous plants*.

Before the beauty and brilliancy of the May-flowering Tulips have quite faded from our memory, we find ourselves taking delight in the fresh bright shades of the Spanish Iris, the sumptuous flowers of the English Iris, and the brilliant colours of *Ranunculus* and *Ixia* come to gladden us.

June.

Ranunculus.—Let us take the Ranunculus to start with. It is a pity that these charming flowers are not now seen more frequently in gardens, as they are easily grown and give a most brilliant effect when massed in the border or used for filling beds. They make a carpet of rich green foliage, above which rise the rose-shaped flowers of scarlet, rose, white, yellow, orange, and many other striking colours, making a brilliant show in the garden at the end of May and early part of June. A well-drained, light rich soil, and a sunny situation which is not wind-swept, are conditions which the Ranunculus enjoys. During April and May, when in full growth, *they should be kept well watered if the weather be dry.* Plant the roots in October or November, or in cold districts in February : they should be put in three or four inches apart, claws downwards, with the crown two inches below the surface and covered with sand. The finest class to grow is the French or Turco-Persian strain, but the Turban varieties should also be used, being very robust.

Iris.—The Spanish and English Irises are the flowers attracting our attention next ; these are now very popular, especially the Spanish Iris, which has taken a prominent place in England as a market flower, being grown by millions for cutting. During the last few years, considerable improvement has been made in this family, varieties being raised with larger flowers and longer stems than the older varieties possessed. Regarded as a border plant, the Spanish Iris is of great value, and fine breaks of rich colour can be obtained by its use. I would just mention a few really fine varieties which should be grown, both for garden effect and for cutting : Princess Ida (white and primrose), Cantab (azure-blue), Wouverman (yellow), Chrysolora (light yellow), Louisa (French grey and white), Snowball (white), Thunderbolt (chestnut-purple and brown).

The English Irises bloom nearly a fortnight after the Spanish, and differ greatly from them in form and scheme of colouring, having a less wide range of shade and being larger and of very refined outline. They

Fig. 202.—Group of Spanish Irises.

produce a handsome effect in flower-beds, and should be freely used for grouping in herbaceous borders. A few of the best varieties are: 'Mont Blanc' (white), 'Rosa Bonheur' (white flaked crimson and violet), 'Simon' (pale lavender, slightly feathered purple), 'Lord Roberts' (violet-blue slightly spotted purple), 'Lord Palmerston' (crimson-purple), 'Blanche Fleur' (white, tinged rose), 'Graaf Bentinck' (white, flaked dark carmine).

Both the Spanish and the English Irises are among the easiest bulbs to grow. They like a light, rich, well-drained soil, and will thrive in either an open or partially shaded situation. September planting will give the best results, but the bulbs may also be put in as late as November. These Irises may also be grown in pots and forced gently, but artificial heat should not be given until the flower buds are formed.

Fig. 203.—Ixias.

Ixia.—Among the gems of June bulbous flowers, the *Ixia*, *Sparaxis*, and *Calochortus* claim our notice. For a wide range of gorgeous colours, there are few flowers which can vie with the *Ixia* (the 'African Corn Lily'). On graceful wiry stems, their loose racemes of flowers present a most brilliant effect, especially when the blossoms, expanding in the sun's rays, display a dark centre, a contrast in colour which enhances considerably the beauty of the flower. A sunny situation protected from cold winds, and a good light, well-drained soil, are essential in growing these plants. The bulbs should be put in from November to January, three inches deep and two inches apart, and be surrounded and covered with coarse sand. The earlier plantings should have a light covering of straw litter or heather to protect the early top-growth, but this should be removed in March. In stiff soils or where there is much wet in winter, the bulbs should be planted on raised beds, and in such cases it is better to plant late than early. A position due south against a wall or greenhouse will suit the *Ixia* well. During very dry weather in late spring and early summer, watering should not be neglected. There are a great many varieties of Ixias, but for a choice of selection I would recommend the following:—'Emperor of China,' 'Conqueror,' 'Humbert,' 'Excelsior,' 'Erubescens major,' 'Crateroides,' 'Magnum bonum,' 'White Queen,' 'Præstans,' 'Nitens,' 'La Favorite,' 'Lady Slade,' 'Azurea,' 'Elvira,' and 'Viridiflora' (the green *Ixia*). The *Ixia* makes a very charming pot-plant, five or six bulbs in a four or five inch pot. Use a compost of turf-loam, leafy soil, and sand, potting the bulb firmly, and plunging in ashes or cocoa-fibre in a cool pit or frame. This may be done any time from October to January. When top-growth has somewhat advanced, keep the lights off, except during wet or frosty weather. As soon as the flower-spikes are showing, the plants may be transferred to the greenhouse, where they should be given a position close to the glass and be regularly attended to with water.

Sparaxis.—Belonging to the same natural order as the *Ixia*, and flowering about the same time, we have the delightful little *Sparaxis*, growing only ½ ft. high, but exhibiting such brilliant combinations of colour in the same flower as to at once arrest attention. A bed of these little gems when in flower produces an effect not readily forgotten. The cultural treatment is the same as for the *Ixia*. I can strongly recommend it for planting in grass in warm, sunny nooks, or on grassy mounds, fully exposed to the sun. In such positions the gorgeously coloured flowers show up in charming contrast to their grassy bed. When planting them in such places it is advisable to surround the bulbs with sand. Perhaps the most striking varieties are 'Tricolor,' 'Grandiflora,' 'Angélique,' 'Garibaldi,' and 'Queen Victoria,' but to obtain the finest effect I recommend a mixture of different sorts being used.

Calochortus.—The *Calochortus* is one of the gems of June flowers, and this will be admitted by anyone who has gazed upon the delicate beauty of its flowers. A native of California, it is the sole representative in the western hemisphere of the Tulip family, although to the uninitiated it bears very little resemblance to our garden Tulips. There are three natural divisions into which the *Calochorti* fall: firstly, the 'Butterfly' or 'Mariposa' Tulips, bearing on branching, wiry, zigzag stems several large erect open flowers, many of them being beautifully blotched and lined with silky hairs. In height these range from one foot to two feet. Secondly, we have the 'Globe' Tulips or 'Fairy Bells'; these differ from the 'Mariposa' Tulips in being of dwarfer stature and having smaller drooping flowers, which are globular and closed. The section is a small one. Thirdly, we have the 'Star' Tulips, also of dwarf growth, and bearing dainty little open cups on slender dwarf stems. In this section, also, there are only a few species, and the flowers are mostly covered with silky hairs. All the

Calochorti are hardy, and can be strongly recommended for choice spots in the flower-border and rock-garden. The 'Mariposa' and 'Star' Tulips should be planted on raised beds to insure perfect drainage, a light gritty or sandy soil being used, and the situation selected being a warm sunny one. Plant the bulbs from September to the end of November at a depth of two to three inches, and three inches apart. Cover lightly with straw or

FIG. 204.—GROUP OF CALOCHORTI.

cut heather during winter to keep off heavy rains and as a protection to early growth, but remove the coverings in March. Occasional soakings of water should be given when the plants are in full growth. The 'Globe' Tulips are by nature woodland plants and like partial shade and a good porous soil made up mostly of leaf-mould. The *Calochorti* make charming pot-plants (several bulbs in a pot), and can be easily grown in a cold greenhouse, frame, or Cape pit. It is difficult to make a selection of the many species and varieties, as they are all so beautiful, but to those who think of introducing these beautiful flowers into their garden I would recommend as a beginning the varieties of *C. venustus* as being the most robust growers and of easiest culture.

Allium.—In addition to the flowers already mentioned for the month of June, I must include the following as being of beauty and interest: *A. acuminatum, azureum, Moly, Ostrowskianum, Rosenbachianum,* and *triquetrum,* all easily grown in any good light soil and suitable for borders, rockwork, or to naturalise in woodlands.

Bloomeria aurea.—A fine showy Californian bulb, bearing umbels of golden-yellow flowers, height 15 inches, thriving in any good light soil.

Brodiæa.—Very decorative bulbous plants from California, flowering from June to July, and suitable for sunny nooks in the border or on rock-work in a light, well-drained soil. Unfortunately, one sees them too seldom in our gardens. Amongst the best are: *B. californica, coccinea, grandiflora, Hendersoni, Howellii lilacina, ixioides splendens, laxa,* and *Murrayana. Brodiæa grandiflora* is a lovely little dwarf blue flower for carpeting the ground in spring.

Gladioli.—The early section commences with the species *byzantinus,* flowering at the end of May, followed by *Colvillei,* and the hybrids of *ramosus, blandus,* and *trimaculatus,* which carry on a display into July. For grouping in borders, forming beds, or as pot-plants they are equally useful, while all of them are of the greatest value for cutting. *Byzantinus* and *Colvillei* are fine plants to naturalise in wild gardens &c. *Colvillei,* 'The Bride,' with its fine spikes of snowy white flowers, is, of course, well known; but of the *ramosus, blandus,* and *trimaculatus* hybrids I would mention the following as being of special merit: 'Ackerman,' *Cardinalis elegans,* 'Fire King,' 'General Scott,' 'Madame Cousin,' 'Peach Blossom,' 'Pink Perfection,' and 'Queen Wilhelmina.' As to culture, a genial situation protected from cutting winds should be given, and the soil should be light and friable. In preparing the ground, dig deeply and work plenty of old manure into the underspit. Plant the bulbs from October to January, four to five inches deep, and cover lightly with straw litter or other material until March.

Ixiolirion tataricum.—An elegant border plant, with umbels of rich dark blue tubular flowers; height 1½ ft.; thriving in a sunny situation and light, well-drained soil.

Hyacinthus amethystinus.—A pretty little alpine Hyacinth, with flowers of a beautiful amethystine blue; height nine inches. A charming plant for grouping in borders and on rockwork; there is also a white variety of it.

Lilium.—The principal Lilies flowering in June and of easy culture are *L. elegans, umbellatum, Brownii, candidum* (the 'Madonna' Lily), the old cottage-garden Orange Lily (*croceum*), and *testaceum.* For herbaceous borders these are all highly decorative; they should be planted in groups or clumps and allowed to remain undisturbed, as when established they bloom much better than the first season after planting. For the successful culture of Lilies generally, it should be borne in mind that the bulbs like a cool rooting medium, and a soil which is thoroughly well drained. These conditions can be easily arranged for in hardy herbaceous and shrubbery borders, where the surrounding vegetation protects the young and tender Lily growths from cold winds, and afterwards keeps the soil cool and shaded, thus inducing, in the case of some varieties, a free production of stem-roots. These stem-roots, when they appear, should be given a covering of good rich soil into which they can freely root, as upon them the development of the flower-head and the preservation of the bulb

Fig. 205.—Gladiolus Colvillei 'The Bride.'

largely depend. In cases where the scil is heavy and damp, add an abundance of sand and leaf-soil.

Watsonia Ardernei.—A remarkably beautiful Cape bulbous plant, producing, on stems 2–3 ft., numerous snowy white flowers of elegant form. A sunny warm situation and a good light soil, with plenty of moisture when in full growth, are its requirements. *Watsonia Ardernei* also makes a charming pot-plant.

July.

I now come to July, which on the whole is rather barren in bulbous flowers. Some of the *Lilium elegans* varieties and other species already mentioned are still in bloom in the early part of the month, also some of the early Gladioli. The following Lilies may also be noted: *L. chalcedonicum, longiflorum, Martagon album* and *dalmaticum, canadense,* and *pardalinum.* The last two delight in shady, damp situations, where the bulbs can find plenty of moisture below to root into. The margins of streams or brooks afford such conditions.

Camassia.—I would mention the Camassias or Quamashes, remarkably elegant hardy plants from California and North-West America. They readily establish themselves in the herbaceous border, requiring only a rich light soil and a fair amount of moisture when in full growth. The finest are *Cusickii, Leichtlinii, Leichtlinii alba,* and *Fraseri.*

Alstrœmeria.—Perhaps the most decorative and showy of border flowers for July are the Alstrœmerias or Peruvian Lilies. With the exception of *A. Pelegrina* and *pulchra* (syn. *tricolor*), they may be considered as hardy, providing a suitable situation is accorded to them. A well-drained and fairly light soil is necessary, and a warm sunny situation, such as at the foot of a south wall or hedge. The fleshy roots should be planted from October to November, the tops being four inches below the surface, and for the first winter a light covering of leaves or litter should be given; when established they will not require this. Should the garden soil be heavy it should be taken out two or three feet in selected spots and the necessary compost filled in after securing a good drainage. When in full growth the plants should be occasionally well watered, and a mulching of old manure may be advisable at the same time. By removing the seed-heads when they appear, the plants will be greatly benefited. Established masses of *Alstrœmeria aurantiaca, lutea,* and *chilensis* hybrids present a gorgeous blaze of colour, maintaining a show in the garden into August, and even sometimes September. For cutting, the *Alstrœmeria* is most valuable, as it lasts long in water and mixes well with other flowers.

August.

Gladioli.—The most important bulbous plants for the garden in August are *Gladioli,* Montbretias, Lilies, and Tigridias. Commencing with the old but still valued scarlet *Gladiolus brenchleyensis,* we have a successional display of flowers from the different sections right up to the middle of October. We owe much to Mons. Lemoine of Nancy for what he has done in hybridising the *Gladiolus,* the result being the beautiful varieties of *Lemoinei* and *nanceianus.* By crossing some of the best varieties of *gandavensis* with the species *purpureo-auratus,* he obtained a very distinct class of hybrids, now known as 'Butterfly' Gladioli (*G. Lemoinei* hybrids). By again crossing these with the species *Saundersii* the section called *nanceianus* resulted. Both classes are distinct and good, and form valuable acquisitions to our gardens. The 'Butterfly' Gladioli have all more or less the characteristic hooded flowers of the parent, *purpureo-auratus,* although of much larger size, and possess a wide range of colours and markings, the lower petals being very conspicuously blotched. The plants are of erect, sturdy, and robust habit, and form a pleasing feature in the garden. The *nanceianus* Gladioli have very large open flowers. produced on erect branching stems. Their range of colour is not so great as in the *Lemoinei* section, but the flowers are of

Fig. 206.—Butterfly Gladioli (G. Lemoinei Hybrids).

elegant outline and are charmingly blotched and marked on the lower petals. Moreover, they are very floriferous. There is another section of hybrids, raised by Herr Max Leichtlin, called *Childsii*, a cross between *Gladiolus Saundersii* and *gandavensis*. They somewhat resemble *G. nanceianus*, but have a more robust and taller habit with larger blooms. The colours, however, are not so refined, and there is a certain coarseness about the flowers which renders them less desirable than the other hybrids I have named. The *Gladiolus gandavensis* varieties are so well known as to need little description ; suffice it to say that their stately spikes of bloom make a pleasing effect in the hardy-flower border, associated with other plants, while they carry on a succession of bloom right into October.

A word as to the culture of the *Gladiolus*. A deep and well-drained soil with a sunny aspect is necessary. The soil should be prepared some time previous to putting in the bulbs by deep digging, and a liberal addition of well-decayed manure. The best time for planting is from the middle of March to the end of April, according to locality, although for securing a succession of bloom the bulbs may be put in up to the end

FIG. 207.—LILIUM AURATUM.

of May. The tops should be four inches below the surface, and it is advisable to surround the bulbs with charcoal or wood ashes. As soon as the plants require support they should be staked and at the same time mulched with well-decayed manure. During dry weather give the plants liberal waterings. If the above directions are carried out a successful growth should be the result. To obtain a fine effect *Gladioli* should be grown in clumps of five to twelve or even more, and be associated with Lilies, *Hyacinthus candicans*, Kniphofias, Dahlias, Cannas, Roses, Funkias, and other border plants. I would just mention that the *Gladiolus* makes a fine pot-plant and can easily be grown as such.

Lilium.—Of Lilies for this month *L. auratum* naturally claims our first notice as being indeed a queen among flowers and having no rival in the hardy border for its stately beauty. Moreover, it is one of the most reliable Lilies for blooming the first season. Grouped in shrubbery borders among Rhododendrons or between herbaceous plants, it produces a grand effect in August and September. Large clumps isolated on lawns show to great advantage. As this Lily makes an abundance of stem-roots, my previous remarks on this subject especially apply. The variety *platyphyllum* is very handsome with its large flowers and bold foliage. *Rubro-vittatum* and *Wittei*, although not such robust growers, have flowers of remarkable beauty. Besides *L. auratum*, the Tiger Lily (*L. tigrinum*) and its varieties open their blossoms in this month and are fine showy border plants of easy culture. *Lilium Batemanni* is also very striking, with handsome apricot-red flowers.

Montbretia.—Among decorative flowers for August, the *Montbretia* is conspicuous. Early in the month its graceful spikes of bloom attract attention on account of their brilliant colouring, which ranges from gold to orange and glowing vermilion. For cutting, the flower-spikes are of great value, as they last long in water, mix well with most kinds of foliage, and have a graceful habit. The *Montbretia* may be grown in any ordinary soil, enriched with manure, but it prefers a sunny situation. Plant the bulbs any time from November to March, covering the early plantings lightly with litter. Grown in pots they form a very effective decoration in the greenhouse. I can recommend the following varieties as being among the best: *Crocosmæflora, aurea,* Bouquet, Parfait, Étoile de Feu, Pluie d'Or, Talisman, and Transcendant. A newly introduced hybrid between *Montbretia crocosmæflora* and *Crocosmia imperialis*, called 'Germania,' is of striking beauty and has a great future before it as a decorative garden plant and for cutting. It grows 3½ feet high, and has remarkably large expanded flowers of a brilliant orange-red with a deep red centre.

Tigridia.—The *Tigridia Pavonia*, or Tiger-spotted Flower, is one of the gems of this month, and it is a pity that this plant is not more frequently met with in gardens. Perhaps it is from the fact that an individual bloom lasts only one day. Nevertheless, it is succeeded daily by another bloom from the same stem and this succession of flowers goes on for nearly two months, rendering the *Tigridia* decorative from the latter part of July to September. The flowers are large, of quaint triangular form, with a gorgeously spotted central cup, and are of great beauty. The showiest variety is *grandiflora rubra*, an improved form of the old *Tigridia Pavonia*; the petals are rich scarlet, while the cup is conspicuously spotted crimson on a yellow ground, producing a most brilliant effect. *Grandiflora alba* has flowers of chaste beauty, white with ruby-spotted cup. *Grandiflora* 'Ruby Queen' has soft ruby-rose-coloured flowers, while *conchiflora* forms a good contrast to the others, with flowers yellow spotted scarlet. The *Tigridia* is of easy culture; the bulbs should be planted in March and April in a well-drained, moderately good soil, with sunny aspect. When the foliage turns yellow after flowering, and before frost sets in, lift the bulbs, dry in a cool airy place, and store them in dry earth or peat, away from frost, until the following spring. In mild localities the bulbs may be left in the ground a year or two, providing a light winter covering be given.

Agapanthus.—Before leaving the month of August, I should like to mention two fine Amaryllids, namely, *Agapanthus* and *Crinum.* Although the family is not quite hardy, the old blue African Lily (*Agapanthus umbellatus*) may be established out of doors in the warmer parts of England, and in all cases it is a valuable plant to establish in pots, vases, or tubs &c., for decoration in the garden during late summer and autumn. On verandahs, terrace walks, and lawns its grand umbels of blue form one of the most beautiful features of a garden.

Crinum.—Crinum longifolium (syn. *capense*) and *C. Powellii* are hardy on warm sunny borders, planted with the top of the bulbs six to eight inches below the surface. Both are noble plants, decorative during August and September, *longifolium* producing, on stout stems two to three feet high, long funnel-shaped, sweet-scented flowers, either white or pale rose, while *Powellii* has very beautiful large rose-coloured flowers and grows about the same height. *Powellii album* is a magnificent plant with pure white flowers.

September.

Lilium.—Coming to September, we have an addition to the Lily family in the form of *L. speciosum* (syn. *lancifolium*), one of the most beautiful of our garden Lilies. Having an elegant branching habit and bearing for a long period large handsome flowers, it makes a grand border plant and is of great value for filling large beds or intermingling with shrubs. Being a late bloomer, it is as well to give this Lily a fairly warm, sheltered spot in the garden, so that all its late-formed buds may develop and open. As in the case of *L. auratum*, it makes stem-roots, so that these should have a little attention.

Amaryllis.—A handsome bulbous plant flowering in this month is the *Amaryllis Belladonna* with its umbels of white and rose flowers. It requires, however, to be established at the foot of a south wall before flowering freely. The variety *purpurea maxima* is a great improvement on the type, bearing more flowers of richer colour and blooming earlier.

Nerine.—Belonging to the same natural order, we have *Nerine*, the best known and hardiest being the Guernsey Lily (*Nerine sarniensis*). To succeed with this, it must be given a warm sunny spot such as at the foot of a south wall, where in summer the bulbs can get a good roasting, and during winter a covering must be given to protect the foliage it throws up after flowering. When established, its umbels of brilliant crimson-scarlet flowers are wonderfully effective. Other species of *Nerine* are very beautiful, but are more suitable for indoor culture.

Vallota.—Vallota purpurea, the Scarborough Lily, is another grand Amaryllid which, although generally seen only in pots, may nevertheless be established out of doors in mild districts at the foot of a south wall, if protected against frost during winter.

Crocosmia.—One of the brightest touches of colour in the garden during September is contributed by *Crocosmia aurea*, with its graceful racemes of showy orange-coloured flowers borne on stems three feet high. It can be recommended for sunny spots in the flower border, where it can remain undisturbed for a year or two, a covering of litter being given during winter The bulbs, if lifted in autumn, should be stored in peat away from frost until spring, when they may be planted in April or be potted up earlier and planted out in May.

Colchicum.—Taking the smaller bulbous subjects flowering in autumn and all of interest and charm, I would mention the *Colchicum* or Meadow Saffron which carpets the ground with its large Crocus-like flowers from September to November, and ranges in colour from rosy-lilac to crimson and pure white. The foliage, which does not appear until spring, is very bold and characteristic. The *Colchicum* is specially adapted to naturalising in grass or on rockwork, and established colonies give a very pretty effect. They should always have a groundwork of grass or such carpeting plants as dwarf Sedums, Mossy Saxifrages, *Arenaria cæspitosa*, *Herniaria glabra*, or *Thymus Serpyllum*, &c., which will keep the flowers from becoming soiled and spoilt by autumn rains. Any ordinary good well-drained soil will suit them, and if the bulbs are planted in August they will produce a mass of bloom a few weeks afterwards. For a good selection of Meadow Saffrons I recommend *C. autumnale album*, and its rare and beautiful double form; also *autumnale plenum*, *autumnale roseum*, *byzantinum*, *giganteum*, *Sibthorpii*, *Parkinsoni*, *speciosum*, and *variegatum*. *Giganteum* and *Sibthorpii* have immense flowers, *Parkinsoni* is beautifuly checkered, while *speciosum* is the most brilliantly coloured of all.

Crocus.—The autumn-flowering species are all little gems, and I know of no more delightful picture than colonies of these dainty flowers nestling in grassy nooks or established on rockwork, especially when rising from a carpet of dwarf Sedums (Stonecrop), or such plants as I have recommended for Colchicums. The culture is simple, as they thrive in any ordinary garden soil, but the bulbs should be planted shallow, and positions given them where their little flowers are not likely to be spoilt by heavy autumn rains. There are a good many autumn-flowering *Crocus* species, but in starting a collection I would recommend amateurs to begin with the following: *C. speciosus*, *zonatus*, *pulchellus*, *sativus*, *asturicus*, *medius*, *longiflorus*, *iridiflorus*, and *hadriaticus chrysobelonicus*, all of delicate and refined beauty. I am quite sure that those who once introduce these gems into their garden will not be satisfied until they have made their collection more complete and added those charming little species which bloom in winter and early spring. I would just add that the bulbs of autumn-flowering *Crocus* species should be planted in July and August to bloom the same season.

Cyclamen.—Among the various hardy species, one of the most beautiful is the autumn-flowering *Cyclamen neapolitanum*, the great feature of which is its large, handsome, silver-marked, ivy-shaped leaves, which remain decorative throughout winter and spring, and make a charming groundwork for little early spring flowers like *Scilla*, *Chionodoxa*, Snowdrops, Miniature Daffodils, &c. This bulb likes perfect drainage, and a little mortar rubbish mixed in the soil, while the situation selected should be protected from cutting winds or hot summer sun. When established it produces, from the end of August to October, hundreds of rosy-pink flowers.

Zephyranthes candida.—Popularly known as the Peruvian Swamp Lily, or Flower of the West Wind; this is a lovely little autumn flower which, however, is not often seen blooming in gardens, no doubt on account of a suitable spot not being selected for it. Its requirements are a rich light soil and a warm sunny situation, such as at the foot of a south wall, fully exposed to the sun, or a similar position on rock-work, where it should remain undisturbed. When established, its large white Crocus-like flowers, expanding in the sunshine, are very attractive.

Sternbergia lutea.—Commonly known as the Lily of the Field, *Sternbergia* is a valuable little bulbous plant on account of its brilliant yellow Crocus-like flowers being produced in October, when gardens are beginning to lose their colour. Complaints are often made of this bulb flowering shyly, but the reason no doubt is want of sufficient sun. It seems to like a deep and fairly rich soil, mixed with a little mortar

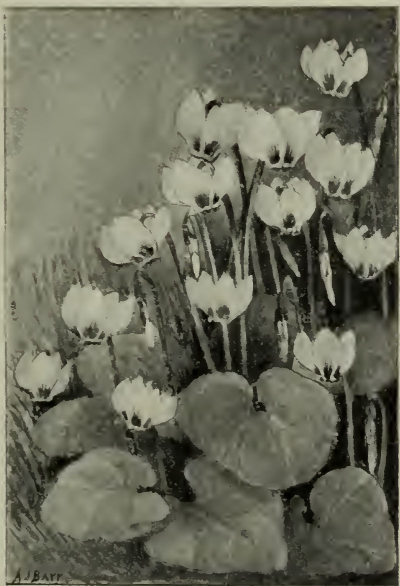


Fig. 208.—Cyclamen coum album established.

rubbish, and a sheltered position where it can obtain all possible sun. The bulbs should be planted four to six inches deep. A carpeting of Stone-crop or other surface-rooting little plants will afford a protection to the bulbs in winter and show the flowers off to advantage.

Leucojum autumnale.—The Autumn Snowflake, sometimes called *Acis autumnalis*, is a graceful little subject to naturalise on rockwork in moist sandy soil. It bears small white flowers with delicate pink markings.

Scilla autumnalis.—This and its variety *japonica* bloom in August and September, and are pretty little objects when seen established on rockwork or massed in front of borders. The type has elegant little heads of purplish-blue flowers, while the blooms of *japonica* are of a pretty bright rose.

SIR WILLIAM JACKSON HOOKER.

A Biographical Abstract compiled by R. Irwin Lynch from a Life-Sketch sent to the "Annals of Botany" by his Son, Sir Joseph Dalton Hooker, F.R.S., V.M.H., G.C.S.I., C.B., &c.

There is a strikingly interesting biographical sketch in vol. xvi. of the "Annals of Botany" dealing with the life of a very eminent man of great individuality, whose history is one with that of the progress of botany in the most important period of the last century, to whose force of character, indeed, we owe an entirely new development which gave to this country a pre-eminence which it still enjoys—very largely increased and augmented by the author himself. The names of men who did good work can easily be recalled, but the modern developments of systematic and economic botany were to centre at Kew, and Sir William Hooker it was who laid the foundations and earlier courses of the present world-famed edifice. He founded the Herbarium, the Library, the Museums, and the Gardens, practically as they are to-day. The three chapters of this sketch cover three periods: Norwich and Halesworth, 1785–1820; Glasgow, 1820–1840; West Park and Kew, 1841–1865; and after them are extensive appendices, to be enumerated at the end of these abstracts. The following selection must be taken as omitting as much or more of equal interest.

I. Norwich and Halesworth, 1785–1820.

"William Jackson Hooker was born in St. Saviour's parish, Norwich, on July 6, 1785. He was the younger of two sons, the only children of Joseph and Lydia Hooker, of that city. His father was a native of Exeter, the home of many generations of the Devonshire Hookers, where he had been a confidential clerk in the house of Baring Brothers, wool-staplers, with whose family his was distantly connected. From Exeter he went to Norwich, and into business there, where he had a collection of 'Succulents,' the cultivation of which class of plants was a favourite pursuit of many of his fellow-citizens. He was mainly a self-educated man, and a fair German scholar. My father's mother was a daughter of James Vincent, Esq., of Norwich, a worsted manufacturer, grandfather of George Vincent, one of the best of the Norwich School of artists, and whose works are now much sought for. Thus my father presumably derived his love of plants from his father's side, and his artistic powers from his mother's. . . . When only four years old he inherited the reversion to a fair competency in landed and personal property in Kent, through the death of his cousin and godfather, William Jackson, Esq., of Canterbury, a young man of great promise. After leaving school he was sent to reside with a Mr. Paul, of Starston (a village on the borders of Suffolk), a gentleman farmer, who instructed sons of the landed gentry in the management of estates. Early in life he devoted himself to ornithology, visiting the Broads and sea-coasts of Norfolk, which abounded in rare birds, shooting, stuffing, and drawing them, besides learning their habits and songs. Sixty years later he knew the birds in Kew Gardens by the eye and the ear, and in a manner which surprised me. Though a keen ornithologist and as keen an entomologist, he was almost morbidly averse from taking life ; he never shot for sport or for the pot ; and many years afterwards, when instructing me in entomology, he was ever urging me to kill with the least suffering, and never to take more specimens than were necessary. His was one of those temperaments that later in life could not look on blood without a feeling of faintness, or on a wax model of the human face with equanimity."

Sir William was born a student of natural history, and botany may not have been his first love. We read : "That his entomological pursuits were, when still in his teens, appreciated by the veteran Kirby is evidenced by the latter having in 1805 dedicated to him and his brother a species of *Apion* with these words : 'I am indebted to an excellent naturalist, Mr. W. J. Hooker, of Norwich, who first discovered it, for this species. Many other nondescripts have been taken by him and his brother, Mr. J. Hooker, and I name this insect after them, as a memorial of my sense of their ability and exertions in the service of my favourite department of natural history.'

"I do not know the age at which my father took up botany. The first evidence of his having done so is the fact that he was the discoverer in Britain in 1805 of a very curious moss, *Buxbaumia aphylla* ; but it may be inferred from this and from his correspondence with Mr. Turner (which I possess) that he had at the age of twenty-one thoroughly studied not only the flowering plants but the mosses, Hepaticae, lichens, and freshwater Algae of Norfolk. The *Buxbaumia* he took to his friend, Dr. (afterwards Sir James) Smith, of Norwich, the possessor of the Linnean herbarium, who advised him to send specimens to Mr. Dawson Turner F.R.S., of Great Yarmouth, author of 'Muscologiae Hibernicae Spicilegium,' and, with L. W. Dillwyn, F.L.S., of 'The Botanist's Guide through England and Wales.' This he did, and it was immediately followed by an invitation from Mr. Turner to visit him, which led to the colouring of his future life.

"In 1806, when only four months over his majority, my father was elected a Fellow of the Linnean Society, probably the youngest individual so honoured. In the same year he visited London, and was introduced to Sir Joseph Banks, Konig, Brown, and other naturalists. The years 1806–9 were passed between Norwich, Yarmouth, and London, with intervals of travelling in Scotland and Iceland. . . . In 1807, when botanising in the neighbourhood of Yarmouth, he was bitten by a viper. Fancying he had been pricked by a thorn he paid no heed to the pain, till giddiness came on, under which he succumbed. After lying for some time in a state of collapse he was accidentally found by some friends who carried him to Mr. Turner's, where violent fever supervened, followed by a tedious illness. On recovery he started with Mr. and Mrs. Turner on a botanical tour in Scotland. . . . In 1808 my father undertook a much longer journey in Scotland, accompanied by his friend Mr. Borrer. On this occasion he reascended Ben Lawers, Ben Lomond, Ben Cruachan, and Ben Nevis, and for the first time Schichallion, Ben Hope, and Ben Loyal. After visiting Mr. Brodie of Brodie, they went to Caithness and the Orkneys, returning to Sutherland. In a letter to Mr. Turner he thus describes their reception in Sutherland: 'We did not leave North Sutherland with the good wishes of the inhabitants, at least the lower classes of them, most of whom took us for French spies, or, what is worse in their estimation, sheep-farmers. Daniel Forbes, who so often acted as our guide, was advised by some to conduct us by the worst way possible; by others he was told that he might be better employed. Our lad heard some saying that we ought to be flogged and sent out of the country. They have not the least idea of persons travelling for mere curiosity, and could not be persuaded that we were not come to do them some ill. . . .' The journey through the north of Scotland was performed mainly on horses or ponies, and the difficulties met with were such as can now be experienced only in the out-of-the-way parts of the globe. . . . In 1809 Sir Joseph Banks, hearing of an opportunity for a naturalist visiting Iceland, where he himself had been in 1772, suggested my father's taking advantage of it. This he did, and all the more eagerly from having as a boy read Van Troil's 'Letters on Iceland,' with a longing to visit the hot-springs and volcanoes therein described. The opportunity was the despatch of a vessel, the *Margaret and Anne*, with a letter of marque, chartered by a London firm, Messrs. Phelps & Co., for the purpose of obtaining a cargo of tallow. The venture was a risky one, for Denmark, to which country Iceland belonged, was at war with England; and the firm were enticed to undertake it by a Danish prisoner of war, Jorgen Jorgensen by name, who was now for the second time about to break his parole and accompany the ship in the interest of the firm. The *Margaret and Anne* sailed June 2, and on arriving June 21 at Reikevik, Jorgensen, finding that commerce with England was prohibited, effected a revolution in the island, proclaimed its independence of the Danish crown and himself its 'Protector,' imprisoned the Governor, Count Tramp, erected a fort armed with six guns, equipped troops, remodelled the laws, established representative government and trial by jury, reduced the taxes, and raised the salaries of the clergy; all without shedding a drop of blood or an attempt at resistance on the part of the people!" We here omit an account of Sir William's reception, and, with regret, the relation of exciting events connected with his return. His ship, the *Margaret and Anne*, was set on fire by Danish prisoners of war who were on board. "Unfortunately the fire broke out on a part of the ship where his collections were stored, and he lost everything but a few weeks of his journal, the clothes he stood in, and an Icelandic lady's wedding dress which the ship's steward flung into the boat as she shoved off from the burning wreck.

"Soon after his return, and yielding to the wishes of his friends, he commenced writing his 'Journal of a Tour in Iceland.' On hearing of this Sir Joseph Banks most liberally offered him the use of his own manuscript journal and various other papers relating to the island, together with the magnificent drawings of the scenery, dresses of the inhabitants, &c., which were made by the artist who accompanied him in his voyage thither in 1772. With these materials, his own journal of four weeks out of the twelve which he passed in the island, and a retentive memory refreshed by a reference to all available works and all documents relating to the revolution, he compiled and printed, for *private distribution only*, in 1811, an octavo volume of upwards of 400 pages and four plates. Sir Joseph Banks was so pleased with it that he induced my father to reproduce it for publication. The second edition with additions in two volumes, with two maps and four plates, dedicated to Sir Joseph, appeared in 1813, and is to this day a standard work. . . .

"The years immediately following my father's return from Iceland (1809–12) were the most embarrassing of his life. His unquenchable longing to travel in the tropics was kept alive by Banks's earnest endeavours to find him a fitting opportunity. On the other hand, his botanical friends were unanimous in urging him to remain at home, publish his Icelandic and Scottish journals, continue his aid to Mr. Turner on the 'Historia Fucorum,' and above all proceed with his 'British Jungermanniae,' his drawings and analyses of which were of unrivalled beauty, and his contemplated 'Muscologia Britannica.'"

We next read that Sir William became partner with Mr. Paget (father of the late Sir James Paget) and Mr. Turner in a brewery at Halesworth, but, omitting some detail, may pass on to say that this did not check either his botanical ardour or desire to visit the tropics. "In 1810 he sold his landed property and determined to accept an invitation which Sir Joseph had procured for him, of accompanying Sir Robert Brownrigg, G.C.B., the newly appointed Governor of Ceylon, to that island. . . . To his bitter disappointment this opportunity had to be put aside, for disturbances, followed by a rebellion, had broken out in Ceylon that would have rendered travelling in the island impossible." Disappointment still followed, a contemplated visit to Java having had to be put aside. "My father was hence compelled to confine his wanderings to nearer home, adding gardening to his pursuits, and this with some success, for he was the first to flower *Cattleya labiata* in his little stove in 1818, and he also flowered *Musa coccinea* and other tropical plants.

"In 1813, owing to the illness of his only brother, my father spent five months with him in Devonshire and Cornwall, which counties he diligently explored for Musci, Hepaticae, and lichens especially. The Trinity House yacht having been placed at his disposal, he visited the Scilly Islands, whence he writes to Mr. Turner: 'The first thing that caught my attention was the situation of the little town of St. Mary's, which so much resembled that of Reikevik that I could hardly help fancying for some time that I was in Iceland. . . .' Early in 1814 my father accompanied Mr. and Mrs. Turner and family on a visit to Paris, then in the occupation of the Allies. There, at the Institute, he made the acquaintance of the principal botanists resident in or on visits to the city —Antoine-Laurent de Jussieu, Desfontaines, Lamarck, Mirbel, Bory de St. Vincent, Thouin, and others. Leaving the party in Paris, he spent the remainder of the year botanising and seeing botanists, sketching and sight-seeing in the south of France, spending some days with De Candolle at Montpellier and in Piedmont, Switzerland, and Lombardy. Returning to Paris early in 1815, he was introduced to Humboldt, who engaged him to publish a cryptogamic volume of his 'Plantae Equinoctiales.' This intention had to be abandoned owing to the publisher's refusal to continue that work. After much subsequent correspondence with Humboldt, that led to nothing, my father commenced the publication on his own account and produced in 1816 the first part of a work entitled 'Plantae Cryptogamicae, quae in plaga orbis novi Aequinoctialis colligerunt Alex. von Humboldt et Aimat Bonpland.' It is a very thin quarto, with four plates of species drawn by the author and exquisitely etched by Edwards. The expense was great and the return nil; the work was therefore abandoned, and of the remaining Musci and Hepaticae many were included in the author's less expensive 'Musci Exotici.'

"On June 12, 1815, my father married Maria Sarah, eldest daughter of Dawson Turner, and immediately started on a long wedding tour to the Lake District and to Ireland, which latter country the pair traversed in almost every direction, making sketches of scenery and ancient buildings; thence they went to Scotland on a visit to Mr. Lyell at Kinnordy in Forfarshire, with whom a close intimacy and correspondence on Hepaticae had long existed. Returning they passed through Manchester for the purpose of seeing Mr. Hobson, a packer in a warehouse, who with only the works of Withering, Hudson, and the 'Muscologia Hibernica,' had acquired a critical knowledge of British Mosses that surprised his visitor, who says of him: 'I never saw a man possessed of more enthusiasm than this poor fellow.'

"As alluded to by M. De Candolle [in a letter here omitted], Lindley, then a youth of eighteen, was at the same time as himself a guest of my father. He was the son of a well-known nurseryman of Catton, near Norwich, and had shown such zeal and ability as a local botanist that with a view of encouraging him in its pursuit he was invited to Halesworth, and to occupy himself there with translating Richard's 'Analyse des Fruits.' This he did, introducing the author's latest corrections, and illustrating his translation with plates and original observations. In the following year my father took Lindley to Sir Joseph Banks, who offered him temporary employment in his herbarium, and introduced him to Mr. Cattley, a wealthy merchant devoted to horticulture, who was desirous of having his rare plants handsomely illustrated; and this again led eventually to the assistant secretaryship of the Horticultural Society of London, which Lindley occupied till 1858. . . .

"The 'British Jungermanniae,' the most beautiful of all my father's works, in point of the drawing, analyses, and engraving of the plates, was concluded in 1816. It had occupied him for about ten years, and was the first work of any magnitude which he projected. It appeared in parts, in both a quarto and a folio form, with eighty-eight plates engraved by Edwards, illustrating 197 species. . . .

"1817 is one of the very few years of his life in which he published scarcely anything. The exception was an account of the very remarkable European moss named after his friend, *Tayloria splachnoides*, in 'Brand's Journal of Science and Art,' No. 111, p. 144, and 'Musci Exotici,' tab. 173. Of a visit to London in August of this year he writes: 'I met at Spring Grove (Sir Joseph Banks's) Abel, Brown, Leach, and a Mr. Manning of Diss, who passed many years among the Chinese endeavouring to get access to the interior, though he failed;

though he tells me he saw much of Thibet.' Mr. Manning is, to this day, the only Englishman who ever entered the sacred city of Lhassa. What is more remarkable is that his journal was lost to geographers till Sir Clements Markham happily found it in the possession of a cousin of his own in Norfolk. See 'Narratives of the Mission of G. Bogle to Thibet and of the Journey of T. Manning to Lhassa,' ed. 2, 1879, by Sir C. Markham, a book full of curious information.

"My father's Halesworth life was now drawing to a close. The brewery business, as might have been expected under the management of an enthusiastic naturalist and author, had proved unsatisfactory, and some of his investments were disappointing. Personally his *ménage* was entirely inexpensive and simple, and this was so throughout his life; but his lavish expenditure on his own unremunerative publications, and on the purchase and beautiful binding of expensive entomological, ornithological, and especially botanical and even archæological and artistic works, had crippled his resources, and he had now a wife and family of four to provide for. Under these circumstances he wrote to his friend Sir Joseph Banks requesting that he might be informed should he hear of any opportunity of applying his botanical knowledge to the improvement of his income. Sir Joseph promptly answered that the Professorship of Botany was vacant in the University of Glasgow, and that he was ready to use his influence to obtain it for him should he desire to become a candidate. My father answered favourably, and at once left for Spring Grove, where he was hospitably received by Sir Joseph, who told him that the emoluments of the chair, though small, would certainly increase; that it was freed from all medical duties; that a really noble botanical garden had been formed at Glasgow, to which the University had given £2,000 and the City £3,000, and towards the development of which he could assure him that Kew would place all its resources."

II. Glasgow, 1820-1840.

"Early in February, 1820, my father was appointed by the Crown to the Chair of Botany in Glasgow, and having despatched his library, herbarium, and household effects to London, to be thence sent by smack to Leith, and on to Glasgow by canal, he severed his connection with Halesworth and the brewery. In May he presented himself before the Senate of the University, who gave him a flattering reception, read his inaugural thesis (the Latinity of which, thanks to his classical father-in-law, was highly praised), and was duly installed, with the welcome addition of having the honour of LL.D. conferred upon him.

. . . .

"Before enlarging on my father's success as a lecturer, I may premise that the teaching of botany in the first quarter of the last century was very different from that which now prevails. It was regarded as ancillary to that of Materia Medica, and as a means of enabling the practitioner to recognise the plants used in medicine when there might be no druggist to appeal to. Furthermore, it was required by the principal examining bodies for medical degrees or licences that the candidate should have attended a course of lectures delivered in a botanical garden registered for the purpose; and in these gardens the plants were invariably arranged according to the Linnean system, which consequently had to be taught. . . . Throughout the course my father's artistic powers were exercised with chalk and the blackboard; and he gradually accumulated a magnificent series of folio coloured drawings, especially of medicinal plants, which were suspended in the class-room as occasion required. I well remember the murmur, and even louder expressions of applause, with which he was greeted on taking the chair, when the number or interest of these pictures was conspicuous. Before his second year's class had assembled he had published the 'Flora Scotica' for its use, and an oblong folio of lithographed illustrations of the organs of plants by his own pencil, with twenty-four plates and 327 figures, a copy of which was placed before every two students. During the course three botanising excursions were taken, two in the neighbourhood of Glasgow, and one towards the end of June, of five or six days' duration, to the Western Highlands, usually to the Breadalbane range. This latter was eagerly anticipated by a contingent of ten to thirty students, amongst whom were frequent accessions of botanists from Edinburgh and England. Further to stimulate their zeal, he habitually invited the more industrious students to breakfast with him after the class (which was from 8 to 9 A.M.), when he would show them books, and give them, from his store of duplicates, specimens of rare British plants. To conclude this episode of his life, it must be recorded that his success as a lecturer was phenomenal; his tall figure, commanding presence, flexible features, good voice, eloquent delivery, and urbane manners are vouched for in every obituary notice of him. His lectures were often attended by gentlemen of the city, and even by officers from the barracks three miles distant. The students of his first year's course presented him with a handsome silver vasculum, chased with a design taken from the moss *Hookeria lucens*, and those of the second year with a richly bound copy in ten volumes of Scott's Poetical Works. . . . Except for short visits to London, Yarmouth, or the Highlands, botanising with Greville or Arnott, and once to Paris, he rarely left home. He was at his desk with pen or pencil by 8 A.M., and never left it much before midnight. The late summer and autumn weeks were frequently passed with his family at watering-places on the Clyde, usually at Helensburgh, where he enjoyed the society of two neighbours of scientific tastes and culture, James Smith, Esq., F.R.S., of Jordan Hill, and Lord John Campbell, afterwards Duke of Argyll, father of the late Duke, who inherited his parent's scientific tastes. In 1837 he purchased a cottage with an acre of ground, 'Invereck,' near Kilmun, on the Holy Loch; a lovely spot where he could indulge his fondness for gardening. In the touring season he received many English and foreign friends who took Glasgow on their route for the Highlands, both to visit him and to avail themselves of his experience of roads, conveyances, and accommodation.

"My father's reputation as one of the foremost botanists in this country was confirmed by his success in the Glasgow Chair, and rapidly rose as his successive publications appeared. Very soon he had but one compeer in Great Britain, Dr. Lindley, for Robert Brown towered above both as 'Botanicorum facile princeps.' It was a happy augury for the progress of the science which both worshipped with single-minded zeal, that Lindley and my father were regarded as meriting equal recognition as scientific botanists and indefatigable labourers throughout forty-five years of their active lives, and that they should have been fast friends till death, within three months of one another."

Referred to from the last sentence is the following interesting footnote, drawing attention as it does to the contemporary career of Lindley, whose name must be of great interest to the Society. "The following admirable summary of the life-works of my father and Lindley respectively is extracted from the Proceedings of the American Academy of Arts and Sciences, May 29, 1866: 'The names of Hooker and Lindley, which stood side by side in our botanical section, are naturally associated as those of the two most eminent botanists in Great Britain; also by the parallel course and near coincidence in the close of their lives. Born in the same neighbourhood, in youth receiving their education at the same school, and early drawn together by similar predilections, they both devoted themselves with singular energy and perseverance to their chosen pursuit; exerted for many years, although in somewhat different ways, a paramount influence upon the advancement of botanical science; and died near together in place and time—the elder at Kew, on August 13 last, at the age of eighty years; the younger at Turnham Green, on the first of the ensuing November, at the age of sixty-seven years. For a long time they were the two most distinguished teachers in Great Britain, one at a northern, and the other at the Metropolitan University. They severally conducted two of the principal serial works by which botany contributes to floriculture; and they developed into highest usefulness the two great establishments, the Royal Gardens at Kew and the Horticultural Society of London. Both wrote and published largely—Hooker only upon descriptive botany, in which he greatly excelled, while Lindley traversed a wider field, and grappled with abstruser problems in every department of the science, always with confidence and facility, but not with unvarying success.'"

While Lindley is before us it may not be uninteresting to take another footnote given in the first chapter. He, having shown great zeal and ability as a local botanist, was invited to Halesworth with the view of encouraging him, and that he might there occupy himself in the translation of Richard's "Analyse des Fruits." He had been looking forward to employment as a botanical collector abroad, and this is the amusing incident: "The housekeeper at Halesworth finding that his bed was never occupied, after a vain search for a reason, reported the fact. His distressed host had to ask for an explanation, which was simply that his guest was inuring himself to the hardships of a collector's calling by sleeping on hard boards!"

We now return to the narrative. "As his own reputation advanced, so did that of his herbarium and library, which, before he had been ten years in Glasgow, were reckoned as amongst the richest private ones in Europe. This was due to his active correspondence, judicious purchases, the contributions of his former pupils, especially from abroad, to his methodical habits, and to the welcome he gave to all botanists who desired to consult his collections. For the operation of mounting specimens, &c., he employed aids, of whom I remember two; the first, in about 1827, I think, was a native of Dundee, a keen algologist, James Chalmers by name, who prepared fasciculi of named Algæ, in quarto form, in the disposal of which my father aided him. The other was Dr. J. Klotzsch, who spent some years as the Curator of the Herbarium. Klotzsch was an excellent fellow, a devoted mycologist, and whilst at Glasgow would study no other branch of botany than fungi. . . . Returning to Berlin, he took up the study of flowering plants, acquired distinction as a botanist, and became eventually Keeper of the Royal Herbarium, Berlin. The only other aids my father had in Glasgow were my mother, as amanuensis, and myself; for, having been attracted to botany from my childhood, much of my spare school and college time was devoted to the herbarium.

. . . .

"Very soon after the settlement of the herbarium and library in Glasgow botanists from all parts of Europe flocked to it, amongst whom the following eight made the most frequent and longest sojourns, some of them becoming collaborators with the owner: R. K. Greville, G. Bentham, Sir J. Richardson, G. A. Walker-Arnott, W. Wilson, the Rev. M. J. Berkeley, H. C. Watson, and W. H. Harvey. Mr. Bentham's first visit was in 1823, from which occasion he dated his permanent adhesion to botany as an occupation for life. The next (in 1823) was Dr. (afterwards Sir John) Richardson, R.N., the companion of Franklin in his Arctic expeditions, through whom my father was made known to the Lords of the Admiralty, the Directors of the Hudson's Bay Company, and the chiefs of the Colonial Office, thus becoming the recipient of many herbaria made by the officers of these departments, and the author of works published under their authority. It further led to his being asked to recommend young medical men, fond of natural history, from amongst his pupils especially, to embark in their service abroad."

. . . .

Numerous interesting associations and important acquaintances made in Scotland must be omitted, but let us take the following paragraph: "In 1828 my father first became acquainted with the Rev. M. J. Berkeley, of King's Cliffe, Northamptonshire, the mycologist, who was then, I believe, on his way to visit Captain Carmichael in Appin. This led to a very intimate friendship and repeated visits to West Park and Kew. Mr. Berkeley took the same interest in the Fungi of the herbarium as Mr. Wilson did in the Musci, and but for him this order of plants would never have attained its present pre-eminence; for his zeal induced my father to urge his correspondents in all parts of the world to collect fungi; with what success is shown by the richness of his herbarium, and the numerous papers on exotic genera and species of the order published by Mr. Berkeley in the botanical journals, in the 'Transactions of the Linnean Society,' and many other works. Mr. Berkeley also contributed the volume on Fungi to the third edition of Hooker's 'British Flora' (vol. v., p. 11, of Smith's 'English Flora'), and, dying in 1889, he bequeathed his herbarium to Kew, together with the choice of his botanical library.

"In 1830 Mr. Hewett Cottrell Watson, the most accomplished of

British botanists, then resident in Edinburgh, requested permission to accompany the students of the botanical courses on an excursion to the Breadalbane Mountains, for the purpose of ascertaining the altitudes affected by their plants. Thus commenced a very active and interesting correspondence between my father and this acute botanist, which led to the publication of many papers in the journals conducted by the former, to the botanical expedition of the latter to the Azores, and indirectly to his valuable account of the flora of that interesting archipelago in Godman's 'Natural History of the Azores' (London, 1870). In 1831 Mr. W. H. Harvey, of Limerick (afterwards Professor of Botany in the Royal Dublin Society, and Keeper of the Herbarium, and eventually Professor of Botany in Trinity College, Dublin), introduced himself by letter, with specimens from two new localities of a West Indian moss (*Hookeria laete-virens*), found nowhere in the eastern hemisphere but the south and west of Ireland. It was answered by an invitation to Glasgow, which resulted in an intimacy that amounted to his being regarded as a member of the family.

. . . .

"I must not close this brief notice of my father's activity in encouraging others without an allusion to the solicitude with which he fostered my own aspirations to become a traveller and botanist; the interest he took in my ambitious projects; the energy with which he aided me in overcoming every obstacle thrown in my way, and prevailed on the higher powers to grant me facilities and the necessary funds; and last, but not least, the liberality with which he helped me whenever other resources were exhausted. In this connection I refer especially to four crises in my scientific career: my appointment to accompany Sir James Ross in the Antarctic Expedition in 1839 (for which he supplied all my scientific outfit); my (unsuccessful) candidature for the Professorship of Botany in Edinburgh University in 1845; my mission to India in 1847; and my appointment as Assistant Director of Kew in 1855. Add to these benefits the legacy of his herbarium and library, and the truth of the saying 'One soweth, another reapeth,' forcibly applies.

"The works published by my father when in Glasgow are very numerous. A complete list of them, with details regarding the more important, will be given at the end of the sketch. They may be grouped under four headings: British Botany, American Botany, Miscellaneous Works, and Serials.

"In the British Botany there was the 'Flora Scotica,' the new edition of Curtis's 'Flora Londinensis,' four editions of the 'British Flora,' and many contributions to a knowledge of British plants in the volumes of his botanical journals." Numerous other works under the classificatory headings mentioned above are then enumerated.

. . . .

"In the same year (1827), finding that his extensive correspondence with botanists and travellers abroad provided him with information of great value that might otherwise never see the light, and that his herbarium was at the same time teeming with plants unknown to science, my father formed the plan of himself editing a periodical for the diffusion amongst botanists of the information obtained from these sources. As a model he took Konig and Sims's 'Annals of Botany,' of which two volumes only had been published (London, 1805–6). He never stopped or stooped to calculate the time, worry, and cost that this undertaking would entail upon him, which occupied him for the next thirty years of his life; for he had throughout no assistant editor, and was dependent solely on my mother, and at intervals on myself when at home, for aid in proof-reading, &c. The heavy correspondence it entailed was conducted by himself alone. Including the continuation of the series issued from Kew, these periodicals embrace twenty-eight volumes with 548 plates, of which seven volumes with 247 plates, the greater number of them drawn by himself, were issued from Glasgow. These were the 'Botanical Miscellany,' three volumes with 152 plates (1830–3), the 'Journal of Botany,' two volumes with 44 plates (1834 and 1840), and the 'Companion to the Botanical Magazine,' two volumes with 51 plates (1835–6). In the interval between the publication of the 'Companion to the Botanical Magazine' and the resumption of the 'Journal' he undertook the editorship, with Sir William Jardine and others, of Taylor's 'Annals of Natural History,' which for three years (1837–1840) was the recipient of much of his botanical matter; but the latter became too copious to be included in the numbers of the 'Annals,' and, the result proving otherwise embarrassing, that editorship was abandoned. After leaving Glasgow for Kew he resumed the 'Journal,' three volumes (1840–2) of which were followed by the 'London Journal of Botany,' seven volumes (1842–7), and that by the 'Journal of Botany' and 'Kew Garden Miscellany,' nine volumes (1849–57).

. . . .

"As a contribution to the history of botany during three decades of the nineteenth century these periodicals were unique; no period or subsequent decade of that century can show so rich a store of valuable botanical material.

. . . .

"Towards the end of his Glasgow life my father resumed a systematic study of Ferns, which he had begun with Greville soon after his arrival there, the first result of which was the commencement of an 'Enumeration of all known Ferns' published in the 'Botanical Miscellany.' The issue in parts of Hooker and Bauer's 'Genera of Ferns' was begun in 1838; it originated in his having been shown the beautiful analyses of many genera of the order by the veteran botanical artist, Francis Bauer, who offered the loan of these for publication to my father; not that the order had in the meantime been neglected by him, as is proved by the numerous genera and species described and figured in his journals, in the 'Icones Plantarum' and other works, and by his publication of J. Smith's 'Genera of Ferns.' As I propose to give in an appendix to this sketch of his life a complete account of my father's works, I shall not dwell here on those devoted to Ferns."

III. West Park and Kew, 1841–1865.

"During his occupation of the Professorship of Botany in Glasgow University my father, feeling keenly his severance from the scientific society of London, was always on the look-out for a congenial position there, even if of less emolument than that which he held. The Professorship of Botany in the newly created University College of London (then entitled London University) was pressed on him by Lord Brougham, but the possibility of an appointment to the Royal Botanic Gardens of Kew had for some years eclipsed all other prospects. Nor were his aspirations in this direction unreasonable, for over and above his botanical qualifications he had inherited a taste for cultivating plants, encouraged by ten years' experience in his own garden, greenhouse, and stove at Halesworth; he had twenty years of good work in and for the Royal Botanic Gardens of Glasgow, and had been for thirteen years author of the 'Botanical Magazine,' a serial devoted to the illustration and description of cultivated plants. Added to this was the fact that Mr. Aiton, who as 'Gardener to Her Majesty' had controlled the Gardens of Kew since 1793, was approaching the age for retirement. Meanwhile the Kew Botanic Gardens, which for upwards of half a century had ranked as the richest in the world, had since the deaths, almost contemporaneously, of King George III. and Sir Joseph Banks, been officially cold-shouldered, and had retrograded scientifically. Their early history is summarised in the official 'Guide-book to the Royal Gardens,' and need not be repeated here. The following is a *résumé* of the circumstances that led to their transference from the private property of the Sovereign to the nation as a scientific establishment under my father, who came forward as a candidate for their control on the first hint of a change in their management being contemplated.

"Soon after the accession of her late Majesty a revision of the Royal Household became necessary, and the question of retaining the Botanic Gardens at Kew as a royal appanage having to be considered, a Commission was appointed by Parliament to report upon them. The Commission, the chairman of which was Dr. Lindley, reported favourably on the whole, and concluded with the recommendation that they should be retained and extended, in the following words: 'The importance of Botanic Gardens has for centuries been recognised by the Governments of civilised States, and at this time there is no European nation without such an establishment except England. The wealthiest and most civilised country in Europe offers the only European example of the want of one of the first proofs of wealth and civilisation. There are many gardens in the British colonies and dependencies, as Calcutta, Bombay, Saharunpore, the Mauritius, Sydney, and Trinidad, costing many thousands a year: their utility is much diminished by the want of some system under which they can all be regulated and controlled. There is no unity of purpose among them; their objects are unsettled, their powers wasted from not receiving a proper direction; they afford no aid to each other, and, it is to be feared, but little to the countries where they are established; and yet they are capable of conferring very important benefits on commerce, and of conducing essentially to colonial prosperity. . . . A

National Botanic Garden would be the centre around which all these lesser establishments should be arranged; they should all be placed under the control of the chief of that Garden, acting with him and through him with each other, recording constantly their proceedings, explaining their wants, receiving supplies, and aiding the mother country in everything useful in the vegetable kingdom; medicine, commerce, agriculture, horticulture, and many branches of manufacture would derive considerable advantage from the establishment of such a system. . . . From a garden of this kind Government could always obtain authentic and official information upon points connected with the establishment of new colonies: it would afford the plants required on these occasions, without its being necessary, as now, to apply to the officers of private establishments for advice and help. . . . Such a garden would be the great source of new and valuable plants to be introduced and dispersed through this country, and a powerful means of increasing the pleasures of those who already possess gardens; while, what is far more important, it would undoubtedly become an efficient instrument in refining the taste, increasing the knowledge, and augmenting the amount of rational pleasure of that important class of society, to provide for whose instruction is so great and wise an object of the present administration.'

"Dr. Lindley's recommendations as embodied in the Report having become widely known, enthusiastic advocates of them soon made themselves heard, and a memorial urging their adoption, drawn up by the Linnean and the Horticultural Societies and the University of London jointly, was addressed to the Government and transmitted through the Treasury.

"But to carry out such a scheme was not so simple a matter as at first sight appeared. There were many conflicting interests in high places to be consulted and conciliated during the three years' interval that elapsed between the sending of the Report to the Treasury and its presentation to Parliament. . . ."

It is only with great regret that here is omitted a valuable history of the difficulties commencing as above, and the manner of their supersession, on to the appointment of Sir William to the Directorship. Following a letter of his to Mr. Dawson Turner, dated January 24, 1841, in which he says: "I believe more than ever that Lord Duncannon's great desire is to abolish the Gardens and save the expense to the Civil List," we again quote: "It was not till the following March that my father was officially informed that the Treasury had sanctioned his being appointed Director of the Botanic Gardens at Kew, with a salary of £300, and £200 allowance for the rent of a house. On the 26th of that month Mr. Aiton, under instructions from the Commissioners of Woods and Forests, transferred the Botanic Gardens and Arboretum to the new Director, reserving all printed books and drawings as being his private property, and all journals, accounts, correspondence, and other documents as not being the property of the Commissioners. On April 1, 1841, my father received his commission, the acceptance of which was regarded by his friends as a very insecure foundation on which to build the object of his ambition, a Botanic Garden worthy of the nation. But he was confident of the support of the scientific public in whatever he should undertake, and, I suspect, of that of more than one of the Commissioners of Woods and Forests.

"The next step was to find a residence within a reasonable distance from the Gardens. There was none to be had within two-thirds of a mile, where, in the adjoining parish of Mortlake, there stood a commodious three-storied many-roomed building, of which he took a lease. It was pleasantly situated on 7½ acres of ground with some fine trees that stretched down to the Thames, had a walled garden, orchard, stables, and coach-house, and was in good repair. It bore the name of Brick-stables, for which its owner, the possessor of large property in the vicinage, substituted that of West Park.

"The translation from Glasgow to West Park occupied my father for three months, during which he was heavily and painfully handicapped by the absence of my mother, who was nursing a dying daughter in Jersey, and the illness of his father, who was nearer ninety than eighty years of age, and had lived with him for ten years. His only surviving son was serving in the Antarctic Expedition under Captain (afterwards Admiral Sir James Clarke) Ross. There being no railroad available in those days, he hired a smack for the conveyance by sea of his furniture, household goods and gods, herbarium and library, from Glasgow to London, where they were put into lighters and landed on the banks of the Thames at West Park itself. Previous to this he had lightened his library by the sale of 1,000 volumes, chiefly of classics, Delphin, Aldine, and Elzevir editions, collected in the middle of the previous century by his godfather, Mr. Jackson, of Canterbury. The cost of the move was about £300, his first year's salary. Early in July he was settled at West Park, where the drawing-room, ante-drawing-room, and study were shelved from floor to ceiling and filled with books, and five rooms were occupied with the herbarium. Nothing was allowed him for the conveyance and fittings necessary for these indispensable working materials, which he kept up mainly at his own cost, for the use of the establishment, for twenty-four years.

"On entering upon his duties under the Commissioners of Woods and Forests the new Director was cordially welcomed, and to his surprise and gratification found that he had a free hand and promise of favourable consideration in projecting improvements in the Botanic Gardens. His plan of operations is tersely and best given in his first Report presented to Parliament on the condition of the Gardens, which begins with, 'Having no instructions for my guidance, I determined to follow the suggestions of Dr. Lindley's Report.' Meanwhile Lord Lincoln (afterwards fifth Duke of Newcastle) had succeeded Lord Duncannon, and in him, Mr. Milne, the Honourable C. Gore, and Mr. Philipps, secretary to the Board, he found gentlemen as interested as himself in the development of the establishment, who made frequent visits, going into every detail of the Garden works and giving much of that 'efficient assistance in scientific management and adaptation to useful purpose' which their former Chief Commissioner had declared the Board to be incapable of affording.

"To give a clear account of the additions made and improvements carried out in the establishment of Kew it will be convenient to consider them as far as possible under the four heads of Botanic Gardens proper, Pleasure Ground or Arboretum, Museum, Herbarium and Library.

"*Botanic Gardens proper.*—The first recommendation of the new Director was that these should be open to visitors on weekday afternoons throughout the year, of which privilege upwards of 9,000 persons availed themselves during the remaining nine months of the year. The next, in 1842, was that the permission of Her Majesty should be asked to add a few acres of the Pleasure Ground to the old Arboretum for the purpose of opening a new entrance to the Gardens from Kew Green. This was graciously granted, as were the far larger areas from time to time asked for, of which the next (in 1843) was for forty-eight acres, to afford sites for a new Pinetum, and for the erection of a Palm House far exceeding in dimensions any previously constructed."

Again it appears necessary to omit much interesting matter, this time with reference to the early history of Kew under the new Director; but let us note a point of incidental information, that "the first hardy herbaceous collection in the Royal Gardens was formed in 1760, near the Temple of the Sun. It was an acre in extent, contained 2,712 species, and was called the Physic Garden." After a paragraph on the Palm House, which was commenced in 1844, we read: "At this time the activity of the Commissioners of Woods and Forests was far-reaching, for it was in their contemplation to annex the Chelsea Botanic Gardens to Kew and to form a Medical Garden for the use of the colleges and schools of London. Referring to these schemes in letters to Mr. Dawson Turner, my father in 1843 writes in respect of the formation of a Medical Garden: 'It will be attended with many difficulties, but I shall encourage it, and have written a long memorial to the Board about it.' In 1845 he writes: 'I have to write to the "Woods" on an affair to be laid before the Queen respecting a Medical Garden adjoining the Botanical Garden.' And again in 1845: 'My Report on the Gardens is printed by the House of Commons, and my letter on the removing Chelsea Garden to Kew. Lord Lincoln thinks it will result in that Garden being removed here, or in Government forming here a Medical Garden on a national scale.' Both schemes were abandoned.

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"In 1843 my father reverted to the plan followed during the palmy days of Kew, when under the patronage of Sir Joseph Banks, of sending collectors to distant countries for the purpose of transmitting plants and seeds to the Royal Gardens; and by way of lightening the demands on the Treasury he on several occasions, with the Commissioners' approval, invited the Duke of Northumberland and the Earl of Derby to contribute to such expeditions and share the produce. At the same time, through his influence at the Admiralty, he obtained the privilege of having all packages addressed to Kew coming by the Royal Mail West India Steam Packet sent freight free. By these means Mr. Purdie was sent to New Grenada, and Burke and Geyer to California and Oregon, with the most satisfactory results to all parties; and by similar arrangements with the Treasury, Foreign, Indian, and Colonial Offices, there were subsequently sent Oldham and Wilfred to Japan, Formosa, and Corea, Mann to the Cameroons, Gaboon River, and Fernando Po, Baikie and Barter to the Niger, Kirk to the Zambesi with Livingstone, Meller to East Africa and Madagascar, myself to the Himalaya, Bourgeau to Canada Lyall to

British Columbia, Edmonstone, followed by Seemann, to Western and Arctic America in H.M.S. *Herald*, and the latter to the Fiji Islands with Colonel Smythe's mission, Macgillivray to Torres Straits in H.M.S. *Rattlesnake*, Milne to the Pacific in H.M.S. *Herald*, Spruce to Ecuador for Cinchona seeds, and Hewett Watson to the Azores. The practice was definitely abandoned when the great nurserymen took it up, and liberally shared their proceeds with Kew in exchange for its Director's services in indicating countries worth exploring, giving the collectors letters of recommendation to his correspondent abroad, naming and publishing their novelties and rarities, &c.

"In 1844 my father was instructed to prepare a Guide-book to the Gardens for sale at the entrance, and to make an annual Report on the progress and condition of the Gardens, to be laid before Parliament. The first edition of the Guide-book contains fifty-six pages and sixty-one woodcuts of objects exhibited. It was entitled 'Kew Gardens, or a Popular Guide to the Royal Botanic Gardens of Kew,' by Sir W. J. Hooker, Director. After bringing out twenty-one successive editions he transferred the duty to Professor Oliver, the Keeper of the Library and Herbarium, who in 1863 included the Arboretum in the Guide-book.

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"In 1853 a house in Kew, in possession of the Queen, having become vacant through the death of its tenant (Sir George Quentin, Riding-master to the family of George III.), Her Majesty was pleased to place it at the disposal of the Commissioner of Works, to be in future the residence of the Director of the Botanic Gardens, in which it was situated. This was to my father a very great boon. He was in his sixty-ninth year, and burdened with the duty of creating a National Arboretum in the Pleasure Grounds, nearly two miles distant from West Park, and demanding unremitting scientific supervision. Nor must it be forgotten that his herbarium was outgrowing his accommodation for it, and that his expenses all along far exceeded his official salary. The house was a good one, facing the Green, with its back in the Gardens, but it would not accommodate his library and herbarium, which, together with his study and artist's room, occupied thirteen apartments in West Park. Fortunately a large house closely adjacent to the Botanic Gardens, which had formerly been occupied by the King of Hanover, afforded abundant space for the herbarium and library, of which last he kept in his study such works as were in frequent use. . . .

"Returning to the operations in the Botanic Gardens, in about 1855 instructions were given to the Director (to his great discomfiture) to decorate the lawns and borders of the paths over a considerable area of the Botanic Gardens with 'carpet-beds' of flowers. These he regarded as out of place in a garden where objects of as great beauty, and far greater interest both popular and scientific, abounded. He further regretted the great expenditure on propagating-pits, frames, soil, and labour, on a show of but a few weeks' annual duration, whilst some scientific branches of the establishment were being starved, and a structure of the dimensions at least of the Palm House, to rescue the magnificent collection of colonial trees, &c., from destruction or deformity, was urgently needed. The object of the proposed decorations seemed to be to rival the London parks, where such an attraction was eminently suitable and admirably carried out. In the end he came to an arrangement with his chief (Sir Benjamin Hall, I think) that a sum of money should be added to the estimates and appropriated to this decorative work, and that he be supplied with a skilled foreman to carry it out. The system was continued for several years, and was thereafter gradually suppressed.

"The years 1860 to 1862 were notable for the successful efforts in introducing the Peruvian barks into India and our tropical colonies. Mr. (now Sir Clements) Markham had induced the Indian Government to undertake this measure, which had been urged upon it by Sir Joseph Banks more than half a century before, and by various botanists since. Mr. Markham himself went to Peru, and brought to England living plants, which, after a short nursing at Kew, he took on to India and established in the Nilghiri Hills. Meanwhile my father, to whom the Indian Government applied for advice, not trusting wholly to the risky transport of living plants, urged that collectors should be sent to Ecuador and Bolivia for seeds of the different species, recommending at the same time the employment in Ecuador of Mr. R. Spruce, an able botanist and collector, who happened at the time to be in that country.

"In the Report on the progress and condition of the Royal Gardens during the year 1861 it is stated that 'the means adopted for introducing Cinchonas (trees yielding quinine) into the East Indies and our tropical colonies rank first in point of interest and importance of the works of the past year. In my Report for 1860 I mentioned the erection, at the desire of the Secretary of State for India in Council, of a forcing-house, especially for the cultivation of the Cinchonas, with the view of establishing plantations of them in India. The operations of the several parties organised to proceed into the Andes and procure young plants and seeds have been described in detailed reports laid before the Secretary of State for India by Clements R. Markham, Esq. Upon the Royal Gardens devolved the duties of receiving and transmitting the seeds and plants to India, of raising a large crop of seedlings, of nursing the young stock, lest those sent on should perish or the seeds lose their vitality, and of recommending competent gardeners to take charge of the living plants from their native forests to the hill country of India, and to have the care of the new plantations there. Further, with the sanction of the Indian and Colonial Governments, it was arranged that our West Indian colonies and Ceylon should be supplied with a portion of the seeds.'

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"In 1865, the last year of my father's life, he received from the Lords of the Admiralty the gratifying intelligence that his long-sustained exertions in sending such plants to the sterile island of Ascension as would most effectively and speedily clothe its naked soil, and thus conserve a water supply, had been crowned with success. It was in 1843, after the return of Sir James Ross's Antarctic Expedition, which had touched at the island on its homeward voyage, that the idea of planting that island extensively with such trees, herbs, and shrubs as were best suited to its soil and climate originated. Ascension being a naval station, the Admiralty favoured the idea, and Kew was applied to for aid in giving effect to it; which it did by sending out seeds and cases of living plants year after year, and a succession of young gardeners to plant and sow. According to Captain Barnard's Report to the Admiralty, 'the island in 1865 possessed thickets of upward of forty kinds of trees, besides numerous shrubs and fruit trees, of which, however, only the Guava ripens. These afford timber for fencing cattle-yards.' In 1843 there was but one tree on the island and no shrubs, and there were not enough vegetables produced to supply the Commandant's table. The Report goes on to say: 'Through the spread of vegetation the water supply is excellent, and the garrison and the ships visiting the island are supplied with abundance of vegetables of various kinds.'

"*The Arboretum, formerly the Royal Pleasure Grounds of Kew.*—In 1845 Mr. Aiton was relieved of the charge of that portion of the Pleasure Grounds (about 178 acres) then in occupation of the King of Hanover as a game preserve, which had not been as yet added to the Botanic Gardens, together with the Deer Park (350 acres), and my father was asked to include these in his directorate. This he agreed to do, though no hint of an increase of salary accompanied the request, and though the duties involved were neither botanical nor horticultural, but rather agricultural. He had no doubt two good reasons for this compliance, one in having an eye to the remainder of the Pleasure Grounds as the site for an Arboretum worthy of the nation; the other, that to have allowed these to be placed under any other authority might have led to complications.

"Thus the Director's rule was extended in four years from a Botanic Garden of eighteen acres and a few hundred yards in length to an area of nearly 650 acres, extending from Kew Green to the Thames at Richmond, two miles distant. Some idea may be formed of the labour which this acceptance of extra duty entailed, from the following extract of a letter dated March 1846, and addressed to Mr. Turner. He says: 'For myself, the gardens have never made such demands on my time as at the present season, when the most extensive operations are being carried on in the Pleasure Grounds, as well as in the Botanic Gardens. In each place our usual complement of men is much more than doubled. In the former, owing to severe illness of the foreman, I have to superintend everything, and there is literally not a man in whom I can put confidence about the place. I have lately detected very gross abuses, which there is every reason to believe have been practised for a long time under the *régime* of my predecessor.'

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"*Museums.*—Referring to the storehouse for fruit in the old Kitchen Garden of Kew, alluded to at p. lvii * as left standing in 1846, when that piece of ground [the Royal Kitchen Gardens, which had remained under Mr. Aiton's management] was added to the Botanic Gardens, it appeared to my father that it might be converted into a Museum of Economic Products of the Vegetable Kingdom, raw and manufactured, and for the exhibition of large fruits and other objects of varied interest, nowhere displayed to view. Of such objects he had a large collection, formed chiefly for the use of his class in Glasgow, and others were scattered

* *Annals of Botany*, vol. xvi.

about the offices of the Gardens, some of them being the property of Mr. Smith, the Curator. Procuring a few trestles and planks, he formed of them a long table in the central room of the building, arranged all these articles on it, ticketed them, and invited the Commissioners to come and see them. This they did (I happened to be present on the occasion), and listened to his eloquent discourse upon them, during which he showed how such a collection of vegetable products might, besides interesting and instructing the public, prove of great service to the scientific botanist, the physician, the merchant, the manufacturer, the chemist and druggist, the dyer, and to artisans of every description. All these might find in such a collection the raw material (and to a certain extent the manufactured article) employed in their several professions, trades, or arts, correctly named, together with their native country and some account of their history.

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"Before proceeding to describe the second and third museums erected by my father, it is gratifying to relate that within six years of the first being opened, eight others, professedly on the lines of that at Kew, were established; they were in Edinburgh, in the India House (London), in Guiana, Jamaica, Melbourne, Calcutta, Madras, and in the Jardin des Plantes, Paris.

"In the summer of 1855 the Director was invited by the Imperial Commissioners of the French International Exhibition of that year to take part in its functions, which resulted in his obtaining almost the entire collection of vegetable products there brought together. In aid of this he procured a grant of £400 from the Treasury, which the President of the Board of Trade, unasked, supplemented with a like sum. Thus provided, and with the ready assistance of the officers of the Board of Trade, and of the Science and Art Department, and enriched by donations of many exhibitors, he secured and transmitted to Kew forty-eight large cases of museum articles. This accumulation, and the fact that the Museum of 1848 was already overcrowded, and the great stores of specimens were being huddled away in the temples and sheds of the Gardens, led to the erection of a second and much larger building. This, which is Museum No. 1 of the Guide-book, was sanctioned by Parliament in 1854, was completed, fitted with 13,000 square feet of glazed cases, filled, and opened to the public in 1857. It is that now standing opposite the Palm House, with the piece of water intervening. . . .

"*Herbarium and Library.*—As stated at p. lvi,* when the new Director of Kew took up his appointment, neither books nor a herbarium were provided for him; but he was well equipped with those of his own; nor was it till he was moved into residence in the Royal Gardens that he received any other substantial aid towards their upkeep and increase than house-rent, and latterly stationery and some cabinets. It is also told that the new residence not affording that accommodation for these which the Government had guaranteed, they were placed in a building adjacent to the Botanic Gardens. On this occasion it was arranged between the Commissioners and my father, that on the condition of his herbarium and

* *Annals of Botany*, vol. xvi.

library being accessible to botanists he should be provided with such a scientific herbarium curator as he had himself hitherto salaried.

"Four years afterwards the Royal Gardens came into possession, by gift, of the very extensive library and herbarium of G. Bentham, Esq., F.R.S., which was second to my father's alone in England in extent, methodical arrangement, and nomenclature, and which was placed in the same building. Its formation was begun in 1816, in France, where and in the Pyrenees Mr. Bentham collected diligently; but its great expansion by the inclusion of exotic plants dated from his introduction to my father in Glasgow in 1823, when the friendship between the two commenced which remained undisturbed for forty-two years. From that date the two botanists may be said to have hunted in couples for the aggrandisement of their libraries and collections, sharing their duplicates, Mr. Bentham giving my father the preference in all cases of purchase, &c. The one great difference between their aims was, that the former confined his herbarium to flowering plants, whilst my father's rapidly grew to be the richest in the world in both flowering and flowerless plants. The offer of this gift was prearranged with my father, who with his wonted disinterestedness put aside the obvious fact that its acceptance would greatly diminish the value of his own herbarium and library, should the Government ever contemplate its purchase.

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"Turning now to my father's concluding botanical labours, the last of his efforts, the results of which have been far-reaching, was to address in 1863 a powerful appeal to H.M. Secretary of State for the Colonies, the Duke of Newcastle, K.G., in favour of H.M. Government undertaking to assist in the preparation and publication of a series of Floras of our colonial and Indian possessions. At the same time, for the information of the Secretary of State, he, in conference with Mr. Bentham, drew up and submitted the following estimate of the scope and cost of such a series of Floras, which is interesting as giving the views of the two best-informed botanists in Europe as to the number of species of flowering plants and ferns natives of the several colonies, specimens of which were assumed to be available in herbaria for description at that time."

The estimated number of species to be described is then given for the different colonies, and further on we read that "the number of volumes required was estimated to be forty-three; the author's remuneration to be £150 per volume, payable at date of publication. . . .

"Of the botanical works published by my father during the twenty-four years of his Directorship of Kew, the more important were the continuation of the 'Botanical Magazine,' volumes lxvii. to xc., with 1,440 plates; the 'Icones Plantarum,' volumes iv. to x., 700 plates; the 'Journal of Botany,' volumes iii. and iv., with 28 plates; the 'London Journal of Botany,' 7 volumes, with 166 plates; the 'Journal of Botany and Kew Gardens Miscellany,' 9 volumes, with 109 plates. On Ferns alone there were the 'Species Filicum,' 5 volumes, with 304 plates illustrative of 526 species; 'Filices Exoticæ,' 100 plates; 'A Second Century of Ferns,' 100 plates; the 'British Ferns and their Allies,' 66 plates; 'Garden Ferns,' 64 plates; and lastly a commencement of a 'Synopsis Filicum.' To these must be added his 'Guide-books' to the Royal Gardens and to their Museums, and his 'Annual Reports,' to be laid before Parliament, on the progress and condition of the Royal Gardens."

The number of plates published by Sir William is estimated to be nearer 8,000 than a lower number mentioned by De Candolle, and no less than 1,800 were from drawings executed by himself.

"With the commencement of a 'Synopsis Filicum,' which the completed 'Species Filicum' made a comparatively easy task, my father's labours terminated. His end was unexpected. On the Monday forenoon he spent two hours with me in inspecting Battersea Park, then in formation; here he left me and walked part of the way back to Kew, meeting by appointment the Queen of the Sandwich Islands and the Rev. Mr. Berkeley, with both of whom he spent the whole afternoon in the Gardens. On Tuesday morning his servant came to tell me that his master could not swallow. I followed immediately, and found him perfectly well except for this paralysis of the muscles of deglutition. I at once sent to London for the best advice, but to no purpose. I saw him no more, for, sleeping on the floor by his bedside that night, under an open window, I was suddenly prostrated with rheumatic fever. Meanwhile he gradually sank, suffering no pain nor feeling the want of nourishment; and died from exhaustion, Saturday, August 12, in his eighty-first year. He was buried in the churchyard of St. Anne's, Kew. A handsome tablet in the church, with a central medallion profile by Woolner, and spandrels with groups of ferns in the corners, all in Wedgwood ware, record the dates of his birth, death, &c., with the motto, 'Thou, Lord, hast made me glad through Thy works.'

"In person Sir William was over six feet high, erect, slim, muscular; forehead broad and high, but receding, hair nearly black, complexion sanguine, eyes brown, nose aquiline—had been broken in a school fight; his mobile face, and especially mouth, was the despair of artists. [In a footnote we read that "he was a vigorous pedestrian, covering sixty miles a day with ease. When taking the week's-end rest at Helensburgh, during his summer course of lectures, he habitually on Sunday walked to Glasgow, twenty-two miles, to be in time for his eight o'clock Monday morning class."] Many chalk portraits of him were taken for friends by Sir Daniel Macnee, of which the best known to me is that which prefaces this article. Other portraits of him are two life-size in oil by Thomas Phillips, R.A., one in my possession, and the other in that of Sir Leonard Lyell, Bart., of Kinnordy; the half-length in oil by Gambardella, in the Linnean Society's meeting-room; a small engraving in the series of portraits of members of the Athenæum Club, one by Maguire in the Ipswich series of portraits of scientific men; and an etching in profile by Mrs. Dawson Turner, from a profile by Cotman, unpublished, but widely distributed. There is also the bust in marble by Woolner in the Kew Museum, an excellent likeness.

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"He was a Fellow of the Royal, Linnean, Antiquarian, and Royal Geographical Societies, LL.D. of Glasgow, D.C.L. of Oxford, a correspondent of the Academy of Sciences of France, Companion of the Legion of Honour, and member of almost every Academy in Europe and America which cultivated the Natural Sciences. In 1836 he received the honour of knighthood from His Majesty William IV., together with the insignia of the Order of the Guelphs of Hanover, then an appanage of the British Crown.

"In evidence of the estimation in which my father was held by his botanical contemporaries, I think I cannot better conclude this sketch of his life and labours than by giving the following extracts from the obituaries of him drawn up by the two most eminent then living botanists, one in America, the other in Europe. Of these, Professor Asa Gray thus writes in the 'American Journal of Arts and Sciences,' Second Series, xli. 1 (1866): 'Our survey of what Sir William Hooker did for science would be incomplete indeed if it were confined to his published works—numerous and important as they are—and the wise and efficient administration through which, in a space of twenty-four years, a Queen's flower and kitchen garden and pleasure grounds have been transformed into an imperial botanical establishment of unrivalled interest and value. Account should be taken of the spirit in which he worked, of the researches and explorations he promoted, of the aid and encouragement he extended to his fellow-labourers, especially to young and rising botanists, and of the means and appliances he gathered for their use no less than for his own.

"'The single-mindedness with which he gave himself to his scientific work, and the conscientiousness with which he lived for science while he lived by it, were above all praise. Eminently fitted to shine in society, remarkably good-looking, and of the most pleasing address, frank, cordial, and withal of a very genial disposition, he never dissipated his time and energies in the round of fashionable life, but ever avoided the social prominence and worldly distinctions which some sedulously seek. So that, however it may or ought to be regarded in a country where Court honours and Government rewards have a fictitious importance, we count it a high compliment to his sense and modesty that no such distinctions were ever conferred upon him in recognition of all that he accomplished at Kew.

"'Nor was there in him, while standing in a position like that occupied by Banks and Smith in his early days, the least manifestation of a tendency to overshadow the science with his own importance, or of indifference to its general advancement. Far from monopolising even the choicest botanical materials which large expenditure of time and toil brought into his hands, he delighted in setting other botanists to work on whatever portion they wished to elaborate; not only imparting freely, even to young and untried men of promise, the multitude of specimens he could distribute, and giving to all comers full access to his whole herbarium, but sending portions of it to distant investigators, so long as this could be done without too great detriment or inconvenience. He not only watched for opportunities for attaching botanists to Government expeditions and voyages, and secured the publication of their results, but also largely assisted many private collectors, whose fullest sets are among the treasures of far the richest herbarium ever accumulated in one man's lifetime, if not the amplest anywhere in existence.'

"From Professor Alphonse de Candolle's long *éloge* (La vie et les écrits de Sir W. Hooker) published in the 'Archives des Sciences de la

Bibliothèque universelle de Genève,' January, 1866, I have taken the following passages :

"'Et ici je me plais à répéter ce que beaucoup d'autres ont dit ou écrit. Hooker n'était pas de ces hommes qu'on oublie quand on les a vus une fois ou deux. Ses manières étaient aisées, affables, sa complaisance était réelle, son hospitalité charmante. La grâce de Lady Hooker y ajoutait beaucoup, j'en conviens, de sorte qu'il restait de la plus courte visite une impression durable. Sir William m'a toujours paru un type de vrai *gentleman* anglais. Il en avait les bonnes qualités et il en acceptait les charges. Poli envers tout le monde, libéral, oubliant ses intérêts au profit de la science, répondant à toutes les lettres et à toutes les demandes, il avait obtenu dans l'opinion publique une position exceptionnelle. Il était le protecteur des jeunes botanistes et des nombreux amateurs d'histoire naturelle qui partaient pour les colonies. S'il fallait créer un établissement public, donner des subventions, les ministres le consultaient. Sous ce rapport son influence directe ou indirecte s'est fait sentir dans le monde entier. Si l'on publie actuellement des Flores de presque toutes les colonies anglaises, on le doit principalement à ses conseils. . . .

"'Je me suis permis de caractériser nettement le botaniste en ce qui concerne ses travaux. Mais il y a, ne l'oublions pas, à côté des ouvrages de Hooker, l'action généreuse, incessante et éclairée qu'il a su exercer autour de lui et à distance. Il a inspiré le goût de la botanique à une foule de personnes, en particulier à son fils. Il a organisé l'établissement scientifique et horticole de Kew, un de ceux où l'on travaille le plus et où les botanistes de tous les pays trouvent le plus de ressources. En arrangeant et en démontrant les belles collections de ce jardin, il a rendu la science populaire. Grâce a ces antécédents et à l'agrément de ses manières, il a obtenu beaucoup en faveur soit de la botanique soit de l'horticulture. Ses recommandations étaient puissantes, même en Australie, dans l'Inde ou en Amérique, de telle sorte que bien des voyages, bien des découvertes et beaucoup de publications importantes sur la flore de pays lointains se rattachent déjà ou se rattacheront à lui, au moins par leur origine.'"

So ends a fascinating biography, valuable as such as well as for the authentic history it gives of the Royal Gardens, Kew, much of which is either unpublished or quite new to the present generation. The botanical, and no less the horticultural world, is indebted to Sir William's equally eminent son and successor for writing a record which no one else could so well have written, whose own history, indeed, must be its natural complement as also its continuation in the history and evolution of one of the greatest, most important, and successful of our national institutions. The present notice, inevitably presenting many points of interest, yet necessarily incomplete, may serve beyond its immediate purpose, to draw attention to the original work enshrined in the "Annals of Botany."

R. I. L.

To the Sketch of the Life and Labours of Sir W. J. Hooker the following extensive Appendices are added :

A. Catalogue, chronologically arranged, of Sir W. J. Hooker's Works, with notes and observations.

B. An attempt to classify the more important Articles contained in the Botanical Journals edited by Sir W. J. Hooker, exclusive of Catalogues of Collections and purely systematic and descriptive Articles, which may be supposed to be incorporated in later works.

B i. Reviews and Notices of Botanical Works, Herbaria, and Gardens ; also Letters from Travellers, Collectors, and Botanists referable to different countries ; arranged geographically.

B ii. Reviews and Notices of Works and Articles bearing upon the Geographical Distribution of Plants.

B iii. Reviews and Notices of Works and Articles on special groups of Plants not confined to individual countries.

B iv. Reviews and Notices of Introductions to Botany, Systematic and Descriptive Works, Periodicals, and Expeditions, with Miscellaneous Articles not falling under preceding heads.

B v. Physiological, Morphological, and Anatomical Articles.

B vi. Catalogue of Articles on and Notices of the more important Economic Plants contained in the Botanical Journals ; to which are added references to figures of those published by the Editor in the "Botanical Magazine."

B vii. Obituary Notices, Memoirs, Éloges, and Portraits of Botanists.

C. List of some of Sir W. J. Hooker's Chief Correspondents, 1808–65.

ASPECTS OF VEGETATION IN KASHMIR.

By Emilia F. Noel.

Kashmir may almost be called the Switzerland of India. It is easily accessible from the Panjab, and the more frequented routes present no difficulties to the traveller, while the topography of the country is varied enough to suit all tastes: the mountaineer can explore almost untrodden ground of snow and ice, and the ordinary tourist will find no lack of beauty among the wooded valleys or high "margs," which are often covered with a sheet of flowers. The English botanist will see no stretches of Heather and Gorse, no woods dotted with Primroses, or colonies of Wild Hyacinths forming those films of blue that we know so well in this country in the spring; instead he will see the lower slopes of the hills covered with a profusion of the pink *Prunus prostrata* and the taller *Rosa Webbiana*, the ordinary Wild Rose of Kashmir, with its spiky habit of growth, each branch being crowned with one or more flesh-colour to carmine flowers, or stony areas sprinkled with the low bushes of the scented *Daphne oleoides*. There is little grass on the lower hills, and the vegetation is characteristically bush-like in its aspect, and often spiny, as, for instance, when *Zizyphus vulgaris* or *Berberis Lycium* covers stony tracts on the "Karewahs," or foothills. Here and there *Clematis montana* is seen draping some small tree with its showers of white blossoms, or the handsome *Jasminum humile* presents a mass of bloom. Later on in the year the fragrant *J. officinale* is abundant. Two species of *Cotoneaster* are common on the hills which rise on either side of the broad cultivated Valley of Kashmir, which is practically one great rice swamp. The herbaceous plants of these spurs, which grow among the stones and under shelter of bushes, are for the most part insignicant; such are, for instance, the little brick-red *Anemone biflora*, *Phyteuma Thomsoni*, and various Cynoglossums.

Beyond the Karewah the forest zone, as it were, is reached, and consists of different species of Fir, notably the Himalayan Blue Pine, Silver Fir, &c., and also many deciduous trees, the latter being plentiful in the Sind and adjoining valleys, especially in shady nullahs to the north and east, where there is plenty of humus, the western and southern aspects of the ranges being barer of vegetation. A few of the more characteristic flowers of the forest zone are our familiar Wild Strawberry, our English *Cephalanthera ensifolia*, Solomon's Seal, and *Campanula latifolia*; *Geranium pratense* occurs in many places, together with *Viola biflora*, *Polygonum amplexicaule* with its rose-red flowers, the white star-like *Ainsliæa aptera* on its brown stalks, the foliage appearing later, and *Doronicum Roylei*. Different species of *Corydalis*, *Spiræa*, and *Rubus* are frequent, and often the undergrowth consists almost entirely of the aromatic *Skimmia Laureola*, or the disagreeably smelling shrub *Viburnum fœtens*, which causes an unpleasant odour to pervade the woods wherever it grows, but has an edible dark-red fruit, which is ripe in August.

I am only mentioning a few of the commoner forms of vegetation which would strike the observer when traversing some of the forests, but must not omit to notice *Parrotia Jacquemontiana*, which is like a Hazel; the elegant *Staphylea Emodi*, and *Elæagnus umbellata*, with its silvery scurfy scales and scented flowers, which grows in scrubs.

You seldom come across great cliffs or escarpments in the formation of the country, but instead, the very steepest of hillsides, which though much grazed over by cattle are in places carpeted with flowers. An English botanist cannot fail to be struck by the variety of *Pedicularis*, *Nepeta*, and *Astragalus* he sees; and though many old friends, such as the Geums, Veronicas, *Lamium album*, &c., occur, there are no Daisies. On these almost perpendicular hillsides grow colonies of *Eremurus himalaicus*, apricot-coloured *Erysimum altaicum*, dark-blue *Lindelofia spectabilis*, besides Forget-me-nots and other *Boragineæ*, of all the different hues of blue under heaven. In spring a noticeable object on hillsides is the yellow *Ferula Jaeschkeana*, its stem, which is full of sticky latex, rising several feet above its compact clump of radical leaves. About the same altitude, but in rather less exposed situations, we find *Polygonum alpinum*, which looks like a mass of seed pearls when in bud, and the rose-pink *Lavatera kashmiriana*.

There are, however, often huge slopes where little else grows than the purple-pink *Indigofera Gerardiana* and *I. heterantha*, which, though frequently forming patches of fine colour, the traveller grows weary of, as where the shrubs abound they seem to allow few other plants to occupy the same vicinity. Another gregarious genus of plants is the *Impatiens* tribe: on the outskirts of forest and at certain altitudes, like the *Indigofera*, they seem to take possession of all the locality, where they establish themselves and grow very thickly. In similar situations *Strobilanthes alatus* occurs, and is very common near Sonamarg.

Characteristic "marg" plants are the deep orange 'Sunflowers' (*Inula Royleana*), *Delphinium incanum*, and *Delphinium cashmerianum*, common in July, and the large cream-coloured and pale-blue Aquilegias. Other marg flowers are the two spiny Morinas. Kashmiri coolies always gather the yellow corollas of *Morina Coulteriana* with its pleasant odour, dry them in the sun, mix with butter, and use the compound for skin-diseases. The white and ruby-coloured *M. longifolia* does not seem to possess the same medicinal properties.

Of Primulas there is the purple *Primula Stuartii*, var. *purpurea*, found principally in bare stony places; *P. rosea* and *P. denticulata* in wet ground, near watercourses; and *P. involucrata* on dripping rocks. Androsaces seem to prefer grassy spots, though some grow in very dry places. *A. rotundifolia* and its varieties are ubiquitous throughout the country. The yellow variety of *Anemone obtusiloba* is always found much higher up than the white or blue forms, and the high passes are dotted abundantly with their primrose-coloured flowers. In July certain spots at an altitude of 12,000 feet are veritable rock gardens, every niche and ledge of a rocky knoll bearing its alpine blossoms. Often where there is a shower of débris or loose stones, and where no blade of grass is visible, Asters, the lace-like *Pleurospermum Brunonis*, *Anemone rupicola*, and the large lilac *Corydalis crassifolia* flourish. Gentians, though there are many species in Kashmir, are local in their distribution, and do not occupy such an important place in the flora of the country as they do in Switzerland. *Gentiana Kurroo* where it occurs is a glorious sight, with its rich blue stars growing in tufts on rocks, and *G. Moorcroftiana* sometimes clothes a bank with its paler blue flowers. Swertias are found in various situations, *Swertia petiolata* on the high margs, brown-speckled *S. Chirata* on sunny slopes, and the peacock-green *S. speciosa* in damp spots.

Among the most beautiful sights of Kashmir are the beds of *Iris ensata* which line the banks of the river Jhelum, and the great rose-coloured Lotus (*Nelumbium speciosum*) which forms the great feature of the Dal Lake, near Srinagar, in August. In the Dal Lake and in ponds *Limnanthemum nymphoides* grows like a weed, with other familiar water-plants, such as *Menyanthes trifoliata*, *Butomus umbellatus*, *Utricularia*, &c., and such unfamiliar ones as the Water Chestnut (*Trapa natans*), which is harvested in August by the Kashmiris, and *Euryale ferox*, with its spiny crinkled leaves, which are often three to four feet in diameter.

In this cursory glance at the flora of Kashmir some of the most characteristic plants of the country have not been mentioned, *e.g.* the Blue Poppy (*Meconopsis aculeata*), the Crown Imperials, the curious Arisæmas, and the little azure-blue *Corydalis cashmeriana*, &c.; but these do not form noticeable features of the vegetation, as they only occur in certain localities. It is perhaps interesting to note that in different districts, apparently similar in general conformation, preponderance of certain families such as the *Compositæ* obtains, Artemisias, Jurineas, and Saussureas being very common in the Gurais district.

PLANT DISEASES. WILD PLANTS AS A SOURCE OF DANGER.

By A. D. Cotton, F.L.S., F.R.H.S.

Many of the organisms that cause diseases in our commonly grown flowers, fruits, and vegetables are well able to exist on British wild plants, which are often allowed to flourish on rubbish-heaps and other out-of-the-way corners of the garden. This is especially the case with diseases of plants caused by fungi; and the object of this paper is to draw attention to the risk that is run in allowing weeds to grow at all in gardens, and to point out those wild plants which may be more especially regarded as affording a home for diseases of plants caused by parasitic fungi. Only those diseases which are of general occurrence in Britain will be dealt with here.

Some of these fungi make use of the wild plants they find at their disposal, to tide over bad times when their favourite garden crops are not at hand; whilst others are always abundant on wild plants * and occasionally make invasions into the garden and cause epidemics on cultivated forms. It is thus evident that weeds are a distinct danger in the two ways just mentioned.

Weeding thus becomes a more important item in gardening than we might at first sight imagine; for we are apt to think that if it is regularly attended to in the flower and vegetable garden, and other parts in cultivation, we have done our duty in this respect. Weeds are then left quite unmolested at the backs of shrubberies, and such places, where they do not attract attention; whilst plots of ground that are not planted are often allowed to produce an abundant crop. This is particularly noticeable if the ground has been manured, or still more so if road sweepings have been applied, when a perfect flora of weeds will make its appearance. Now, quite apart from the fact that these weeds will probably produce a stock of fresh, well-grown seed, which will be blown about, and come up in due course where least wanted, they often prove to be very undesirable in encouraging diseases in the garden in the manner alluded to above.

As gardeners, we are all inclined to think that our cultivated plants are much more subject to fungus pests than their relatives which grow wild; but a careful examination of wild plants would convince anyone that this is not the case. Naturally a clump of diseased Hollyhocks in a garden would be more conspicuous than plants of *Malva sylvestris* attacked by the same disease at the roadside; though it is a fact that one can seldom find the wild Mallow quite free from the Hollyhock rust, *Puccinia malvacearum*.

* Of course one would not for a moment condemn the use of British wild flowers in gardens, as they have a charm of their own, and no garden should be altogether without them; but the weeds referred to are those which are not left because of their beauty, but simply because it is thought they do no harm.

Garden plants do, however, often receive treatment which renders them more liable to attacks of fungi than the wild forms. Broad areas of one sort of plant, overcrowding and overfeeding, are instances of this; and again, weakly plants are sometimes produced from poor cuttings (through trying to get up too rapidly a stock of some new variety, *e.g.* of a Chrysanthemum). With greenhouse plants, too, "susceptibility" to disease may be induced by soft unripened growth, if insufficient ventilation is given; or the constitution of the plants may be weakened in some other way. Forcing, needless to say, is apt to do this; and to those who know the countless myriads of spores that are produced by fungi the wonder is that plants which are constantly forced, like Tomatos, Cucumbers, &c., are not more subject to epidemic diseases than as a matter of fact they are. The latter plant especially must be very resistent to fungi, as the atmosphere that is required for forcing it is ideal for the growth of fungus parasites, and yet the number of forms which attack it is comparatively small. But, apart from the special conditions, cultivated plants should not be more liable to diseases than wild species.

Before giving a list of those wild plants which afford suitable hosts for these fungus parasites, we will refer to two widespread diseases, viz. the Club Root of the Cabbage tribe, and the disease of fruit-trees caused by *Eutypella*, as affording an illustration of the twofold danger which wild plants may bring about.

The *Club Root* of Cabbage, Turnip, Wallflower, &c., affords an excellent example of how a garden parasite can make use of common weeds which may have been left to thrive. The disease is caused by a microscopic fungus (*Plasmodiophora brassicæ*) which gains an entrance into the young roots of the crops, and when inside grows and flourishes to such an extent that it completely distorts the roots, and causes the characteristic swellings so familiar to gardeners. The remedy usually given is to lime the ground and not grow Crucifers for at least five years. But it must be remembered that the Club Root fungus can live in the ground for several years without any host at all, and though it does not flourish or increase under these conditions, it manages to get along somehow or other, and is ready to seize every opportunity of infecting the roots of Shepherd's Purse, Mustard, or such common cruciferous weeds on which the gardener may have had compassion. If these weeds are available, it is enabled again to increase, and it obtains, as it were, a new lease of life. Shepherd's Purse is one of the commonest weeds, and is no doubt a welcome friend to *Plasmodiophora*; but most, if not all, cruciferous weeds form a harbour for this pest.

A very important point in connection with this disease may be emphasised here, though not strictly within the bounds of our subject. Great care should be exercised in *keeping the seed-beds free from the fungus*. The plants are mostly attacked when quite young, though the swellings may not be visible until after planting out; but if the seed-beds are kept clean and well limed, the danger of an attack by "club" is greatly diminished. (G. Massee, "A Text-book of Plant Diseases," p. 334.)

The new disease of fruit trees caused by *Eutypella* is an instance of a fungus common on wild plants turning its attention to cultivated forms, and causing an epidemic disease. *Eutypella pruni* has long been known to botanists as a parasite on various wild species of *Prunus*, specially the Sloe or Blackthorn (*see* figure, JOURNAL, xxvi. p. 742). During the last few years, however, it has found its way into gardens, and is now attacking Apples, Pears, Plums, Peaches, and other rosaceous trees. Specimens have been received at Kew during the past summer from various parts of England, and reports show that its invasion into orchards is becoming general, and that it is working dire havoc amongst young trees, especially those on a clay soil. (*Gard. Chron.* Sept. 27, 1902.)

This is a forcible illustration of how disease on wild plants can pass on to cultivated varieties, and though in the case cited some may regard it as unavoidable, yet it is hoped such an instance may convince gardeners of the existence of the danger, and stimulate their efforts to eradicate those weeds which may be easily destroyed. Some of these latter plants will now be mentioned, taking them according to their natural orders.

RANUNCULACEÆ. — Several common species of Buttercups (*Ranunculus repens*, *bulbosus*, and *auricomus*) aid in retaining the disease of garden Anemones and Hellebores, known as Smut. The fungus (*Uromyces anemones*) which causes this disease produces black sooty masses on the leaves and stems, and in some seasons completely destroys the beauty of the plants attacked. In combating this pest, a sharp look-out should be kept for Buttercups, and if any are seen to be diseased, they should not merely be hoed down and left to die, but be collected and burnt, as the black sooty masses are made up of thousands of minute spores. The Wood Anemone is also a common victim to this disease, and if cultivated varieties are grown in the immediate vicinity of these it is not astonishing that the disease spreads. A description and figures of this fungus, with references to literature, will be found in Dr. M. C. Cooke's "Pests of the Flower Garden" (JOURNAL, xxvii. p. 14).

Another disease, caused by *Sclerotinia tuberosa*, is also constantly found on wild Anemones. In woods, the Peziza cups (or fruits of the fungus) are easily overlooked, as they are of a brown colour and hidden by the Anemone foliage, and the damage they do here remains unnoticed. If the disease makes its way into the garden, however, its effects are at once observable by the sickly plants that result. *A. japonica* is mostly attacked, and in some districts so badly that its cultivation has been abandoned altogether. This fungus, as far as is known, only attacks the genus Anemone, and where it is rampant it is advisable not to grow cultivated Anemones nearer any patches of the woodland species than is absolutely necessary. (M. C. Cooke, *loc. cit.* p. 15.)

CRUCIFERÆ.—Club Root, which is the worst disease of this order, has already been noticed.

There are, however, two others of more or less importance, that are common on weeds; both of these are white moulds which resemble in external appearance the mildews. The one, *Peronospora parasitica*, is very destructive to Wallflowers and Stocks, and also Turnips; the other, *Cystopus candidus*, attacks Radish, Horse-Radish, and Cabbage; young plants are chiefly attacked. *Capsella bursa pastoris* (Shepherd's Purse) and *Alliaria officinalis* (Garlic Mustard) are the wild plants which are mostly to blame in encouraging these fungi; and where either of the two moulds give trouble, care should be taken to uproot these and other cruciferous weeds that may be about in the garden. (M. C. Cooke, *loc. cit.* p. 20.)

Besides these two moulds there is the *Turnip Mildew* caused by *Erysiphe polygoni*. This parasite is able to attack plants of various orders, it being very common on those Polygonums which are garden weeds, such as *P. aviculare* (Knotgrass) and *P. Persicaria*, and also on Vetches, and other members of the *Leguminosæ*. It is probably able to pass directly from these weeds to Turnips.*

MALVACEÆ.—The *Hollyhock Rust*, already referred to, is the only case we need notice here. Wild Mallows should not be allowed to grow in the neighbourhood of Hollyhocks, if it can be avoided, as the disease is often abundant on the former, and it would rapidly pass into the garden, if a suitable host were at hand. When *all* diseased leaves are burnt in the autumn, the attack will be diminished the following season. Care should also be exercised in obtaining clean seed, as the fungus (*Puccinia malvacearum*) frequently forms pustules of spores on the carpels themselves. (M. C. Cooke, *loc. cit.* p. 36, plate iii. fig. 42.)

ACERACEÆ.—The large black blotches so common on *Acer campestre* and *Acer Pseudo-Platanus* are caused by the fungus *Rhytisma*. The ornamental foliage of garden Maples also is sometimes completely disfigured by this parasite. The fungus ripens its spores in spring, on the dead leaves that have fallen off the previous autumn, and on a dry day these spores are exploded from the leaves in countless thousands, and are blown about by the wind, thus inoculating the young unfolding leaves on any Acers within reach. The obvious remedy, therefore, is to burn all diseased leaves in the autumn. The burning of the leaves of the variegated varieties alone will not suffice; therefore, when practicable, those of *A. campestre* or any other affected species should be destroyed. (G. Massee, "Text-book of Plant Diseases," p. 142.)

LEGUMINOSÆ.—The *Rust* attacking Beans of various species is caused by *Uromyces fabæ*; and it is also common on Vetches and wild Lathyrus; hence these should not be tolerated.† *Pisum sativum*, the garden Pea, is favoured with two mildews: a false mildew (*Peronospora viciæ*), which is common on Vetches and allied plants; and a true mildew (*Erysiphe polygoni*). The latter is the same that attacks Turnips, and the hosts mentioned for it there should be looked out for in this case. *Polygonum aviculare*, the Knotgrass, is a very common weed, and it is often covered with this mildew.

ROSACEÆ.—This order has more than its share of fungus pests, not a few of which have been imported into the garden from the hedgerows and copses.

ROSES.—The *Rose Rust* (*Phragmidium subcorticatum*) is abundant on wild Roses, and is often introduced into gardens by means of the stocks which are employed for grafting &c. The foliage of the Briers used for

* For full particulars of the Mildew Parasites, see *A Monograph of the Erysiphaceæ*, by E. S. Salmon (Mem. Torrey Bot. Club, ix. 1901).

† For Rust Fungi, see *A Monograph of the British Uredineæ and Ustilagineæ*, by C. B. Plowright.

budding is often covered with the rust fungus, so that it is not surprising if the resulting Roses also suffer; a little care, therefore, in the selection of the Briers, would avoid much annoyance later on. In early summer the fungus causes orange masses on the leaves and shoots, but in autumn these give place to black patches which, in the case of leaves, are chiefly seen on the under surface. The black patches are formed of resting spores which remain dormant till the spring and then germinate and reinfect the plant; hence the more of these diseased leaves that are destroyed in October and November the less the chances of infection the following season.

The *Rose Mildew* (*Sphærotheca pannosa*) is of general occurrence wherever Roses are grown, and it is common also on the wild forms. Sulphur is the usual remedy, and is useful if applied early. If a little more common sense were sometimes used as well, however, the results would be more satisfactory. For instance, where Roses are grown under glass, sulphur is generally applied if mildew is present, though plants just outside the greenhouse (especially if common sorts) are not given this attention. A case of this kind came before us lately; an old climbing Rose immediately outside a greenhouse was vigorously supplying the spores of the Rose mildew; these spores were blown inside whenever the ventilators were open; the Roses inside were well powdered with sulphur, whilst the one outside, which was doing most of the mischief, was left alone.

FRUIT-TREES.—Apple Canker (*Nectria ditissima*). This fungus is so general on all sorts of trees and shrubs that its spores may be regarded as always present in gardens. These spores can only obtain an entrance into the plant through wounds and cuts; hence avoid bruising the branches of the trees in any way. When once an entrance has been effected the mycelium is permanent. Diseased patches may be cut out and the wounded surfaces tarred, though in many cases the fungus makes too much headway before it is discovered to allow of this. All useless trees and branches attacked by canker should be removed and burnt.

Brown Mould of Fruit.—This is exceedingly common on Apples and Pears, but most kinds of rosaceous fruits are attacked. The spores of this fungus (*Monilia fructigena*), like the preceding one, are very abundant. Diseased fruits should be burnt, as infection the following year depends on spores produced on them.* Useless fruit-trees of every kind should be removed, as they only increase the spread of the disease. (See JOURNAL, xxvi. p. 738.)

Plum-leaf Blister.—The foliage of Plum-trees is often seen to be spotted with red blotches caused by the fungus *Polystigma rubrum.* When the blotches cover large areas the injury done is serious, as the assimilatory surface of the leaf is reduced. In fighting this pest it should be remembered that wild species of *Prunus*, specially Sloe, can harbour the fungus; diseased leaves should be burnt, as they contain the resting spores for reinfection in the spring.

* Recent investigations have shown that this parasite produces an ascophore stage on mummified fruit two years old: and it is now referred to the group Pezizæ and known as *Sclerotinia fructigena* (*Trans. Acad. Sci. St. Louis*, xii. p. 91, 1902).

Plum Rust (*Puccinia pruni*).—Very similar remarks as to remedial measures apply to this. The fungus is very common on *Prunus* in the hedges, and when Plum-trees in gardens are attacked the damage done is often considerable in causing premature defoliation. Cherries, Almonds, Peaches, and Apricots also suffer from the same pest.*

Strawberry Mildew.—See Hop Mildew.

Apple Mildew.—This is caused by *Podosphæria oxyacantha*, which is found on Hawthorn and *Prunus avium* and *P. Cerasus.*

Pear-leaf Cluster-cup.—As the last of the long list of parasites which attack the members of this natural order this Cluster-cup may be referred to. It is an instance of a group of fungi which are known as *heterœcious*: that is to say, for part of the year they live on one host and for the other part they live on a perfectly different one. The habit of the parasite on these two hosts is absolutely distinct, and in most cases one could never guess that it was the same fungus in a different phase of its existence. The grass rust, caused by *Puccinia graminis*, is the most familiar example of a heterœcious parasite, and is the one described in botanical text-books; part of its existence is spent on cereals and grasses, and the other part on the Barberry.

The fungus which causes the Cluster-cup of Pear-trees is *Gymnosporangium sabinæ* (see JOURNAL, xxvi. p. 724), and the other host which is required for its existence is *Juniperus Sabina.* We see, therefore, that in the case of heterœcious parasites the two hosts that are necessary are not nearly allied to each other, but of widely separate orders. Thus, in looking for wild plants which may afford a home for these particular garden pests, we must not confine our search to plants of the same order, as we have done for the most part hitherto, but extend it to plants as widely separated as Barberry and Grass, or Pear-trees and Conifers. This, without the knowledge of the life-history of the fungus, would be utterly impracticable, especially when one remembers that the Cluster-cup on Pear leaves has no resemblance whatever to the teleutospore stage of the same fungus on Juniper. The life-history of the fungus and the exact host-plant it requires must be known, and the knowledge that botanists have gradually acquired after years of labour is of all importance, if gardeners are to deal successfully with such a parasite as *Gymnosporangium.*

On Pear leaves the disease hardly looks like Cluster-cup to the naked eye, but more like little horns arising from brown spots. The horns are really, however, very elongated cups full of spores. The cups burst when ripe, and the spores blow away and infect the Junipers. In some parts of the country the disease is very prevalent and greatly affects the health of the trees; in other parts it is quite unknown. This, no doubt, may be often accounted for by the Juniper necessary for its existence being absent.

On this latter plant the disease shows itself by producing swellings on the branches, from which orange-coloured masses of spores protrude in spring; these are very conspicuous in damp weather, as the gelatinous

* Attention need not be drawn here to what are known as biological species, as in the light of the most recent research—*e.g.* "Grass Rust" (H. Marshall Ward, *Ann. Bot.*, xvi. 1902, p. 300)—it appears that the parasite can, by gradual transition from one variety to another, secure a large range of hosts.

matrix in which the spores are embedded swells, and often hangs to a length of 4 or 5 inches; but in dry weather it shrivels up and may easily be overlooked.

The spores produced on the Juniper give rise to minute secondary spores which are capable of infecting the leaves of any Pear-tree in the neighbourhood.

The mycelium of the fungus is annual in the leaves of the Pear, but perennial in the branches of the Juniper. Hence inoculation from the latter to the former must take place each spring. The remedy, therefore, is to remove Junipers if the Cluster-cup on Pear-trees is to be destroyed. On the other hand, if it is wished to save the Junipers, all infected branches should be cut out and the wounds tarred; it is no use to remove the Pear-trees alone, as the mycelium is perennial in the Junipers, and can go on increasing without reinoculation each year.

CUCURBITACEÆ.—The Vegetable Marrow Mildew.—This mildew (*Erysiphe Cichoracearum*) is also found on many Composites, such common weeds as Groundsel and Sow-thistle being frequently attacked by it. If these, therefore, are left to grow amongst Marrows, it is small wonder if the disease gains ground.

LABIATÆ.—The Mint Rust is a very troublesome pest to garden Mint; it is also abundant on the wild species of *Mentha* and other *Labiatæ*, hence they should be strictly watched.

An additional difficulty in the extermination of this particular rust (*Puccinia Menthæ*) is found in the fact that the fungus mycelium is perennial in the rootstock of the Mint; thus, when once it has gained an entrance, it is almost impossible to get rid of it. Cuttings which appear quite clear of the pest often contain portions of mycelium, which sooner or later shows itself by producing pustules. The best plan is to obtain a fresh healthy stock, and plant it in a different part of the garden, but first make sure that all infected Mint plants are dug up and burnt. As Basil, Thyme, and Marjoram are subject to the same rust, diseased plants of these herbs should be destroyed, if the fresh stock of Mint is to be kept clean.

URTICACEÆ.—The Hop Mildew, which is caused by *Sphærotheca Humuli*, sometimes does enormous damage in Hop-gardens. *Humulus japonicus* is also attacked by it. As well as destroying Hops, it is very common on many weeds of various orders, and of late years it has become particularly troublesome to Strawberry-growers. A full account of this disease is given by E. S. Salmon, JOURNAL, XXV. p. 132.

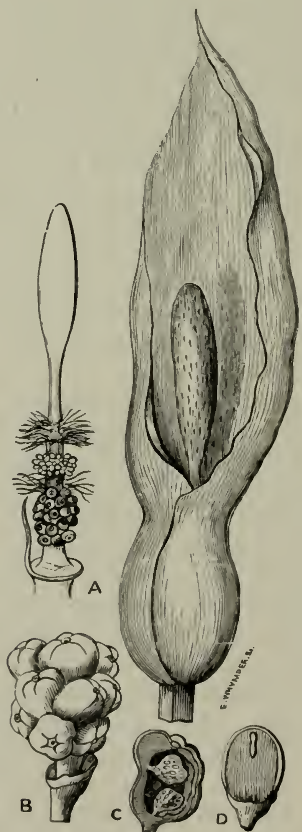
LILIACEÆ.—Several plants of this order are disfigured by a fungus, *Urocystis colchici*, which causes black streaks on the leaves. *Colchicum autumnale, Scilla bifolia*, and species of *Muscari* are some of those most commonly attacked; the black streaks are masses of spores. Wild liliaceous plants may also be infected, so care should be taken lest these are propagating the disease. (M. C. Cooke, *loc. cit.* p. 399.)

Many other cases might be mentioned of plant diseases growing on weeds and wild plants, but the limits of this paper only permit of attention being drawn to the best known and most commonly occurring examples; every cultivator could doubtless extend the list by his own personal observations.

Conclusion.

As a general rule, it will be seen that only the wild plants most nearly allied to the cultivated forms are likely to be infected by the same disease; but there are so many exceptions (*e.g.* Marrow and Hop Mildews) that this cannot be taken for granted; whilst in the case of heterœcious parasites, like the Pear-leaf Cluster-cup, the most unlikely plants are frequently the culprits.

In many of the cases mentioned it is comparatively easy to remove the sources of infection, but in others it is more difficult, notably those of fruit-trees. It will, however, generally be found that even in the latter something may be done in the way of prevention; and failure need not be courted by innocently planting a crop in the neighbourhood of diseased plants; for instance, when planting choice varieties of Plums, one would avoid Blackthorn as a neighbour. But when once the cultivator is alive to the existence of such dangers, each one for himself will strive not only to cure his diseased plants, but to exterminate other plants which may be providing a nursery-ground for the mischievous germs.



ABNORMAL "FLOWERS" OF HELENIUM AUTUMNALE, L.

By W. C. Worsdell, F.R.H.S., F.L.S.

Mr. F. Crisp, of Friar Park, Henley-on-Thames, kindly selected and forwarded to me on request some capitula, or flower-heads, of the above-named plant of which he possessed several specimens, some or all of which, since August last, when they first flowered, were badly affected. Strasburger * has described abnormal flowers, with special reference to the ovule, in *Helenium Hoopesii* A. Gray. Masters,† in various places, has brought forward similar abnormalities to those I am about to mention.

Fig. 209.—Normal "Flowers."

No really *complete* and clear account has, however, ever yet been given of the so-called "sports" in this genus, which I now propose doing.

These abnormal flowers exhibit two chief phenomena, viz. *virescence* of organs usually coloured or colourless, and *proliferation of axes* usually extremely short or suppressed, both these constituting parts of the general *vegetative* development of organs usually confined to subserving functions connected with reproduction.

Amongst the malformed flowers there were a few which were fairly

* *Angiospermen und Gymnospermen*, 1879, p. 43.
† "Sidelights on the Structure of Composites," *Journ. Bot.* 1878.
Gardeners' Chronicle, 1885, ii., p. 621.
Pflanzen-Teratologie (trans. by U. Dammer), 1886, pp. 299, 388.
Gardeners' Chronicle, 1902, Nov. 29, figs. 138, 139, p. 405.

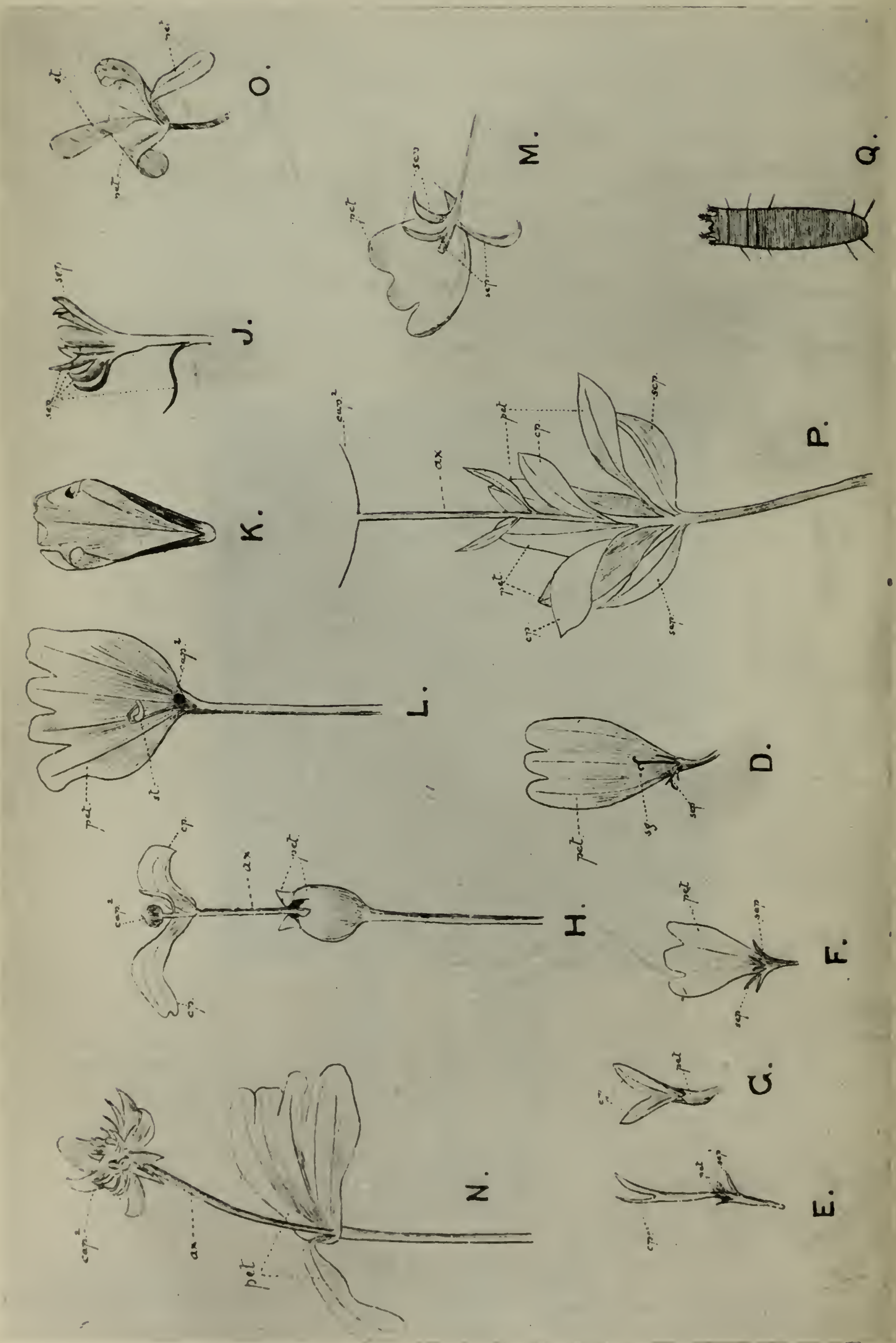


FIG. 210.

D.—Ray-floret showing very slight virescence in which the pappus is in the form of small green leaves.
E.—Disc-floret showing green calyx, normal corolla, and slightly virescent carpels.
G.—Disc-floret with normal corolla and virescent carpels.
H.—Proliferated disc-floret bearing, as lateral foliar members, the virescent corolla and carpels, and producing a terminal secondary capitulum.
J.—Disc-floret with virescent calyx and corolla.
K.—Transitional form, near periphery of capitulum, between tubular disc- and ligulate ray-floret.
L.—Ray-floret showing a 4-lobed corolla, a slightly virescent stamen, and a minute secondary capitulum borne at the end of the proliferating axis of the floret.
M.—Ray-floret (lower side) showing calyx of 5 green sepals.
N.—Ray-floret showing corolla of which one of the five petals is completely separated and the axis proliferated to form a secondary capitulum of normal structure.
O.—Ray-floret with one of the corolla-lobes distinct and two virescent stamens.
P.—Proliferated ray-floret showing calyx, corolla more or less resolved into its constituent petals, the two foliaceous carpels, and the axis bearing two bract-like foliar organs, and a terminal secondary capitulum of normal structure.
Q.—A *Phytoptus* belonging to another species. Nat. size $\frac{1}{200}$ in.

regular and normal (fig. 209). Of the former, those which, as far as external appearances went, deviated least from the ordinary condition, did so owing to the fact that the pappus of the disc- and ray-florets was often present in the form of 5–8 *green*, linear leaves (fig. 210, D, E, F, J, M), while the ovary was somewhat enlarged and elongated. Here we have an index to the true calyx-nature of the pappus.

Within these ovaries in almost every instance was concealed a very young *shoot* which in most cases was more or less distorted owing, probably, to its efforts to grow out beyond the confines of its prison-house (fig. 211, B, C); in one instance, however, the young shoot did not extend to the top of the ovary; the rudimentary foliar organs could be seen at the apex of these shoots (fig. 211, B, C). The latter must probably be regarded as an extension in growth of the normally abortive axis of the floret. As these abnormal changes would be almost certainly contemporaneous with a very early stage in the development of the flower, we may conclude that the commencement of proliferation of the axis of the floret would occur at a time when the basal ovule was either entirely undeveloped or in an extremely rudimentary condition. If the former, the shoot would completely replace it as a basal production in the ovary; if the latter, the ovule-rudiment would be easily displaced, if not obliterated, by the more vigorous vegetative organ, the vegetative metamorphosis of the ovule itself being prevented from the same cause. Professor Čelakovský, of Prague, whose recent death we deplore, has, in my opinion, shown beyond reasonable dispute, from his study of the vegetative metamorphoses of the ovules in various Cruciferæ, *Reseda*, *Aquilegia*, &c. (in which he found *every transitional form* between the normal and the extreme virescent condition), that the ovule is the homologue of a *leaflet* or *segment* of a carpel. Now, as *all* ovules must possess the same morphological value, the above must also apply to the ovule of *Helenium*. It would be, therefore, absurd to suppose it possible for the basal ovule in this genus, as Strasburger asserts, to develop into a shoot. It might truly, as he also asserts to be the case in *H. Hoopesii* A. Gray, arise adventitiously from the funicle of the

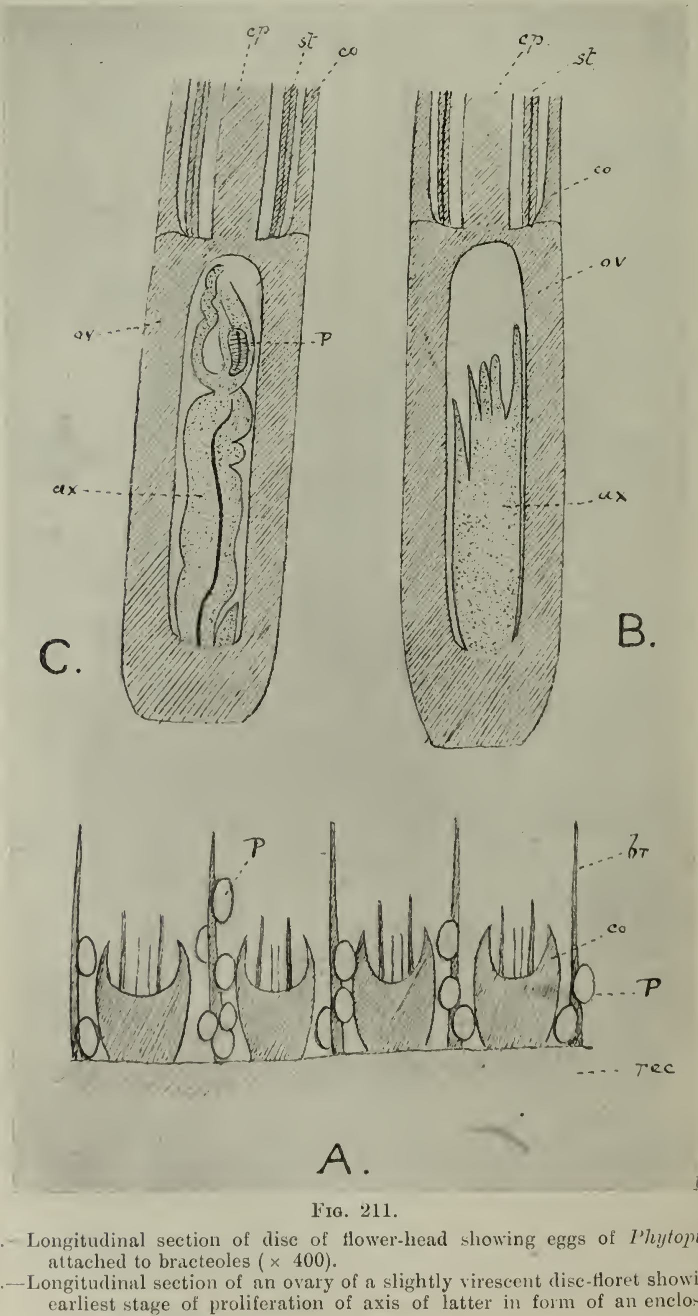


Fig. 211.

A.—Longitudinal section of disc of flower-head showing eggs of *Phytoptus* attached to bracteoles (× 400).

B.—Longitudinal section of an ovary of a slightly virescent disc-floret showing earliest stage of proliferation of axis of latter in form of an enclosed rudimentary shoot.

C.—Ditto.

ovule; it is also quite possible that it might develop *adventitiously* from any part of the ovule; but that is totally different from the idea of an actual proliferation into a shoot of the ovule itself, this latter being, for the reason above given, a morphological impossibility, and this in spite of the assertions of Peyritsch and others to the contrary.

What the exact course of events is in the particular case before us I am unable to precisely determine from the longitudinal sections of the ovaries which I made, but I interpret it according to the above description.

FIG. 212.—CAPITULUM SHOWING PROLIFERATION BOTH OF DISC- AND RAY-FLORETS, AND ALSO SPIRAL TORSION.

In one ovary, a minute papilla, which might represent the abortive ovule, was present at the side of the shoot at the bottom of the ovary. The rudimentary shoot within the ovary of these scarcely modified disc-florets is most probably identical with, and represents the earliest stage of, the leafy shoot (fig. 210, H) proliferating out of the disc-florets at a more advanced stage of the metamorphosis. This being so, it would seem unlikely that this leafy shoot (figs. 210, H and 212) could be anything else than a natural prolongation of the ordinary but usually suppressed axis of the floret. This view of the matter appears to me much more reasonable than the supposition of the shoot being either an adventitious outgrowth of the ovule, or that this latter is itself of axial nature and has given rise by proliferation to the shoot; in fact, this latter is impossible.

On closely examining this exceedingly minute enclosed shoot, there was found, lying in a more or less distorted condition, amongst the small foliar organs near the top of the shoot, the probable author and cause of

FIG. 213.—CAPITULUM ALMOST ENTIRELY COMPOSED OF VIRESCENT CARPELS; LIGULATE COROLLA OF RAY SEEN IN ONE PLACE.

the abnormalities in these flowers, viz. the annulate body of a *Phytoptus* (fig. 211, C, P), having a length, in its distorted state, of about 45–50μ (the length of a normal, fully extended creature being about 100μ) (fig. 210, Q). These excessively minute animals probably entered the flowers during a very young condition of the bud stage. This must necessarily follow from what we know of the character of the various virescent organs of the flower, for the profound nature of the metamorphosis and radical alteration of the ordinary character of so many of the organs could only have been incurred through the tendency to virescence, and vegetative development generally, having supervened at a very early period, viz. when the organs were represented by very young and entirely undifferentiated rudiments. This is a rather important point to remember. The eggs of the creature were observed in considerable quantity attached to the bracteoles between the disc-florets in a longitudinal section of one of the flower-heads (fig. 211, A).

In many cases, though not quite in all, in which the disc-florets have become conspicuously virescent, the ray-florets (possibly in correlation therewith) have shown but little development, yet in some cases they also have proliferated. The former case is seen in figs. 213, 214, 215, where

FIG. 214.—CAPITULUM ALMOST ENTIRELY COMPOSED OF VIRESCENT CARPELS; SPIRAL TORSION ALSO SHOWN.

the carpels of all the disc-florets are developed as small green leaves, two to each floret; they are usually tipped with pink; the same are also shown in fig. 210, E, G, where the minute yellow corolla is seen to be unaltered. In all these cases the inferior ovary disappears as such, as also do the ovules. Of the leafy carpels, the upper portion must be regarded as representing the styles and the lower part the ovary; they clearly indicate the bicarpellary nature of the pistil. In these instances the impulse to vegetative or virescent growth probably set in *after* the corolla and stamens were already formed, seeing that these latter two sets of organs have been left untouched and in their normal condition. In these florets the calyx was generally present in the form of about eight green, linear leaves. It should be mentioned that frequently there appeared to be three green leaves present in the place of the carpels; this was found to be due to the fact that one of the latter was deeply forked. In the next case to be considered, however, the virescence must have set in at an earlier period, viz. before the maturity of the corolla, which, as seen in figs. 216 and 210, H, has developed, in the majority of florets, to an abnormal size, at the same time becoming perfectly green instead of yellow. The non-development of the stamens and pistil in these cases is doubtless correlated with this exceptional growth of the corolla.

In some capitula the disc-florets, besides becoming virescent, had proliferated into shoots (figs. 212 and 210, H); the virescent corolla itself was

FIG 215.—CAPITULUM SHOWING BOTH LIGULATE COROLLAS AND VIRESCENT CARPELS OF A FEW DISC-FLORETS.

FIG. 216.—CAPITULUM WITH GREAT DEVELOPMENT OF VIRESCENT COROLLAS OF DISC-FLORETS.

carried up on a long stalk, and the axis of the shoot was continued for a considerable distance beyond it, bearing, not far from its summit, a pair of small foliage-leaves: the exceedingly vegetative and luxuriant carpels; at the top of all was a young secondary capitulum or flower-head (fig. 210, H). In some of the more peripheral florets an early stage of the proliferating axis could be observed as a minute shoot springing from the centre of the floret, bearing 1–3 small green leaves, probably the carpels, which protrude beyond the mouth of the corolla; between them and borne at the tip of the shoot was a tiny capitulum. The earliest stage of this proliferation, where the shoot is as yet confined within the ovary—in other words, enclosed between the fused basal portions of the two carpels—has been described above.

All such cases of proliferation of the florets into shoots represent the extreme form in which the tendency to *vegetative*, as opposed to the tendency towards the more usual *generative* development, sets in.

Passing outwards from the centre to the periphery, we find in certain heads, but not in all, that forms standing midway between the tubular disc- and the ligulate ray-florets occur; and occasionally more or less

FIG. 217.—CAPITULUM SHOWING EXTREME CASE OF PROLIFERATION OF RAY-FLORETS; ALSO THE TRUMPET-SHAPED CHARACTER OF THE RAY-FLORETS OF THE SECONDARY HEADS.

trumpet-shaped ray-florets resembling in shape those of *Centaurea* may be seen; in such cases typically shaped ray-florets are, as a rule, absent. Such transitional structures are very interesting as showing that the two types of florets are essentially identical in structure. These semi-ligulate, semi-tubular florets are usually of a yellowish-green colour (fig. 210, K; fig. 217. It was interesting to note that in a few heads yellow tubular florets, of much greater size than those normally occurring in the disc, were observed to be situated *outside* the ligulate florets of the ray.

Another interesting point is that in certain secondary capitula one or two ray-florets were situated independently some little way down the peduncle, thus quite outside the flower-head itself; this appears to be a partial reversion of the latter to a more elongated spike-like inflorescence.

In the ray-florets the ovary also ceases to be any longer inferior in position and becomes replaced, in the least proliferated forms, by a short solid stalk (fig. 210, D). A great feature of the abnormal capitula in this plant is the complete virescence of the corollas of the ray-florets, yielding to the flower a quite remarkable, even beautiful appearance. This character represents, of course, part of the results accruing from the tendency to *vegetative* growth. The cases in which the corolla is entirely of a green colour are less common than those in which the segments, or fused petals, are of a somewhat duller green and tipped or partially bordered with yellow. The corolla may be all of one piece, and in such case may consist of 3–5 segments or fused petals (fig. 210, D, F, L, M), or it may be variously split up, one or two detached petals being situated in a lateral position or on the *inner* side of the floret (fig. 210, N, O, P). In many florets the calyx is conspicuously developed as 2–5 green leaves (fig. 210, D, F, M, P). As regards the stamens, of which, in the disc-florets, no unusual development takes place, these are, in the ray-florets, very frequently more or less vegetatively developed; no longer connate to form a tube, but separate and distinct, they are at the same time often much enlarged and more or less virescent and petaloid (fig. 210, O). These latter still often betray their origin by the slightly incurved tips or margins and less regular shape as compared with the petals, which curled and somewhat twisted character (even retaining part of the original anther-structure) is naturally still more evident in the less modified forms (fig. 210, L). Where, however, the tendency to vegetative development runs in the direction of shoot-formation, the stamens are either less virescent (fig. 210, L) or entirely suppressed, according as the shoot has become less or more proliferated beyond the floret. In some instances the stamens (usually recognisable by their curled tips) are carried up as perfectly green small foliar members of the shoot, and in such cases may be confused, and are actually frequently confluent and connate with the equally virescent carpels, as if, indeed, they were playing a new rôle, viz. that of true vegetative foliar members or bracts of the shoot. In one such case, besides the three thus carried up, there were two other stamens (thus completing the five of the normal florets) at the base of the shoot, one of which was curled and showing an antheroid structure, but greenish in colour; the other foliaceous, with yellow edges, and slightly curled at the tip of one corner.

Fig. 210, L shows a minute secondary capitulum terminating a scarcely developed shoot (the prolongation of the axis of the floret); indeed, every ray-floret possesses, deep down within its tubular portion, a very minute secondary axis, each with its capitulum. In other instances the shoot-development has greatly advanced, bearing a secondary capitulum of ordinary size (figs. 217, 218, cap.[2], 210, N, P). In such often no sign of the stamens appears, but in some the carpels are conspicuously in evidence (fig. 210, P).

There may be present as well a few small green leaves, which I interpret as bracts pertaining to the secondary inflorescence (fig. 210, P).

Fig. 217 shows how the ray-florets of the secondary capitula exhibit the curious semi-tubular or trumpet-shaped condition. It affords at the same time an excellent example of the extreme proliferating habit of the primary ray-florets.

A further fact in connection with these various virescent productions may be mentioned, viz. that the bracteole subtending each individual floret

FIG. 218.—CAPITULUM SHOWING PROLIFERATION OF RAY-FLORETS AND PRODUCTION OF NORMALLY FORMED SECONDARY HEADS.

of the disc has become abnormally elongated, and at the same time green.

And I would point out the interesting physiological fact of *spiral*, downwardly directed torsion, exhibited by such capitula as those of figs. 212 and 214.

In conclusion, I may draw attention to the fact that these abnormal flowers of *Helenium* are not "sports" or "monstrosities" in the rigid sense of the word. For they display no structural development which is in any way foreign to, or subversive of, the ordinary laws of vegetable growth. They are "sports" or "freaks" only in the sense that the various parts of the inflorescence which, in the normal condition of the genus and order, are, for special purposes connected with the reproduction of the plant, specially modified in the direction of, as it were, a contraction and suppression of their vegetative growth, become, under the stimulation of the tiny *Phytoptus* (the exact rationale of which we do not yet understand), induced or forced to assume an extreme expansion of growth and a vegetative development like that of the more actively growing parts of the plant. But it should ever be remembered that all these changes, whether caused by parasitic stimulation or other agencies, are always governed by the ordinary definite laws of vegetable growth, and represent what is merely a further extension in development of parts already present. No new organs appear, but only the same old organs under a modified (in the direction merely of luxuriant vegetative expansion) form.

But I go further than this, and maintain that these abnormal developments, especially when *gradual transitional stages* occur between the perfectly normal and the extreme abnormal form, throw great light on the exact morphology of the different organs affected, and this I have already drawn attention to in the foregoing pages. For example, from these virescences, we should learn, even if we never knew it before, that the ovary consists of two carpellary leaves; that the stamens and carpels are foliar organs borne at all times on an axis (the various proliferations being but upward extensions of the normally suppressed axes of the florets); and that the corollas of the two kinds of florets are homologous structures, both modified to subserve their highly adaptative functions.

A quite interesting point, as illustrating what I hold to be the true views of Nägeli, Drude, Grant Allen, Čelakovský, and others, as to the origin of the petals from the stamens, is the fact that in some of the virescent forms of the ray-florets the yellowish foliaceous stamens are hardly distinguishable from the narrow, separated segments of the ligulate corolla, as is well seen in fig. 210, o.

From these cases we further learn that the pappus (an adaptation to subserve fruit- and seed-dispersal) is merely a highly modified calyx, whose segments have not only become hair-like in texture and colourless, but also subdivided into a greater number of members than the usual five. If the pappus is not the homologue of the calyx, where are we to look for the latter in the normal floret? for it cannot be supposed to be entirely absent! In view of the fact that in the virescent florets there is very frequently present *below the corolla* a whorl of small, green, linear leaves, the conclusion inevitably must be that this whorl is the calyx appearing in its natural position, while the pappus in these cases is absent as such. The idea that the two are homologous is further strengthened by the fact that, in cases where these little green leaves are incomplete in number, minute subulate or hair-like structures occur either amongst or close above or below them; these are probably remnants of the normal pappus-formation.

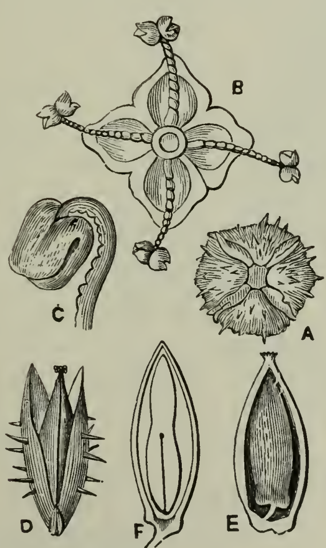
Finally, we learn that the capitulum itself is a contracted or suppressed axis or shoot, bearing great numbers of laterally placed sessile flowers ; in other words, a " spike." In the abnormal proliferated condition it ceases to be a spike, and becomes a complex racemose inflorescence, owing to the fact that the individual flowers composing it (each in itself an axis bearing lateral foliar organs) proliferate and repeat the structure of the mother spike.

Obscuration of the true morphological nature of some of the organs of the flower has been carried very far in the case of the *Compositæ*, owing to the exceptional methods of adaptation to the processes of fertilisation and seed-dispersal obtaining in this group. We should, therefore, hail with satisfaction the appearance of these so-called " sports " and " freaks " as the documents containing the exact and irrefragable record of the true meaning and morphological nature of the otherwise so often obscure and modified normal structure. Studied and regarded in the proper light, they should be (as, amongst the majority of botanists, they are far from being at the present day) of great service in the solution of many morphological problems.

In conclusion, I wish particularly to thank both Mr. F. Crisp for the care and trouble he took in obtaining the flowers for me, and Mr. L. A. Boodle, of the Jodrell Laboratory, Kew Gardens, for the photographs accompanying this article, and also the editor of " The Garden " for lending me figure 209.

LIST OF ABBREVIATIONS USED.

Cap.[1] = primary capitulum ; cap.[2] = secondary capitulum ; ray co. = corolla of ray-floret ; disc co. = corolla of disc-floret ; sep. = sepal ; pet. = petal ; st. = stamen ; cp. = carpel ; sg. = stigma ; ov. = ovary ; ax. = proliferating axis of floret ; br. = bracteole ; rec. = receptacle ; P. = *Phytoptus*.



BULB-EXTENSION IN DECIDUOUS ANDINE AMARYLLIDS.

By A. Worsley, F.R.H.S.

Among the following genera and sub-genera indigenous to the Andes, viz. *Ismene*, *Elisena*, *Chlidanthus*, and *Habranthus* [and probably also in *Placea*, *Phycella*, and *Eucrosia*], certain characteristic bulb-growth has been noticed by various writers. None of these writers have, as far as I am aware, given any comprehensive explanation of the facts which they had noted. In place of this we find rather disjointed notes scattered over a vast literary field, and in fact many mutually destructive theories have been advanced to explain what some considered abnormalities.

Other authors—and these are the majority—take the very superficial view that such bulbs are drawn underground by the action of their "contractile" roots. Without denying that the roots of these bulbs may exercise a special function of this kind, yet I am convinced that we should not seek *here* for the sole, or even the main, cause of subsidence. Such bulbs begin to bury themselves before they have any true roots, and continue to do so after, but not solely because, root action has begun.

The life-history and race-history of these plants show that they sustain a constant struggle to bury themselves in the soil.

On germination of the seed the original process (the cotyledon of some writers) transposes the embryo from the seed and causes it to undergo the process of weaning often half a foot deep in the ground. (See p. 853, fig. 191.)

The young bulb, perhaps during its first deciduous period, certainly every year after attaining maturity, loses by decay the whole upper portion of the bulb. Simultaneously a still greater growth and swelling occurs in the lower part of the bulb.

In the full-size drawing here given the upper half of the bulb is already dead, and the point of issue of the new leaf-growth will be from the constricted middle (or waist) of the bulb upward through a crater-shaped hole in the dead upper part of the bulb (which was filled in the year previous by the bases of the leaves).

The top of the bulb maintains in the pot its original level, thus showing that, in this case at least, the bulb has not been drawn downwards by "contractile" roots, but the great growth in the lower part of the bulb has in reality formed a new bulb below the original one, and it would appear as though the only part of the plant which persisted from year to year was the root-stock (disc). When leaf-growth recommences and the soil becomes moist the dead upper portion of the bulb will speedily disappear and perish.

It is very easy to trace this regular process of events in gardens where Ismenes or Elisenas are grown in pots. For to keep them in good health it is almost necessary to repot them all in autumn, at which time every bulb will be found near the bottom of the pot, with the dying old bulb-tunics in various stages of decay above it.

With *Habranthus* and *Chlidanthus* much variation will be found in the shapes of the bulbs: some will have buried themselves more than others, some not appreciably. Seasons also appear to influence the burying propensities of these latter plants. There are writers who place much importance upon the power of the roots to clasp large stones &c., and by their growth draw down the bulb through the soil.

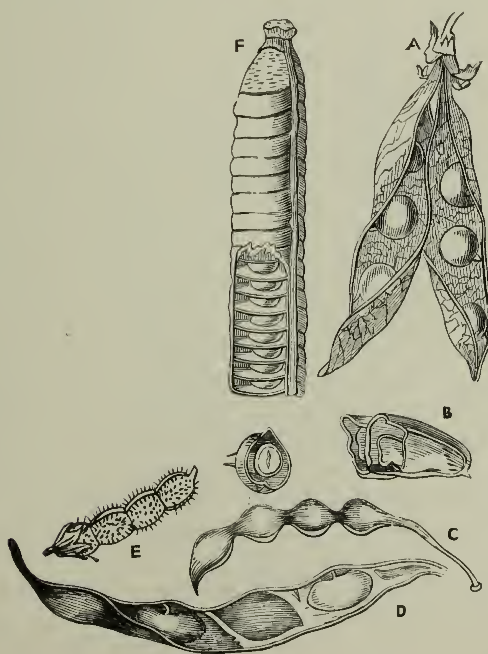
It is evident to me, however, that it is not necessary, in the cases of the plants with which I am dealing, to have recourse to this theory. The yearly growth downwards and laterally of the lower part of the bulb and the yearly death of the upper part account quite satisfactorily for all the facts that have been noted concerning them.

The fact that I selected a hybrid *Ismene* to draw from was because it happened to present at the time a typical instance of growth; not more so, however, than either parent exhibits at the same season.

A great part of the Andine regions are situated in zones of "dry and wet seasons." In many cases the soil is easily disintegrated and the gradients very steep.

On such steep hillsides the heavy and sudden rains falling on desiccated soil cause great detrition, and any bulb lying on the surface is liable to be washed away. By establishing themselves at a deeper level some immunity from such accidents is attained. The bulbs also avoid the extremes of surface temperature both in summer and winter, the attacks of hungry animals, and countless other chances to which surface bulbs must be exposed, not to mention the possibility of being started into growth by any slight showers of rain during the dry season.

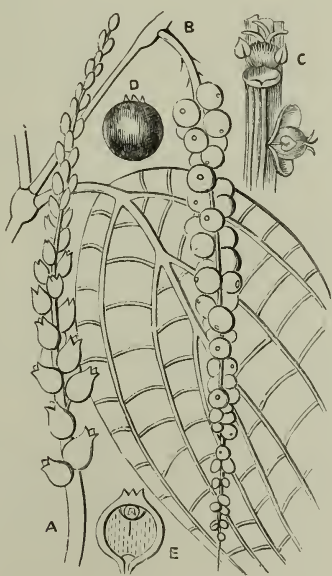
Possibly there may be other advantages gained by these self-burying plants.



CORDYLINE INDIVISA = TOI OR MOUNTAIN PALM.

By Mr. R. S. Thompson, Vice-President of the Normanby (New Zealand) Horticultural Society.

I believe it to be strictly within the functions of a Horticultural Society not only to encourage the growth and improvement of products already known, but to seek out and introduce to the notice of the government and people of our colonies such specimens of the flora of New Zealand as promise, by cultivation, development, and expert treatment, to add to the staple productions and to the industries of the Empire. Taking this for granted, I wish to bring before the notice of the Society a plant indigenous to New Zealand which yields a very strong and fine fibre, with a view to experiment as to the best mode of treatment for extracting that fibre, and also the most suitable method of reproduction and culture, in order to obtain a speedy maturity, and the maximum quantity of fibre annually. The botanical name of the plant is *Cordyline indivisa*, but I have failed to find it described in Kirk's "Forest Flora," and am indebted to Williams's Maori Dictionary for its classical name. Kirk, however, mentions that there are six species of *Cordyline* in New Zealand, but confines himself to a description of *Cordyline australis*, the ordinary Cabbage-tree Palm. Kirk speaks of the utility of this latter, both in leaf and trunk, for paper-making purposes, but as these matters have lately been brought into notice by our timber expert, Mr. Freyberg, they may be safely left in his hands. I am not aware that *Cordyline indivisa* has ever received a European name other than the botanical one, hence I have ventured to call it the "Mountain Palm." Palm-trees are generally associated in our minds with sunny fountains and coral strands, but the Palm under notice invariably grows at high altitudes. It was first brought to my notice some twenty-five years ago as an edible plant, when a party of natives returned from an exploration trip up the Tararua Mountains, the chief saying, "There is no food on that mountain, only *Toi*." Notwithstanding its native habitat, it flourishes exceedingly well when brought under cultivation in the lower lands of the colony, and I believe reaches maturity in less time than when, on its native heights, it has to struggle with the severe cold and biting frosts of a semi-Alpine altitude. Both in its wild state and under cultivation the full-grown tree is a most beautiful object, of the ideal form of the Palm familiar to all in artistic pictures, and when in blossom it throws out a flower-stem two or three feet in length, so thickly covered with dainty white flowers as to give it the appearance of one immense blossom, which subsequently yields innumerable seeds. The native name of the tree is *Toi*, and it was much valued by the aborigines for the high quality of the fibre it produces. A mat made of it is said to be thoroughly impervious to rain, even in inordinate quantities, and in proof of this the Maoris have a tradition that of two men caught in a bitter blizzard of days' duration, the one with a *Toi* mat survived, whilst the other, with three capes of [New Zealand] flax fibre, perished miserably. Not only is the fibre proof against wet, but it is exceedingly durable, immensely strong and tough, and is free from all gummy and resinous matter. As is well known, the fibre of *Phormium tenax*, the so-called flax of New Zealand, lacks continuity; it is a combination of an immense number of minute lengths of fibre which can be divided almost indefinitely, and these are joined together by an adhesive gum, which is very difficult to extract, and the extraction of which tends to the disintegration of the thread. Now the name of *indivisa* botanically applied to the Mountain Palm suggests that possibly the name was given on account of the absence of any such break in the continuity of the fibre, and as a matter of fact close observation results in the discovery that each fibre of the Mountain Palm is of individual and continuous identity throughout the entire length of the leaf. A peculiar property of both leaf and fibre is that they will stretch and are to a large extent elastic, a quality which has not come under my notice in any other plant. The native mode of cleaning the fibre is by wetting the leaf in the softest water procurable. The native way of cleaning flax (*Phormium*) is by scraping the leaf, and as our machinery imitates but falls far short of native manipulation in excellence of results, we might also follow their lead by attempting the retting process with the *Toi*, as this also is the method of freeing linseed fibre (European Flax) from extraneous vegetation. I would suggest that the Society should communicate with the Government in order that experiments as to its growth and propagation should be made at experimental stations. I believe there can be no doubt about the value of the fibre, and the only questions to be settled are, the rapidity of growth of the plant, and the quantity of fibre which each plant will yield per annum. To discover these important points exhaustive experiment is warranted.



WASTED OPPORTUNITIES OF FRUIT-GROWING IN ENGLISH VILLAGES.

By Mr. Owen Thomas, V.M.H.

[Read at the Horticultural Club, Jan. 13, 1903.]

That the power and usefulness possessed by Horticulture in influencing the national life and prosperity of Great Britain are much greater than it receives credit for, is, I think, undoubted. That influence has been expressed and demonstrated in many ways, but I think it has been more particularly expressed during the past century in what may be called two distinct forms of gardening. One may be called the luxurious and ornamental, and the other the commercial and utilitarian. The expression of the former is seen in the creation and embellishment at enormous cost of thousands of beautiful gardens scattered through the British Isles. These range in size and importance from the princely and palatial gardens of hundreds of acres to the more modest surroundings of suburban homes. This development of the higher art of gardening has been made possible by the encouragement of our royal, noble, and wealthy houses, and by the genius, industry, and perseverance of the past generation of British gardeners, the combination resulting in the possession by England of gardens and parks which are the admiration and the envy of the whole world, and are one of her most cherished possessions.

The development of commercial gardening has been equally as great as that of ornamental, and much of its success can undoubtedly be traced to the influence upon the nation exercised by the older and more luxurious art which in its train has called forth the creation of our great nurseries and seed-houses, and the hundred and one other industries it has brought forth and fostered into prosperity.

To our towns and cities Horticulture has been a liberal benefactor, as witness our beautiful parks and gardens, which, as recreative and educational places of resort for the teeming thousands of our crowded towns, are now deemed by many as indispensable to the public welfare as are our schools and other educational institutions. Indeed, to our town population Horticulture has been prodigal in its lavishness of good things. In the neighbourhood of large towns throughout the kingdom it has been the means of establishing, upon hundreds if not thousands of acres, glass-houses in which to grow the choicest of fruit, flowers, and vegetables for their sustenance and delectation.

Seeing then the immense and beneficent power Horticulture has exercised in the development of the higher and commercial aspects of gardening in this country, it may not unreasonably be asked—What has Horticulture done during this long time for the rural working population of England? The answer, I am sorry to say, must be practically, "Very little indeed." I am far from ignoring the fact that the love of flowers, so deeply rooted in the hearts of our working people, into whose life it brings so much brightness and pleasure, and so well expressed in our village cottage flower gardens and windows and at our village flower-shows, is the direct result of the example given by our wealthy patrons of Horticulture. But on the industrial aspect of gardening as it affects our rural population, Horticulture as yet has scarcely made its influence felt at all. The migration of our country population into the towns in such large numbers of late years has been much deplored by all thoughtful men and women, both in the interests of the people themselves and that of the land. There are many theories advanced as to the cause of this, and the remedies to apply. Most of these, as far as I have seen, are of a nature requiring the enactment of special laws before effect can be given to them, and are therefore more or less of a political character and outside the scope of this paper. But there are other causes at work exercising a powerful influence in determining this unfortunate exodus of our working population from the country to the town—causes which, in my humble opinion, Horticulture is capable of arresting, and not only of arresting but of turning the current the other way and bringing the people back to the country.

The cause of this exodus must not be looked for in the nature of the work, whether of the garden or of the farm. Husbandry is the most honourable and health-giving of all callings. What then, may we ask, are the causes? I will only mention two, and these, I believe, are amongst the most powerful. One is the extreme poverty of interest associated with their homes, and the other is the low rate of wages usually paid for their labour.

As bearing on the first cause, I need only recall to the minds of those conversant with the associations surrounding the cottage homes of labourers in purely agricultural districts, their loneliness, their isolation, and the absence of congenial society and sympathy in their lives. What leisure the labourer possesses after working hours are over is usually spent in dull monotony, with no further apparent interest in life than to dream away the hours till bed-time. The bit of garden surrounding his home is as a rule devoted to the growth of potatoes, cabbages, and perhaps a few roots, with possibly an old stunted apple-tree and a few gooseberry bushes, the whole surrounded by a neglected and broken-down fence or hedge. What wonder that the boys and girls who have received a better education than their parents forsake such dull homes for the excitement of the town? I am speaking thus of the isolated homes of our workers far away from the influence and society of their fellows, and there are thousands of these. The condition of things in our country villages is no doubt better in this respect, as a result of healthy garden rivalry and under the influence of the gentry and clergy of the district and of the village garden-shows. But even here not a tithe is done for the comfort and well-being of the labourer's home surroundings that Horticulture properly applied is capable of doing.

What then, may be asked, are the remedies I would suggest? It is that every country cottage should have allotted to it at least half an acre of garden land, not necessarily adjoining the cottage, but as near to it as practicable, enclosed by a hedge or a fence. The land should be of fair quality, and if possible near a stream of water. After acquiring this land the first process to take in hand, with a view of as good a yield as possible, is to trench and manure it heavily, taking it for granted that it is well drained. Half this land should be planted with standard trees of Apples, Pears, and Plums, with bush fruit between, such as Currants, Raspberries, and Gooseberries, as is the custom of our best market gardeners. The remaining quarter of an acre could be devoted partly to Bush Apples, Pears, Cherries, and Strawberries, and in the hedge (which for preference should be formed of Quick) standard trees of Damsons, Prunes, and Crabs should be planted at distances of twenty feet apart. Moderate space must be allotted for the growth of vegetables, and part should be laid down under permanent crops, such as will occasion little trouble or labour in looking after, including Asparagus, Seakale, Rhubarb, Artichokes (these would come in for selling purposes), the remainder of the garden to be cropped with Potatos, Peas, Cauliflowers, and the usual vegetables annually grown from seed. The walls of the cottage could be furnished with fruit-trees. On the south and west Apricots and Peaches would succeed, and Plums and Cherries on the north and east. Once the labourer and his family became proficient in the growth of these crops, and realised their value, whether as daily food or for the purpose of sale, a new interest would come into their lives, and ample, interesting, and remunerative employment for their leisure, which would effectively drive away one of the prime conditions of discontent which I mentioned—namely, the poverty of interest associated with their homes.

We now come to the second cause of discontent—namely, low wages. Wages of agricultural labourers in the past, especially in some counties, have undoubtedly been very low as compared with labourers' wages in towns, hence the temptation to forsake the country; and I fear there is no immediate prospect of any material improvement in this respect unless recourse is had to putting an instrument in the labourer's hand, in the shape of a garden, wherewith he can, by his own and his family's labour in their leisure, supplement their week's wage. It is needless to say that a cottage and a garden, planted and cultivated as I suggest, might be made worth nearly as much to the labourer and his family in the course of the year as his wages. Indeed, this idea should be the moving spirit in the scheme, as nothing will convince a working man sooner of the advantage to him of any work he may do than the chink of the money in his pocket resulting from his labour. With the garden would be included such aspects of rural economy as preserving fruit, the pig yard, poultry run, and bee-keeping. As years passed on, so would this garden increase in fertility, and the crops in value, bringing to the workman in kind and in money a more satisfactory return for his labour than that which the town labourer receives, to say nothing of the more healthful conditions under which the countryman works and lives.

It may be objected that my suggestions are not capable of practical development, necessitating as they do a considerable expenditure of money to establish, as well as much technical skill and knowledge on the labourer's part in carrying out the work successfully. I grant that there are difficulties in the way; but they are only difficulties which could be easily removed; and I hold that the subject is so pregnant with beneficial possibility to the country workers of the future that the adoption of some such scheme is imperative. The question of expense in the initial stage of preparing and planting these gardens is perhaps the most serious, and many landowners might not feel themselves justified in going to such an expense, although in the case of each garden it need not cost very much, and the improvement to the estate would be so great in the aggregate as to compensate the owner for the outlay, to say nothing of having on his estate a more industrious, provident, and contented people. This source failing, a law, I believe, exists by which landlords can borrow money at a low rate of interest, with repayment extended over a long period of time, for the improvement of their estates, such as draining, reclaiming land, or the erection of necessary buildings. This would probably be available for the provision of these gardens. Should this not be so, then we have the County and District Councils to fall back upon. These bodies have lately taken a practical interest in this question, and I believe in some cases have not hesitated to charge the expenses of carrying out such works on the rates of the districts affected.

The second serious difficulty which would seem to interfere with the successful working of such a scheme is the fact of the absence of the technical knowledge necessary to carry out the work successfully amongst our agricultural labourers and artisans. This, no doubt, would prove a serious difficulty until the workman became interested and aware of the value of such knowledge and the possession of such a garden. He would not be long in availing himself of the information which in many counties is now furnished by lecturers on Horticulture employed by our County Councils. Indeed, the interest taken in the improved surroundings of the homes of the people is now so great that no difficulty would be found in bringing the knowledge to their doors of how to make the best of their gardens. I suggest half an acre of land as being the extent of the labourer's garden for the reason that I believe he and his family could manage to extract from this quantity of land all it is capable of yielding without any undue pressure of work; whereas if he had more it might tax his strength too much, and thereby become a burden.

I said that the garden should be enclosed by a fence or hedge; it should also have a tool-shed, large enough to shelter the workman in case of rain, and also a seat or two where he can enjoy his pipe and a chat with his family or friends. This enclosing of the garden gives a sense of possession, privacy, and enjoyment, which is impossible in a piece of land not so enclosed, similar to a colony of allotment gardens one frequently comes across in the neighbourhood of towns. I can never look at those very mixed and conglomerate plots of land without a spirit of sadness coming over me at the apparent chaotic state of disorder and the appearance of forlorn confusion they always possess. By hedging the land and planting fruit-trees, this depressing aspect would be altered, transforming the allotment garden into an adjunct of beauty and interest to every town and village.

In my opening remarks I pointed out what Horticulture has been the means of accomplishing in the higher, as well as in the commercial, aspects of gardening. I submit that its power of ameliorating and improving the position and home surroundings of our rural industrial population is equally great. We possess every favourable condition for the full development of such an industry to an enormous extent. We have some of the best land in the world, and, on the whole, the most thoughtful and considerate landowners. Our climate, for hardy fruit and vegetable growing, is hard to beat. No country possesses better teachers or exponents of the art of gardening than England, and certainly no country is blest with such splendid markets at our doors for the ready sale at remunerative prices of every article of food it is possible to raise from the soil; so much so that many growers living thousands of miles away find it profitable to deal with us in such articles, although hampered and handicapped by the expense and difficulties incident to such vast distances. What is wanted is some authoritative body to organise and put life into such a scheme. Seeing that we have now a Government Department of Agriculture (which of course includes the utilitarian aspect of Horticulture), with a Minister at its head evidently in sympathy with any movement having for its object the improvement of this kind of husbandry, and having also our County and District Councils working in the same direction, may we not hope that something will be done to educate our rural population on these important lines? Is it too much to hope that the Council of the Royal Horticultural Society, with its great position and immense influence, may see its way to arrange for a conference to be held in London on the subject, composed of representatives of our landowners, the authorities above mentioned, and others interested?

I have only one word to add, and it is that such a scheme as I have so imperfectly outlined may benefit the middle-aged and declining workman but little. But for the younger men, and for the children of both sexes, I believe it possesses possibilities of great moment as regards the future prosperity and well-being of our rural working population. Once having learnt how to make the most of half an acre of land, it is not too much to hope that many of our future country workers would aspire and succeed in converting the half-acre garden into one of ten or twenty by their industry and skill acquired under such a scheme, becoming small occupiers or proprietors rooted by love to the soil, a blessing to themselves and to their country.

*** At the time the foregoing paper was passing through the press a discussion was taking place in Parliament upon a very closely related subject. Mr. Keir Hardie moved an Amendment to the Address calling on the Government to give power to Local Authorities to acquire land and to set upon it industries whereby men might obtain permanent employment.

The Times in a leading article upon the subject points out that there is no need whatever for fresh legislation or for further powers, as the Local Authorities already possess all that is required in the Small Holdings Act passed in 1889, and it adds: "The Act has been successful wherever it has been put in force. Striking examples will be found in Mr. Collings's speech. But only two or three county councils in all England have made use of their powers. We send abroad fifty millions a year for country produce which might be largely obtained from our own fields. The land is lying idle, and the people who might be leading prosperous and independent lives as their own masters are loafing about our towns 'unemployed.' Our legislators pass laws and do not ask how they are administered or whether they are administered at all, our local authorities are too busy with parochial politics to bother about the welfare of the country, our professors of political economy spin barren theories at which practice mocks, our working-class leaders are blind to the real interests of their class, our schools teach smatterings of everything under the sun to children left in blank ignorance of all that it concerns them to know. Then, with the whole machinery of social life and social conduct shaking itself to pieces with unbalanced vibrations, and consuming its energy in internal friction, we look helplessly at a population degenerating physically and socially, and listen contentedly to a show debate about some quack remedy."

The following is the substance of the speech delivered by Mr. Jesse Collings and referred to in the above quotation from *The Times*. He said that for years past there had been steady migration of the population from the country to the towns; and the towns and manufacturing districts had long since reached the limits of their powers of absorption, and were now dangerously overstepping them. In the meantime agricultural land was crying out for labour and to a large extent remained uncultivated. Hence arose the great social problem which we were trying to meet by improved housing and palliatives of various kinds. They were but palliatives, and if a thousand persons were to-day provided for in London within a few months the flow of the human tide would make things just as they were before. It was suggested that local authorities should acquire land for cultivation, and here, on firm, sound, economical principles, he agreed with Mr. Keir Hardie. But that had already been done and done effectively. It was twenty years since he introduced a Small Holdings Bill, and in those days no attention was paid to the subject. True, the importance and necessity of the question were not so great, but in 1889–90 the Government of the day passed a Small Holdings Act giving local authorities full and effective powers to do the very thing it was now suggested should be done. The administration of the Act was placed in the hands of county councils. Well, you can bring a horse to water, but cannot compel drinking. With the exception of two or three, county councils had almost ignored that measure. The Worcester Council, under the chairmanship of Mr. W. Bunn, put the Act into operation, seeing its importance from an economic and social point of view. A concrete instance was perhaps more useful than declamation, and he proceeded to show how the object had been secured. The first venture was the purchase of a farm of about 300 acres. It was poor land, and farmers had worked it unsuccessfully. It was cut up into holdings of from five to thirty acres. He knew the district thoroughly. Years ago misery, destitution, and starvation were rife there, and expenditure was large on outdoor relief. To-day there was not a man or woman on the rates, and the population were thriving and happy. Seven or eight cottages were erected on these holdings. If he could induce hon. members to visit the occupiers, all of whom were his personal friends, they would find them in pretty, comfortable cottages, in which no one could object to live, surrounded by all the indescribable qualities of home. These men not only worked themselves, but employed others. One of the smaller holdings employed more labour than the original farmer with his 300 acres. The largest holder on the estate, who farmed twenty-nine acres, had kept some rough accounts, for the accuracy of which he could vouch. In the year 1901 that man paid more than £250, cash down, for labour, and received £600 from the produce of his holding. These were the men who for years had been going into Birmingham to offer their labour at almost any price, only to receive the answer, "No; we are overdone with labour." To-day these men drove into Birmingham in their own horses and carts with the produce of their holdings, and said to the very same people, "You did not want our labour; will you have our vegetables and fruit?" and the reply was "Yes; we can do with any amount of those." Now these men afforded employment in the workshops by spending their money on shovels, spades, and other agricultural instruments, instead of, as formerly, competing with the workmen in the workshops. The home market was, after all, the best of our markets; and yet but little attention was paid to it. Setting aside meat and corn, and confining himself to the smaller articles of agriculture, which this country was, perhaps, better able to produce than any country in Europe, he found that the trade in them was fifty-six millions sterling. He sometimes smiled when he read complaints at meetings of Chambers of Commerce about a few tons of girders having been imported from Belgium. Not a word was said about the importation of six millions' sterling worth of cheese. He appealed to members engaged in the county councils to follow the example of Worcestershire, and put the Small Holdings Act into operation. It might be said that there was no demand for these holdings. Of course there was no demand. Peasant proprietary had been well described as a lost art in this country. But the supply would create the demand, for there were hundreds of thousands in our big towns who would be only too glad to go back to the land. There was no demand for education in 1870 among the uneducated; yet the country thought it essential for the public good to give them education. Another objection was that the State should not set up men in business in one class of trade. That was a point that was urged by political economists, who, Heaven be thanked, were in a very small minority in these days. His answer was that there was no business like that of the land; that the land was the origin and source of every trade in the world; the trade of every kind depended for its success on the purchasing power of the land. Great interest was taken in the purchasing power of foreign countries, and large sums of money were spent in advancing it. But why not take an equal interest in the increase of the purchasing power of Worcestershire? If they got a pound more to-day from the land than yesterday, it was an additional pound to be spent in the workshops. Landlords and farmers were interested in this small holdings movement, for it meant more rent for the landlords and more labour at the command of the farmers. The education which was given to the agricultural labourers had created in them a profound dissatisfaction with their lot as mere wage-earners, which he rejoiced in, and they would continue to hasten from the land to better themselves elsewhere unless the chance was given them of becoming themselves cultivators of the land. In Belgium the small holders and the farmers lent each other mutual assistance—the small holder gave his labour in return for the use of the farmer's team of horses—and that state of things would prevail also in this country under an extension of the system of small holdings. What he urged was not new legislation. People cried out for new legislation and grumbled about insanitary houses and other things; but let them put the Acts they had got in force, and they would be found ample to meet such defects. It was not Parliament which was at fault in this matter at least. The Government could not go beyond the present legislation; at all events, he did not know what they could do except a few little amendments. It remained only for the county councils to put the Acts in force. That was what they had to apply themselves to. He believed that there was ample room for at least a million families employed, as he had stated, on the land, with honour to the country and for the good of themselves. That meant about 5,000,000 persons. He was no alarmist; he saw a nation rich, luxurious, temporarily prosperous by trade and commerce; but there was no guarantee for permanency in these things. If he read history, ancient or modern, aright, he did not think a nation could be found whose fighting and resisting power remained unless it was based upon a numerous and contented rural population.

THE DIETETIC VALUES OF FOOD-STUFFS PREPARED BY PLANTS

By Rev. Professor G. Henslow, M.A., F.L.S., V.M.H., &c.

[Delivered November 4, 1902.]

The necessity of food may be regarded from two chief points of view: first, the growth and restoration of bodily tissues; and secondly, the supply of energy. Though such (nitrogenous) foods as can accomplish the former may also furnish fat and supply force, yet the value of non-nitrogenous foods may be usefully regarded as having the special function of force-producing, though they can also supply fat as well, in the building up of the structures of the body.

The nitrogenous food-stuffs, called collectively albuminoids, consist of several substances in plants, such as fibrins, *e.g.* gluten-fibrin, associated with gliadin and mucedin in the gluten of wheat; * while legumin and its allies are found in the seeds of leguminous plants. Regarding the value of the vegetable albuminoids as food, it must be borne in mind that they are not so readily acted upon and absorbed as animal albuminoids. This is partly due to the fact that the aleurone grains, as the reserve form of albuminoids is called by botanists, are included within the cells composing the cellular tissue. Cellulose, of which the cell-walls are composed, more or less resists the action of ferments; so that it is important that wheat and other kinds of grain should be completely ground, in order to liberate the cell-contents. Secondly, a moderate quantity only of such foods should enter the daily diet, or else a certain portion will escape digestion.

The non-nitrogenous food-stuffs consist of carbon united with hydrogen and oxygen in the same proportions as these two constitute water. They are "cellulose," of which the cells are composed; "starch"; "inuline," characteristic of *Compositæ*, as the 'Jerusalem Artichoke'; "dextrine," which is an intermediate condition between starch and glucose, produced by the ferment, diastase; "levuline" in Jerusalem Artichokes; "mucilage," and varieties of "sugar." As none of these contain any nitrogen, they are powerless of themselves to restore waste in the numerous parts of the human body which depend upon that element; but they can all contribute to the formation of fat.

Several minerals are also of great value in the human economy. The majority do not form so obvious a feature as does lime in the structure of bones, but are diffused throughout the system. Similarly are they in growing plants. But analyses show that they become localised in seeds, where they are laid up with temporary reserve food. Therefore the mineral value of such special parts which constitute human food should not be lost sight of from a dietetic point of view. Sodium chloride, or

* This is easily obtained by washing some flour with cold water in a sieve or cloth, which allows the water to carry off the starch; the gluten is then left behind.

table-salt, is the only one wanting in ordinary vegetables, so it has, of course, to be supplied as an extra adjunct to a diet.

The natural orders or families of plants which furnish food to man are not very numerous; one or two contain a large number, while isolated plants in others have special values of their own respectively. The chief is *Gramineæ*, or grasses, of which the cultivated members or cereals are the most important of all foods. The grains are remarkable for containing considerable quantities of both nitrogenous and non-nitrogenous food-stuffs, as well as mineral matters, or "ash." Indeed, cereals alone supply the greater part of all the materials required for restoration and the supply of energy. The *Leguminosæ* follow suit; but their percentage of albuminoids is excessively high in comparison with that of cereals and other foods, so that they require to be supplemented by more farinaceous (starch) and oleaginous substances to form a complete diet. Of isolated species, the potato, sweet potato, and yam are examples of vegetables of wide-spread cultivation, resembling each other in being poor in albuminoids, but rich in starch. Hence they form excellent adjuncts to meat and other nitrogenous—sometimes also called plastic—foods, being very inferior flesh-formers themselves. Roots used as food are scarcely worthy to be called nourishing food at all, but rather pleasant additions to a meat-diet, because the percentage of water (upwards of 90) is so great that the actual amount of nutritive matter contained in a portion eaten at a meal is extremely small. The carbonaceous ingredients (especially sugar) are: in carrots, 7·7; in parsnips, 13·7; in beet, 12·5—the average amount of albuminoids being only 0·7. They are useful, however, for their salts.

Taking wheat as a type of a nearly perfect food, the grain consists of a single seed, invested by the dry pericarp or ripened ovary, so that it is really a complete fruit. There are five skins of one cell in thickness, being the homologues of the pericarp and seed-skins combined. It was thought that the outermost, the cells of which are elongated and of a fibrous nature, was coated with silica, like the surface of a straw; but Professor A. H. Church analysed it, and detected none. He found, however, that, as far as any nutrition was concerned, the ash, 2·6 per cent., contained only 15·3 per cent. of phosphoric acid, while the high proportion of fibre rendered it nearly valueless. Moreover, "decortication" * is also desirable, as the tip of the grain carries bristly hairs, technically called the "beard." One of the inner layers of the husk, called the "cigar coat" from the shape of its cells, is coloured, and gives rise to the varieties known as red, yellow, grey, white wheats, &c. Certain phosphates, &c., are contained by them, so that these inner skins should be, and indeed always are, retained in whole and wheat meal. The most important layer is that next within the innermost skin. It is the outermost part of the endosperm of the seed, or the tissue which contains the reserve food for the use of the embryo or germ. This layer is called the aleurone or cerealin layer. It consists of somewhat cubical cells filled with albuminoid grains, accompanied by the ferment cerealin, the function of this ingredient being to digest the aleurone on germination by converting it into soluble peptones. The rest of the endosperm consists

* A word used by millers, who, in high-class milling, remove this outermost skin before grinding.

of cells radiating towards the innermost part of the grain, and becoming more and more filled with starch, and containing a less amount of aleurone on passing from the circumference to the centre. The germ or embryo lies at the bottom of the grain; the back of it or the cotyledon, the so-called scutellum or shield, abuts against the endosperm, while the front or side from which the shoot arises lies outwards.

In the diagram below, figures 1 to 4 illustrate the preceding remarks.

On germination the ferment cerealin dissolves the aleurone grains, converting them into peptones, the grains themselves consisting of amor-

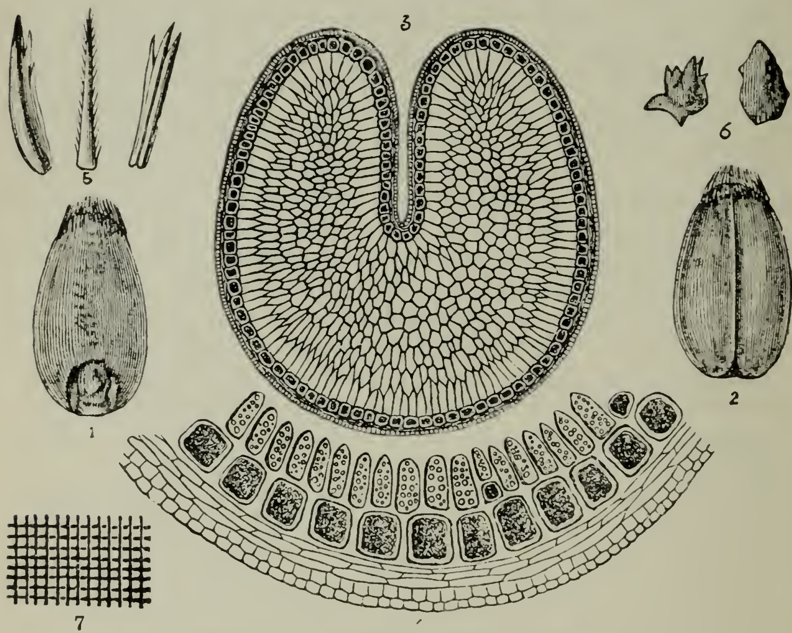


Fig. 219.—Sections of a Grain of Wheat.

1. Grain, showing germ and beard. 2. Grain, reversed. 3. Section of grain. 4. Outermost part of grain, showing five skins of husk, square gluten-, and inner starch-cells. 5. Split chaff, awns, &c., from ordinary "whole meal" and "brown bread." 6. Bran flakes. 7. Every particle of wheatmeal should pass through this 18-mesh wire sieve in order to be generally digestible.

phous and crystalloid nitrogenous substances, associated with the so-called mineral globoids or globules of phosphates of magnesia and lime. Another ferment, diastase, dissolves the starch, converting it into maltose and sugar. These are then absorbed through the shield by the embryo.

With regard to the analysis of the germ or embryo itself, Professor Church * found that it is really the most nutritious part of the whole grain, for it contains 35·7 per cent. of albuminoids, diastase, &c., 31·2 per cent. of starch, dextrine, and maltose, 13·1 per cent. of fat or oil, and 5·7 per cent. of ash. Cellulose, or the more or less indigestible matter, is

* I am indebted to this author for analyses and some other facts stated in this paper. The reader is referred to his work "Food."

only 1·8 per cent., water being 12·5 per cent. Comparing these with the analysis of the whole grain, it will be seen at once that the germ should not be neglected in bread ; but it is the universal practice of millers to reject it from the flour, as it discolours it.*

Wheats from different countries vary greatly in the relative proportions of their ingredients ; those from southern and warmer climates containing more nitrogen, while those of northern regions and England are relatively richer in starch. Hence millers make various mixtures before proceeding to grind them into flour. The following examples are Professor Church's analyses of two kinds of wheat, one being soft white English, the other a hard red Indian grain.

In comparing the relative amounts of nutritive substances in grains and other foods, it is customary to regard the proportions as ratios, viz. that of albuminoids to carbohydrates with fats. This is called the "nutrient ratio," while the sum of both nitrogenous and non-nitrogenous substances per cent. is the "nutrient value."

Taking the following as an average standard of ratios of a daily ration, the reader will be able to compare the value of any special food with it :—

Water.		Albuminoids.		Starch and Fat.		Salts.
25	:	1·2	:	4·4	:	0·25

The nutrient ratio is 1 : 3·7 ; the nutrient value, 5·6.

Analyses of English and Indian Wheats.

	English.	Indian.
Water	14·5	12·5
Albuminoids	11·0	13·5
Starch, dextrine, and sugar . .	69·0	68·4
Fat	1·2	1·2
Cellulose	2·6	2·7
Ash	1·7	1·7

Nut. rat. (English) 1 : 6·5, nut. val. 82 ; nut. rat. (Indian) 1 : 5·2, nut. val. 84·6.

In the simplest manner of milling, the whole (undecorticated) grain is ground and separated into three siftings, viz. firsts, or the whitest flour ; seconds, or that used for ordinary "household bread" ; and thirds, or bran. The first contains most starch, and is therefore least nutritious ; the second contains more albuminoids ; while the bran, with which is removed the aleurone layer, contains most of the nitrogenous elements, the germ, as stated, having been previously expelled. Hence it will be seen that the greater portion of flesh-forming materials and valuable mineral ingredients are lost as waste products as far as the making of bread is concerned.

Dr. Oliver † has called attention to the growing tendency of the working classes to prefer articles of food which "please the eye," and so

* A preparation was invented in 1886 from the embryos for making "germ flour." It consists of the germs extracted from wheat grains with flour, the former being in the proportion of 25 per cent. This is mixed with 2 per cent. of whole wheat-meal. It was prepared by Messrs. Fitton and Son, Flour Mills, Macclesfield.

† "Our Workmen's Diet and Wages," *Fortnightly Review*, October 1894, p. 513.

insist on having their flour "beautifully white," though this is done to the great loss of its nourishing value. Theoretically, whole-meal bread would obviate this error; but practically it is found that unless the corn be most scrupulously cleaned by the miller before grinding, numerous foreign substances are often to be met with, such as sharp-pointed fragments of awns, bristling points of seeds and fruits, pieces of pointed chaff-scales, &c. (as shown in fig. 219, 5). In addition to these, and even if they be absent, the angular scales of bran (fig. 219, 6) are found not only to irritate the lining of the intestine, but prevent the complete action of the digestive fluids attacking the aleurone grains included within the cells, so that by no means is the full value of the cerealin layer secured in its passage through the body. Hence whole-meal bread is rather to be regarded, at least partly, as an aperient than wholly as a food. "Wheatmeal" bread, as it is called, in order to distinguish it from ordinary whole-meal, is formed of "granulated" flour, the whole decorticated grain being ground by a different process from that by means of millstones, so that no irritating substances are present, and the full value of the grain can be secured.*

Though bran contains the most nutrition, *i.e.* flesh-forming ingredients, it also contains the largest proportion of cellulose or indigestible matter. Hence the necessity of its being very finely ground. The following is Professor Church's analysis of rather coarse bran:—

Water	12·5
Albuminoids and cerealin	13·3
Indeterminate nitrogenous compounds	3·1
Starch with some maltose	43·6
Fat	3·5
Cellulose	18·0
Ash	6·0

Here it will be observed that the fibrous indigestible matter forms one-sixth of the bran, when it is not $\frac{1}{100}$ part of fine flour. Professor Church adds: "If we include cerealin with the true albuminoids, the nutrient ratio of this bran may be set down as 1 : 4; the nutrient value will be 67. This ratio will be perceived to be closely the same as that of a true diet, viz. 1 : 3·7."

Of course, in high-class milling great refinements are obtained. The first grindings are sifted, and some of them are re-ground until an exceedingly fine flour is secured for those who prefer to have the whitest bread; but it is one which is greatly deficient in flesh-forming materials. One of the products is semolina, a name given to fragments of grain which fell into the grooves of the stones, when it was so ground. These are useful for puddings, being mostly of the highly nitrogenous South European wheats; and are therefore more nourishing than ordinary milk-puddings made with starches, such as sago, tapioca, or corn-flour, which contain no nitrogen, that element being only supplied by the milk.

* Mr. G. Pimm, Flour Mills, Upper Wandsworth, has for the last twenty years supplied an excellent meal of this kind. It should be all able to pass through an 18-mesh sieve, or at the least a very slightly coarser one (see fig. 219, 7).

Dr. Oliver, in comparing the ordinary diets of the Scotch and Irish peasants, although that of the latter has much improved of late, shows how by their mainly living on a diet composed of half flour and half Indian meal, together with potatos and milk, the Irish do not extract sufficient nitrogen, all three of these vegetables falling short in quantity of that element. Hence he says: "So insufficient is his feeding that, when he comes to this country to take part in harvest operations, it is not until two or three weeks have elapsed, during which he has fed on a more wholesome and sustaining diet, that he is capable of doing an average adult's work."

On the other hand, the Scotchman, by using oatmeal, bread, and potatos, "gets most for his money, the Irishman the least." A comparison between the analyses of oatmeal and Indian corn by Professor Church will illustrate the above facts:

	Scotch Oatmeal.	Indian Corn.
Water	5·0	14·2
Albuminoids	16·1	9·0
Starch, &c.	63·0	66·5
Fat	10·1	5·0
Cellulose	3·7	·0
Ash	2·1	2·0

Scotch oatmeal	nutrient ratio,	1 : 5·7;	nutrient value,	102
Indian corn	do.	1 : 8·5;	do.	87

It will be here seen that not only are the albuminoids greatly in excess in the oatmeal, but the fat, which can supply more energy than any other vegetable product, is double the amount of that in Indian corn.

Passing to the leguminous plants, we here meet with vegetables containing by far the highest amount of nitrogenous or flesh-forming materials of any vegetables. Beans, peas, Indian dal, lentils, &c., contain upwards of 20 per cent. of albuminoids. Hence their great value lies in the flesh-forming quality. If, therefore, the Irish were to combine some form of pea or bean meal with their diet, their present deficiencies might be readily met. The following analyses by Professor Church show this:

	Peas.	Haricots.	Lentils.*
Water	14·3	14·0	12·5
Albuminoids	22·4	23·0	25·0
Starch	51·3	52·3	56·1
Fat	2·5	2·3	2·0
Cellulose	6·5	5·5	1·9
Ash	3·0	2·9	2·5

	Nutrient Ratios.	Nutrient Values.
Pea	1 : 2·5	79
Haricot	1 : 2·5	80
Lentil	1 : 2·4	86

* The advertised meal called "Revalenta" consists of lentil-meal mixed with barley or other flour and common salt. The Latin for lentil is *Ervum Lens*. This is changed to Erva-lenta; the first two letters being transposed, "Revalenta" is the result.

Although leguminous foods contain an abundance of nitrogen, it must be remembered that it is not all available unless a moderate quantity only enter the diet.

The potato may be taken as the best representative of a carbonaceous food. Comparing it with rice, one of the least nutritious of the cereals, the analyses are as follows :

	Potato.	Rice.
Water	75·0	14·6
Albuminoids	1·2	7·5
Extractives (solanine, &c.)	1·5	——
Starch	18·0	76·0
Dextrine and pectose	2·0	——
Fat	0·3	0·5
Cellulose	1·0	0·9
Ash	1·0	0·5

	Nutrient Ratio.	Nutrient Value.
Potato	1 : 17	22
Rice	1 : 10	84

Flesh-forming albuminoids in the potato being practically *nil*, the two useful ingredients are the starch and the ash. It will be seen how poor rice is also in nitrogen, though exceptionally rich in starch. Hence its use is like semolina, or even tapioca, for the making of puddings.

With reference to salts contained in the mineral matter or ash of plants, it has already been pointed out that they are diffused in growing vegetables, but especially located in seeds. Herein, as observed, lies the importance of retaining the outermost parts (excepting the superficial layer) of grains of cereals, which are rich in phosphate of lime, magnesia, &c. Potash also abounds in ordinary land plants, while table-salt occurs in saline and maritime plants ; but as these latter do not form any part of ordinary diets, this salt has to be supplied in addition. One use of salads, besides being a refreshing cool diet, lies in the salts they contain ; for, although having no amount of nutrition to speak of, in the proper sense of the term, salts are retained in them, while to a considerable extent they are removed by cooking. Their function in the human body, as also in the plants themselves, is for the transference, absorption, and elaboration of oxidisable nutrients. Watercress, it may be mentioned, is particularly rich in salts.

The value of foods in supplying force or energy has had more attention paid to it of late years, since the exact value of work capable of being executed can be ascertained from the amount of heat given by the burning of any organic substance. Oxidation is, in fact, the measure of work.

The non-nitrogenous compounds have been called "heat-givers" ; a better term is perhaps "force-suppliers." Of these, starch and sugar, taken as types of their polymers, are called carbohydrates, because the hydrogen and oxygen enter their composition in the proportion which forms water ; while oil has a less amount of oxygen, so that its carbon and hydrogen require more oxygen to be burnt. It is thus the greatest force-producer of any organic substance.*

* The staple diet of a Suffolk labourer is bread, cheese, and fat bacon.

The following is a table furnished by Dr. Frankland, illustrating the amount of force which each of the substances mentioned can supply; the estimation being the number of tons one pound of each substance can lift one foot in height :—

Butter	4507 tons.
Starch (arrowroot)	2427 ,,
Cane sugar	2077 ,,
Grape sugar	2033 ,,

Comparing butter with peas, it is found that 1 lb. of the latter can raise only 2194 tons. Of this amount only one-fifth at the utmost is available for work done outside the body, according to Helmholtz.

With reference to the degree of *rapidity* with which the force liberated by digestion is at disposal, Dr. Oliver has some interesting observations upon the especial value of sugar.

It appears that the Northumberland coal-miners and English navvies have found out for themselves the great use of sugar as a quick force-giver or active generator of muscular energy. He observes: "There is always a small quantity of sugar present in human blood, viz. 0·1 per cent. When muscle is in a state of activity, there is a disappearance of sugar from the blood, four times greater than occurs in the blood issuing from muscle in a condition of rest, clearly indicating, therefore, that during activity sugar is used up." He refers to experiments by Harley, who "abstained from all food except 500 grammes of sugar daily, *i.e.* a little over one pound by weight, and he found that there was not only an increase in the amount of work accomplished, compared with that done during fasting, by 70 per cent., but that muscular fatigue was decidedly retarded. It is recognised that when sugar is added to food a man is capable of doing more muscular work with than without it, and that this occurs about two hours after it is taken."

Although complete analyses are the only safe methods of ascertaining the exact values of foods, a rough approximation may often be obtained by a microscopic examination, which readily shows (by taking a fair average sample of several observations) the relative amounts of the nitrogenous and carbonaceous ingredients. Numerous foods are advertised for infants and invalids; and, in lieu of a chemical investigation, recourse may be had to the microscope. Thus, for example, Dr. Cutler,* New York, finds Ridge's food to be deficient in gluten cells as compared with wheat, while the starch, being more or less "frothy," shows signs of being partially cooked. Mellin's food he regards as one of the best, the starch not being in too great an excess, but changed into a soluble form, which he considers to be an advantage. He says: "I place this food very high on the list of prepared infants' foods, as it contains gluten cells easily visible on inspection."

"Frame food" † bread professes to contain "all the phosphates and nourishing matter of wheat," to be "free from woody fibre of bran, and to be easily assimilated and digested."

* Popular edition of *Infants' and Invalids' Cereal Foods under the Microscope.* Pub. Gaillard, New York, 1881.

† Advertised by the Frame Food Co., Lombard Road, Battersea, London, S.W.

The analysis of Frame food "extract" (to be used with white flour) as made by Dr. Frankland is as follows:—

Water	9·58
Albuminoids	21·40
Starch	13·00
Dextrine	22·60
Sugar	12·30
Other organic matters	10·43
Phosphoric acid	3·68
Potash	4·24
Iron and other minerals	2·77

The nutrient ratio is 1 : 2·7, and the nutrient value is 80.

Of other vegetable foods, numerous starches might be mentioned ; but they are all precisely the same chemically, though differing microscopically from each other, so that many can be readily distinguished at sight. As examples, tapioca is granulated starch from *Manihot utilissima* of Tropical America ; sago is obtained from the pith of palm-trees of the genus *Sagus*, the preparation being made at Singapore—imitative forms of this are made from potato-starch ; " Tous-les-mois " is from species of *Canna* of Peru ; corn-flour is the starch of Indian corn. In addition are wheat and rice starch. Dietetically, it must be remembered that, as starch contains no nitrogen, it cannot be a flesh-former. It is useful, however, as a vehicle for the nutritive matters of milk when made into puddings.

Space will not allow a further description of vegetable foods ; but what has been said in this paper, it is hoped, will give the reader at least a clear insight into the general principles of the dietetic values of food-stuffs as prepared by plants

THE ENGADINE OUT OF SEASON.

By Marian H. Mason, F.R.H.S.

As everyone knows, the Engadine has two "seasons": the winter for invalids, and the summer for tourists. It would be quite superfluous to write about a place so well known at those periods of the year. One might as well write a description of Brighton. But the Engadine in the spring, between the two seasons, is quite a different thing. The year before last I spent the middle and end of June and beginning of July, that is the late spring, at Silvaplana, at the foot of the Julier Pass; and though there were several Germans there, I saw only three English people during the whole time, though there were a few at other places in the neighbourhood. A few notes on the spring flowers of the high Engadine, seen by so few, may therefore not be without interest.

Leaving the unbearable heat of Florence on June 3, I came by way of Milan, Lecco, and Chiavenna to Promontogno, about two hours' drive up the Val Bregaglia. What a beautiful railway journey it is from Lecco along the shore of Lake Como! The day too was lovely, and the lake so clear that, looking down into the water, one could sometimes see the fish swimming about.

All was green and fresh, but no wild flowers worth mentioning were to be seen till we neared Chiavenna, where the rocks were covered with pink Pinks and white *Cistus*. The Foxtail Saxifrage and Orange Lilies which grow so abundantly at Colico were quite over, and were in their last stage at Chiavenna. Here, however, the rocks were pink with the blossoms of the cobweb *Sempervivum*, now in its first bloom. I did not remain long enough to find much else, and went on to Promontogno, which is a convenient place for waiting between the heat of Italy and the cold of the Engadine. There I remained till the weather was warm enough to go on to the Engadine. It is a most picturesque place. Three hamlets lie at the top of a narrow valley, completely shut in by steep overhanging mountains. The hamlet which contains the post-office, diligence-office, and a good hotel, actually fills up the narrow end of the valley. Two roaring torrents, one of them crossed by a high bridge, meet exactly below the hotel, and, beautiful as they are to the eye, they are deafening to the ear. It is difficult to sleep for the noise at night, especially after heavy rains, and conversation has to be carried on at a fatiguing pitch of voice. A further drawback to any prolonged stay is that the amount of water which collects in this narrow valley raises clouds of mist and steam from below, while the overhanging peaks gather the clouds from above and bring down torrents of rain. For the first few days of my stay, nothing could have been more beautiful than the sunshine on mountains crowned with snow, clothed with Pines and Larches further down, and below these with Chestnuts and other deciduous trees. But for four days afterwards it not only rained continuously, but the clouds filled the valley and floated past and into the house. The hotel became a sort of Ark: nothing was to be seen from the windows but water and clouds. But for persons in good health, who can take long walks, it is in fine weather an interesting place for scenery and sketching, rather than for flowers. The Dente del Lupo, with its magnificent double peak, is seen above a narrow Pine-clad valley to the south, seeming quite to tower and hang over the village itself. It is one of the most striking mountain views that can be found. Then, above the village, on the Engadine road, are an old brown castle tower and a church with a white campanile perched on a rock, which completely closes the top of the Promontogno valley. There is certainly plenty of good sketching here.

But the flowers are scarcely equal to those of the same altitudes in other parts of Switzerland. I found nothing out of the way. There were quantities of the large St. Bruno's Lilies, besides the smaller *Anthericum* named after St. Bernard. The meadows were gay with Globe-flowers, Pinks, Harebells, pink Snake-grass, Salvias, large purple and pink Milk-worts and the usual field flowers, but not much else. The Foxtail Saxifrages were, however, in full bloom, and simply magnificent; one could see them from right across the valley, and here and there among them were Orange Lilies, spots of bright scarlet. I was not able to take many long walks, and so cannot speak fully as to the flowers, but one day I walked up the valley till stopped by the snow at the foot of the precipices of the Dente del Lupo. I found the Alpine *Myosotis*, besides the Water Forget-me-not, which grows all over this damp valley, even on high and now dry meadows; Alpine Rhododendrons (the earlier kind, *ferrugineum*) just coming out; some belated Cowslips, Dog Violets of various kinds and colours, and of course the yellow *Viola biflora*, and by one stream a patch of the glorious large blue *Pinguicula*. *Primula viscosa* was over, lower down, and, as might be expected, did not grow on the side of the valley facing east, on which the path was, but it was in blossom, sparsely, on the opposite side facing west. Here was a lesson for gardeners, showing how plants depend on aspect. This valley and its torrent run north and south. The afternoon sun being far hotter than the morning, all the snow patches were of course on the side facing east, and reason, if not instinct, should tell one what flowers would be found on the one side or the other, according as they could stand the baking of summer or not. And the *Daphne Mezereum* gave a good illustration. There was scarcely a plant on the side facing west, those in the meadows in the wider part of the valley were in full leaf with full-sized berries, while not a hundred yards off, on the side of the cold steep east aspect, it was still in full blossom and sweet-scented. One side of a valley which you could cross in less than five minutes was thus clearly at least six weeks of the year behind the other. These deep narrow valleys are, however, not favourable to the growth of flowers. I found but one Gentian blossom and one flowerless plant besides. There is not enough sun or free air, and too much draught. We are beginning to learn that human beings are like flowers in this respect, and that delicate people should not be shut up, but given all the light and air possible. It is not, however, so certain that the difference between draughts and a free circulation of air is so well understood. Many people seem to think they are the same. But a draught nips flowers and gives human beings colds, whereas free air is needed by both.

On the first really fine day after the rain, sending my luggage on by the diligence, I drove up the Maloja Pass to Silvaplana in a little light open carriage, which I could stop at my own pleasure, and jump out to secure any desirable flowers. I jumped out only once before reaching the top of the Maloja, and that was for the first *Gentiana verna*, and for the first Soldanellas and lilac and white Crocuses on the edge of a melting snow-patch just above Casaccia. But on reaching the top of the Maloja it was like coming into another world. The first sign was the coming upon streams of golden Marsh-Buttercups pouring down the cliffs on the edges of the torrents. Like the streams, they came from a lake—of Marsh-Buttercups above. And here were also pink lakes of *Primula farinosa*, and blue lakes of *Myosotis*, and sheets—almost acres —of *Viola calcarata*, of every shade and tint of lilac and purple. There were plenty of large blue Gentians, though not masses of them here, but the meadows were simply blue with *Gentiana verna*. Never have I seen it growing like this, and comparatively few people can have seen it so, for it was growing in the now short grass meadows which are really hay-fields. Before the tourists or summer visitors arrive the hay grows up, the Gentians and other lovely and delicate spring flowers are over, hidden by the long grass, and by the end of July or beginning of August the hay is cut, and there are scarcely any flowers to be seen.

At Silvaplana it was the same thing; the hay-fields lying between the lake and mountains were gay with these flowers in the middle of June, but coarse Docks, Snake-grass, Dandelions, and Buttercups, besides other even less beautiful plants, were springing up, and, when full-grown, no one would guess the treasures hidden underneath. The marshy meadows on the other side of the lake were full of large patches of *Gentiana bavarica*, which those who do not observe closely sometimes take for *verna*. It grows only in wet places; the stalks are longer and more delicate than those of *verna*; the petals are more pointed, and the flower perhaps not quite so large. Nor has it quite so large a white eye. *Verna* is very variable in colour, ranging from dark blue to an occasional turquoise. But *bavarica* is of an invariable dark blue—the most brilliant of all the Gentians—a blue that is perfectly dazzling, especially when looking down upon it in the grass, in the morning. As soon as the sun turns in the afternoon it shuts its eyes, and may be easily passed by unnoticed. These marshes are also full of the smaller *Pinguicula*, both lilac and white, large purple *Pedicularis*, and purple *Orchis*, not to speak again of *Primula farinosa*, besides masses of Marsh-Buttercups and paler yellow Globe-flowers, which I have never seen elsewhere anything like so fine.

Then one had only to walk half a dozen yards above the level of the marsh, or along the highroad running along the lakes, to come upon large blue Gentians as plentiful as Daisies in an English meadow. I have never seen them anywhere in such quantities. The hillsides were everywhere simply blue or purple with them. It is difficult to describe them by saying how many were out together in a patch, on one plant, for there was little or no interval between the patches. I have, however, on isolated patches or plants, counted fifteen or twenty heads together. The Gentian here is not *acaulis*, but *excisa*, so named from its calyx, which stands away from the flower. Its stalks are longer than those of *acaulis*, and its leaves are larger. The two species are so much alike that they are often mistaken for each other. In a garden the most important difference is that of habit, at least according to my experience. *Acaulis* increases so rapidly that it becomes matted together, and perpetual division is necessary to make it flower well; whereas *excisa* remains more stationary and flowers steadily. Here *excisa* was of every shade of blue and purple. These Gentians were in full beauty and almost incredible blossom on June 20, but before another week was over they had passed off, and to find them in abundance one had to climb higher. *Anemone sulphurea*, too, was just in perfection and abundant at the same levels as the Gentians, though here it is not nearly so fine as on the Simplon, where it is more magnificent than I have ever seen it elsewhere. *Ranunculus glacialis*, of the very finest, was out at its own great heights.

On the lower hillsides were the sweet pale pink or cream-coloured *Daphne striata*, and numbers of Orchises, pink, dark purple, and the sweet white Butterfly. *Aster alpinus* came out at the end of June, together with *Arnica* and the glorious large golden *Senecio*. *Gentiana punctata* (pale yellow with dark spots) and *utriculosa* (a bright dark blue annual), not very common, were also in blossom, and with the lilac *campestris* remained in full bloom till I left the Engadine on July 17. Then too, in the middle of July, the Alpine Rhododendrons (*ferrugineum*) were at their best, and the side of the ravine facing north, going up the Julier Pass, was simply crimson with them, both under the Silver Firs and Larches, and also for some way higher up after the trees had ended. They were, indeed, wonderfully beautiful, growing in a setting of golden green moss and bilberry plants, with a clear mountain torrent tossing over rocks below them.

On July 16, the day before I left, I drove up the Julier to see what plants were to be found there, and besides those already named were quantities of *Primula integrifolia* and *Azalea procumbens*. The first *Primula* I found was quite over and beginning to seed; but, knowing the difference in climate caused by aspect, I went a few yards higher, where the aspect was more northern, and there I found it in blossom, covering the ground with sheets of pink. Here again may I repeat the lesson Nature teaches as to aspect. Below, at Silvaplana, when the large blue Gentians (as well as *Gentiana verna*) were dead and dried on a small mound facing south or eastward, they were still in full beauty on the other side of the same mound and at the same elevation, half a dozen yards off. But what most travellers do not understand is the difference between plants of different levels and seasons, and they class them all as "Alpines." *Anemone sulphurea*, and Gentians such as *acaulis* or *excisa* and *verna*, for instance, are not plants of the highest levels, such as *Ranunculus glacialis* or *Eritrichium nanum*. Those who visit Switzerland in July, August, or September find them sometimes in considerable numbers at or near these levels, and therefore regard these heights as their natural *habitat*. But these are really only the stragglers from their true homes below, which come out later on the colder heights.

They are really spring flowers of the still high but medium levels, and no one who has not seen them there in their proper season can imagine their brilliancy or abundance. No climbing is required to find them in June. They are within reach of the feeblest walker along the high roads of the Upper Engadine, and their banks and meadows,

When I arrived at Silvaplana on June 20, the whole country was literally carpeted with them, and long before I left, on July 17, the tall grass had swallowed up all trace of them in the meadows, and only the dry greenish-grey horns of *Gentiana excisa* and the seed-clocks of *Anemone sulphurea* remained among the shorter grass of the steep mountain-sides to record something of the glory departed a month ago.

PEACH TREE IN POT. (*The Garden.*

SPRAYING FRUIT TREES AND PACKING APPLES AS PRACTISED IN CANADA.

By CECIL H. HOOPER, M.R.A.C., F.S.I., of Swanley, Kent.

[Delivered November 18, 1902.]

ORCHARD spraying is much more practised in Canada and the United States than in England. Among the reasons for this may be mentioned: 1st. That both insect and fungous attack, if they exist at all, appear to be more destructive in America than here, and if caterpillars, when they do appear, are not held in check, an orchard may in a short time be skeletonised; 2nd. That the orchards, especially in the United States, are much larger than most of those in this country (for example, in 1896 the Hon. F. Wellhouse of Kansas, had 1,600 acres of Apple orchard, ranging from two to twenty-two years old; Mr. J. H. Hale had in Georgia last year 200,000 bearing Peach trees and 50,000 Plum trees—one Peach orchard is 600 acres); 3rd. That their orchards are not of mixed fruits, but the whole is of one species. Apple trees are planted 30 to 40 feet apart, so there is ample space for a horse and cart, or sloven, to be driven between them. The "sloven," a low wagon having cranked axles, is principally used for carrying the spray pump and, later in the year, the barrels filled with apples. After about ten years' growth it is not usual to grow any crop between the trees; the land is ploughed and frequently harrowed by disc, zigzag, and pulverising harrows to insure a fine tilth, thereby retaining the moisture in the soil. Successful spraying needs intelligence and care; it is always done by the farmer himself, or with his constant superintendence, it being considered of equal importance with cultivation, manuring, and pruning.

Some of the best spray pumps have been designed and brought to perfection by fruit-growers, while the Professors of Horticulture in the Agricultural Colleges (of which there is one in every State of the U.S.A. and several in Canada) have experimented with insecticides and fungicides, and, by free pamphlets and demonstrations in orchards, have brought spraying into the important position in fruit-growing that it now holds.

Coming now to the materials used, the insecticide most common is Paris green; it was first employed to destroy the Colorado beetle in the sixties, and is still an absolutely necessary dressing in some parts of the U.S.A. and Canada to insure a potato crop. In 1873, at the suggestion of Le Baron, the State Entomologist of Illinois, Paris green was used as a spray for Apple trees, to destroy the caterpillars of Canker or Winter moth. Paris green is now the exterminator chiefly used to destroy Winter moth, Bud moth, Pith moth, Lackey moth, Ermine moth, and any other biting insect which eats foliage, flower, or fruit.

Alkali wash is used in winter for sucking insects, such as green fly or aphis, woolly aphis, mussel scale, and the hibernating caterpillars of the Codlin moth, which hide in crevices of the bark; this wash destroys eggs

FIG. 220.—A SPRAY-PUMP COMPETITION IN ONTARIO.

as well as living insects, and rids the trees of lichen. In summer-time for most of these insects (except scale) some such spray as kerosene emulsion or whale-oil soap is used.

The usual mode of application of the afore-mentioned wash is a pump, having an air chamber, fitted into a 40-gallon paraffin cask, or, better

FIG. 221.—SPRAYING LARGE APPLE TREES.

still, into a 100-gallon one. A pump with the air chamber inside the barrel is most convenient, as taking less space and less likely to strike against the trees, and more readily balanced. The best pumps have some automatic system of stirring the liquid. The hose pipe, from 9 to 15 feet long, is terminated by a pipe passing through a bamboo rod from 8 to 10 feet in length, at the end of which are two Vermorel nozzles. The barrel is placed on a sloven or cart and chained, so as not to move ; one man drives and pumps, another directs the spray. A calm day is necessary, and the trees are usually sprayed from each side. A broad-

Fig. 222.—Sprayed with Copper Sulphate.

brimmed hat and leather gloves are conveniences, and rubbing the hands with mutton fat protects them against lime.

The solution recommended for winter spraying with alkali is 6 lbs. potash to 50 gallons of water ; some use a stronger solution. This alkali wash cleans the bark splendidly. I have seen tree-trunks thus treated shining in sunlight as if they had been varnished.

Fig. 223.— Apples from Next Row of Trees, but not sprayed.

Another winter wash to destroy fungoid diseases, of which the scab on apple fruit is the most serious, is made of from 2 to 4 lbs. copper sulphate in 50 gallons of water. Copper sulphate is the chief fungicide used. In summer, to prevent the foliage from being burnt, lime is added, thus forming Bordeaux mixture, which was used in France as a fungicide in 1886, and has since been largely employed for potatos and other plants subject to fungoid diseases.

In the case of spraying with combined insecticide and fungicide, the poisonous insecticide should be carefully mixed with water to form a

Fig. 224.

thick paste, afterwards diluted and added to the wash. Paris green and green arsenite are used at the rate of about 4 oz. to 40 gallons of water; some use 8 oz. and some use as much as 1 lb. to the cask of 40 gallons.

Fig. 225.

Lead arsenite (another good insecticide) may be used in the same proportion. Paris green and London purple, if used alone in water, should have an equal amount or even twice the quantity of lime added, to prevent the possibility of burning the foliage, flowers, or fruit.

Now, regarding the time of spraying, as has been already stated, the potash and sulphate of copper solutions can either of them be applied any time in winter or before the buds burst. When an orchard is in good condition, winter washes are usually only given once in two or three years, unless it is to keep down aphis or scale. It is more economical in labour, during summer, to apply the Paris green and Bordeaux mixture combined. The first summer spraying is applied when the buds are opening, to destroy spores of Apple Scab fungus, and to kill the larvæ of Winter moth, Bud moth, and Apple weevils. This first spraying should cease before the blossoms open.

If aphis or scale insects are harmful, soft or hard soap may be used as a wash, 1 lb. to 6 gallons of water.

The second summer spraying, with Bordeaux mixture and arsenite, is given immediately after the petals have fallen, whilst the calyx lobes are

FIG. 226.

turned back, exposing the eye. This spraying is specially to destroy the caterpillars of the Codlin moth, one of the most serious insect pests attacking apple orchards; the parent moth deposits her eggs usually upon the young fruits soon after the blossoms fall. The Bordeaux mixture also prevents the spread of the Scab fungus from the leaves to the fruit. If this spray is washed off by a sudden storm before the mixture has "set," the spraying should be repeated; one or more additional sprayings may be given if thought advisable.

The insects usually found most injurious to apple trees in England are the following: Woolly aphis (*Schizoneura lanigera*) and Mussel scale (*Mytilaspis pomorum*), which are found on trees all the year round (the same varieties exist in America). As soon as the buds commence to open they are attacked by the looper caterpillar of the Winter moth (*Cheimatobia brumata*), a cousin of the American Canker worm; together with caterpillars of the Small Ermine moth (*Hyponomeuta padella*) and the Eye-spotted Bud moth (*Tmetocera ocellana*) (the latter is common in America) and the Apple-blossom weevil (*Anthonomus pomorum*); while

FIG. 227.—JUST RIGHT FOR SECOND SPRAYING.

the Pith moth caterpillars (*Laverna atra*), by eating the centre of the young twigs, cause the foliage and blossoms to wither. Later, as the

FIG. 228.—GETTING LATE FOR SECOND SPRAYING.

fruit begins to form, the caterpillars of the Codlin moth (*Carpocapsa pomonella*) enter it; this is considered, with the St. José scale, the most injurious insect to apples in America. The caterpillars of the Lackey moth (*Bombyx neustria*) now emerge from the little band of eggs round the twigs, and through forming webs are called "Tent caterpillars" in America. In Worcestershire and Gloucestershire the Apple-sucker (*Psylla*

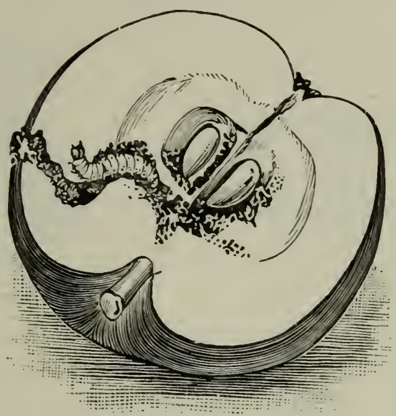


Fig. 229.—Codlin Moth Caterpillar.

mali) does much injury, but appears not to be so common in Kent. For this insect, at Toddington, the trees are sprayed with 10 lbs. soft soap to

Clean (sprayed). Scabby (not sprayed).

Fig. 230.

100 gallons of water before they come into bloom, and with 5 lbs. to 100 gallons when in bloom. Next comes the apple Aphis (*A. mali*), hatched from eggs laid on the bark the previous year, and by sucking the leaves on

the underside causes them to curl. The most injurious fungus is the Black spot or Apple Scab (*Fusicladium dendriticum*), also the Canker fungus on trunk and twigs, and the Powdery mildew (*Podosphæra oxyacantha*) on the leaves of young Apple-trees.

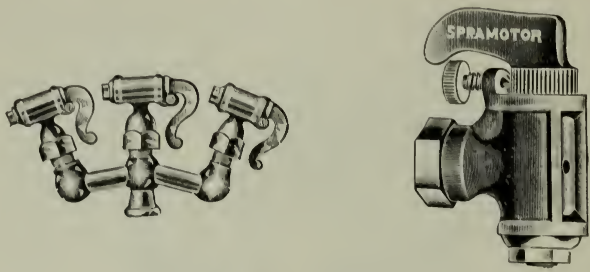


Fig. 231.—Nozzles.

The Cost of Sprays and Spraying.

Spray mixtures cost per 100 gallons wash:

Paris green at 1*s.* 6*d.* per lb., 10 oz. to 100 gallons + 20 oz. lime	1*s.* per 100 gallons.
Bordeaux mixture:	
10 lbs. copper sulphate at 4*d.* per lb., 10 lbs. lime	3*s.* 6*d.* per 100 gallons.

Fig. 232.—Garden Spray-pump.

Paris green and Bordeaux mixture at above strength:	
10 oz. Paris green, 10 lbs. copper sulphate, and 10 lbs. lime	4*s.* 6*d.* per 100 gallons.
Paraffin emulsion: Paraffin 10 gallons at 8*d.*, soap 5 lbs., water 90 gallons.	7*s.* 10*d.* per 100 gallons.

WINTER WASHES.—For use before buds open.

Copper sulphate: 4 lbs. to 100 gallons water—1*s.* 4*d.* per 100 gallons.

Alkali wash: proportions recommended by Wye Agricultural College Kent.

10 lbs. commercial caustic soda at 4*d.* 10 lbs. crude potash at 6*d.* 7½ lbs. soft soap at 2*d.*	9*s.* 7*d.* per 100 gallons.

Paraffin-naphthalene emulsion (Cousins's patent) costs 1*s.* to 1*s.* 2*d.* per 100 gallons.

Soap wash for aphis, scale:

10 lbs. hard or soft soap at 2½*d.* to 100 gallons water.	2*s.* per 100 gallons.
Quassia and soft soap: quassia 4 lbs. at 4*d.*, soft soap 7 lbs. at 2*d.*	2*s.* 6*d.* per 100 gallons.

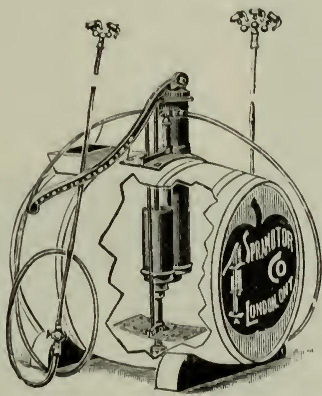


FIG. 233.—ORCHARD SPRAY-PUMP.

As an example of the cost of spraying, using a knapsack pump, on one acre of bush apple trees, ten years old, planted nine feet apart (too near), the following I found to be approximately the cost:

	s.	*d.*
107 gallons water (43 knapsacks × 2½ gallons) .		
10 oz. Paris green at 2*s.*	1	3
9 lbs. copper sulphate at 3¾*d.*	3	0
12 lbs. lime at ¼*d.*		3
Materials	4	6
Labour, one man 2¾ days at 4*d.* per hour . . .	9	0
Cartage of water and use of pump		6
	14	0

14*s.* ÷ 494 trees = ¼*d.* per tree.

If done with large pump and on more extensive scale, the cost of labour is much reduced. Examples of cost of spraying in America are given in JOURNAL R.H.S. September 1902, p. 352: Abstract, "Spraying the Orchard," by W. B. Alwood.

The following account of apple picking and packing in Nova Scotia was kindly written for me by the Rev. F. J. H. Axford, who some time ago won a prize of twenty-five dollars offered for the best packed ten barrels of apples on their arrival in England, the fruit sold 2*l.* per barrel.

Apple Picking and Packing in Nova Scotia, Canada.

To pick an apple, hold it firmly between the fingers and thumb, turn it upwards towards the top and centre of the tree, pressing fingers or thumb as convenient on the stem at its union with the branch; if ripe it will remove easily without shaking off others, which pulling will certainly cause to fall.

Steps and ladders of various lengths are used. The kind of ladder preferred is brought to a point at the top, as being lighter and more easily pushed among the branches, and for greater security is provided with an iron hook to hook over a branch, the object being to prevent the springing up of the branch when the weight of fruit is gathered, and the danger of the ladder and the picker falling, from lack of support. If the trees are very high, twenty or thirty feet or more, the picker may use a rope and lower his basket over a branch through the centre to someone below to empty it; this saves a lot of travelling up and down the ladder and shaking the ladder, but can only be done in a well-pruned tree.

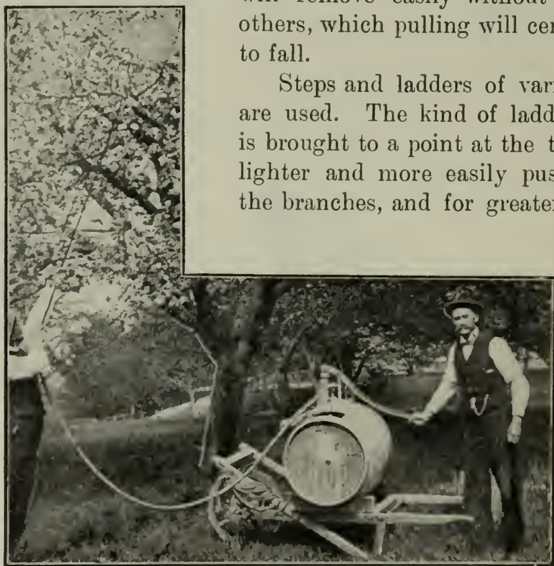


Fig. 234.—Spray-pump mounted on Wheelbarrow.

The receptacles for picking in are usually baskets holding from a peck to a half-bushel, with handles constructed to fall like that of a bucket; this is for ease in emptying it into the barrel, which is used for taking the fruit from the orchard. Some of late have introduced a canvas or duck basket, which, when painted, is stiff, but more pliable in the barrel—the essential point being to have the handle so as to fall to one side.

The barrel is the same as that used for transportation, and holds about two and a half bushels, made either of hard or soft wood, now of a standard size, viz. twenty-seven inches from end to end, and nearly cylindrical.

When the fruit is to be shipped at once, it is sorted when picked in the orchard. A sorting table is made of a frame of scantling, 3 in. by 2 in. is strong enough, and 6 ft. long and 3 ft. wide; this is covered by stout sacking, which sags slightly from the weight of fruit, supported at the four corners by barrels, or attached to a pair of light truck-wheels at one end, and a pair of stout legs at the other; this is a convenience for moving where required, and if a little lower at one end than the other, the fruit will roll down to the picker's hands.

If the fruit is to be stored, it can be done either in the barrels or in bins in the fruit-house, each plan having its advantages.

Barrels require less room, as they can be piled one on top of the other, but in bins the apples are more evenly mixed. The fronts of the bins are made of movable narrow boards sliding in slots at the ends to allow of the removal of a board as the heap lowers. When sorted from a bin, the quality both as to colour and size will be more equal in all the barrels shipped, whereas of apples stored in barrels, when turned out, some may be highly coloured or the reverse, and the same as to size, and so the grades will not be as even.

To prepare the barrel for packing, choose the smoothest end, nail well through the hoops into the head, drive down the bilge hoops and nail them, loosen the hoops at the other end, knock the end in, flatten down any nail points inside, then place on the inside a thin layer of excelsior or wood wool, and on this a sheet of white printer's paper, or paper specially cut for the purpose.

For the top layer the fruit is chosen an average of the quality to be in the barrel; the apples are placed stem down, thus when the barrel is opened they will show stem up; some place a second layer in a like manner, after which the apples are poured from the basket, taking care to lower it well down and turn over gently so as not to bruise the fruit. When a third full the barrel is well shaken on firm ground, which is done again after each basketful is emptied; the barrel is filled to the very brim, then a sheet of paper is placed over them, then the bottom (or head so called), which is pressed down with a screw-press, shaking occasionally, that the fruit may fall into the crevices; nail in bottom as before directed. It will now handle solidly and bear transhipment without bruising.

The fruit is sorted into extras, No. 1, and No. 2, or XXX, XX, X. If any are abnormally large, they should not be placed to show up when the barrel is opened, but put in the middle of the barrel; there will not be many of them, but many will be looked for, if at first seen, with a disappointment at not being found, but when come upon unexpectedly in the centre a pleasant surprise is the result, with a demand for that particular brand, which in the previous case would be avoided. The name of the grower or packer, and name and quality of apple, are stencilled on the head of the barrel.

A small quantity of apples are exported in bushel boxes, made with solid ends and bottom, and slatted sides; the ends are made of $\frac{3}{4}$-inch boards, the bottom of $\frac{1}{4}$-inch, the slats 2 inches wide; size of crate 18 inches long, 13 inches wide, and 12 inches deep. These may gradually become popular, as they have with Tasmanian apples, but at present the barrel is the standard package, and is, I think, easier and quicker to pack, and carries the fruit remarkably well.

We, as English fruit-growers, have much we may with advantage learn both from our colonies and from the United States, and from our foreign competitors, modifying some of their methods to our individual requirements. In the United States, in most of our colonies, and in many foreign countries, the Government experimental stations and colleges are the great practical and scientific teachers. Here we have to work these things out more slowly ourselves, with the help of information collected and spread by horticultural and agricultural societies and gardening literature.

I believe it would be a great help to fruit-growers to have an expert in spraying to visit fruit farms and gardens, and advise and show the best and easiest ways to clean our plantations from insect and fungoid pests. The County Bee-keepers' Associations have their experts, who are of great assistance in showing us how to manage our bees; why do we not have a spraying expert, well versed in practice and theory?

I desire to express my thanks for the permission to use their photographs to Prof. F. C. Sears, School of Horticulture, Wolfeville, Nova Scotia; and to Prof. Wm. B. Alwood, F.R.H., Polytechnic Institute, Blacksburg, Virginia. Also for the loan of numerous blocks from the Spramotor Company, London, Ontario.

FIG. 235.—PEAR EYEWOOD. (*Journal of Horticulture.*)

THE MANURING OF MARKET-GARDEN CROPS.

By Bernard Dyer, D.Sc., F.I.C., and F. W. E. Shrivell, F.L.S.

Introductory.

Our experiments on the manuring of vegetable and fruit crops have now entered on their tenth year. The following pages contain the records of the first eight years, and, to a partial extent, those of the ninth year, together with the practical conclusions which they thus far appear to us to indicate.

In order that the reader who has not followed the earlier accounts of our work may be enabled more easily to understand its scope and bearing it is necessary to make some general prefatory observations.

Our work very largely resolves itself into an inquiry as to whether or not the large quantities of purchased dung now used by market gardeners are being used to the greatest economical advantage. It may be taken as common knowledge that market-garden crops are more heavily manured than any other crops except hops, and that nowhere is the worship of dung more devoutly practised than in the market-garden. For this there are two chief reasons. The first lies in the tradition of the ages during which dung was the only available manure, and during which the home patch of vegetables preceded the modern market garden. This home patch, being near the stable and the cowhouse, and also near the domestic rubbish heap, could be manured lavishly with the maximum of ease, and afforded an always near and striking object-lesson in the value of the then only manure to be had. And so the ideas of vegetable growing and of heavy dunging became correlatively fixed, even when market gardening had grown into an important branch of broad-acre farming.

The other reason is that, since the market garden exists to supply large towns or cities, it is necessarily situated within fairly easy reach of them, and therefore within fairly easy reach also of the vast quantities of stable dung produced therein. If the journey to town is a road journey, as it very commonly is, the carts that take the produce into market bring back dung; and in this case the cost of carriage of the dung is not directly felt, although it is really paid for in wear and tear of the horses and carts. When the journey to town is a railroad one, the companies' trucks take the place of the farm carts, and in this case the cost of carriage of the dung is directly felt.

When we began our experiments, the use of supplementary fertilisers in the market garden had not, of course, been wholly neglected, but the position they occupied in this industry relatively to dung had long been inconspicuous compared with the corresponding position which they occupy in ordinary farming. Moreover, the supplementary fertilisers most in vogue in the market garden were those of the more bulky kind—that is to say, of the kind more nearly allied to dung—namely, raw fish, furriers' waste, woollen rags, shoddy, and the like. In fact, for the most part, the same kind of bulky manures as the hop farmer has long delighted in. Most of these manures are chiefly nitrogenous, and the market gardener, like the hop farmer, is too often not alive to the fact that he is neglecting to supply the phosphates necessary to balance the nitrogen in them and to enable them to do their full work.

No doubt the better read and more thoughtful of our market gardeners have learned sufficient from ordinary farm practice to extend their system of manuring to the use of more concentrated fertilisers, such as Peruvian guano, bone dust, dissolved bones, superphosphate, fish guano, nitrate of soda, and sulphate of ammonia. But it is probably not too much to say that they are still in small proportion, considered relatively to their many brethren who neglect the aid offered by concentrated and easily portable fertilisers, and who question the virtue of any manure that does not, either by its bulk or by its smell, present some resemblance to dung.

Market gardeners who rely upon purchased dung from towns are aware that it consists largely of soiled straw not half saturated with liquid excreta; and of solid horse manure from the streets, which is little more than undigested fodder; and that this town dung is a very different thing from the cake-fed dung of the farmyard Some of them have probably heard that the weight of purchased dung is sometimes made up by the use of the hose or of the pump, and some who have taken the trouble to use a weighbridge may have discovered that the dealer in dung is apt to make mistakes either in his weights or in his invoices.

To partly make up for all these deficiencies, the common remedy is to apply very much larger quantities of purchased dung per acre than would be used in the case of ordinary farming with ordinary farmyard manure.

The cost of town dung on rail in London is usually about 3*s.* to 3*s.* 6*d.* per ton during the time of chief demand. It is cheaper in summer when it is in less demand, but it then has to be heaped and stored and deteriorates in value before it is used, which discounts the advantage of cheapness to a considerable extent. The cost of carriage varies from about 2*s.* per ton for twenty-five miles or under, up to 3*s.* 6*d.* per ton for fifty miles. That is to say, the dung costs, during the busy time, delivered in trucks at a local station, from 5*s.* to 7*s.* per ton. If we assume an average distance of two miles from the station to the farm, cartage at 9*d.* per mile brings up the cost, on a farm from twenty to fifty miles distant from London, to from 6*s.* 6*d.* to 8*s.* 6*d.* per ton. At Hadlow it costs us, on the farm, 8*s.* per ton, and it is probably only on very favourably situated farms that purchased dung costs much less than 7*s.* per ton.

Our market gardeners seldom use a dressing of less than 25 tons of dung per acre, costing, in round numbers, £10 per acre—a quantity quite insufficient to grow maximum crops; and they often use as much as 50 tons, costing £20, per acre, in one dressing.

It had long been the conviction of one of us that such heavy dressings must be economically wasteful, and that market gardeners would do far better for themselves in using smaller dressings of purchased dung and

GENERAL VIEW OF EXPERIMENTAL FIELD.

(Showing in the left middle of picture the failure of a half-plot of undamaged Onions which received only Phosphates and Nitrate without Potash, while the other half, receiving also Potash, shows a good crop.)

(*To face page* 996.)

spending a portion of the money thus saved on concentrated fertilisers, keeping the balance in their pockets. This conviction did not involve, we think, any blindness to the particular virtues of dung. Dung constantly adds to the store of humus or organic matter in the soil, and thus gives it a mechanical condition which corrects the inherent physical shortcomings peculiar in the one extreme to sandy soils and in the other to heavy clays. Probably the most intrinsically valuable property that dung possesses is its power of regulating the absorption and evaporation of water, and for this property alone it is so useful, on almost any soil, that the market gardener, even more than the farmer, cannot afford to neglect it. Formerly it had an altogether other and unique value; it was the only source of plant food that could be added to those of the unaided soil and air. But this has long ceased to be the case, and, regarded only as a source of readily available nitrogen, phosphates, and potash—merely as plant food—we had long suspected that purchased dung was an unduly expensive manure. On soils in fairly good mechanical condition, if one could but predict a rainfall normal in quantity and distribution, we could probably, for many vegetable crops, economically dispense altogether with dung; but as we have to insure ourselves against uncertainties of season, we cannot afford altogether to forego the assistance of dung, even at the risk of some extravagance. The market gardener, however, who is not too wedded to custom to make trial of new methods and to profit by new experience, will probably eventually learn to limit his outlay in purchased dung and to increase his expenditure in concentrated manures.

An opportunity occurred ten years ago of putting our views to the test of practice. One of us was consulted by Mr. Hillman, the Secretary of the Permanent Nitrate Committee, as to the drawing up of some practical instructions for the use of nitrate of soda for vegetable growing, a subject on which inquiries were occasionally being made by market gardeners and other gardeners who happened to have heard something of the general virtues of this particular fertiliser. Very little definite or reliable information, however, appeared to exist as to the best mode of using either this or any other artificial fertiliser for vegetable or market garden crops. Endless experiments had been made with all sorts of manures on the ordinary farm, but scarcely any had been recorded either in the market garden or in the kitchen garden, and all the detailed advice that could be given was necessarily cautious, meagre, and based largely on analogy. To meet the difficulty, the Committee, having a trust fund at its disposal for encouraging experimental work, liberally offered to defray the expense of a series of practical field experiments on the subject. The opportunity thus offered was gladly welcomed, and it was resolved to establish a market garden experiment station which should deal on an ample scale with a large variety of crops, if only a colleague able as well as willing could be found in occupation of a farm suitable for the purpose. The result was the co-operation of the authors of this report and the establishment of the now well-known Hadlow Experiment Station on the farm occupied by one of us near the village of Golden Green, in the parish of Hadlow, a few miles from the town of Tonbridge. This station is now in the tenth year of its age, and we hope, with the continued generous and public-spirited aid of the Committee which enabled us to establish it, to carry it on for many years to come.

It may be mentioned that the scope of our experiments has been since extended to the manuring of Hops and of various other agricultural crops. But at the present moment we are not concerned with that part of our work.

The Soil.

Having selected the farm on which to establish the experiment station, the next step was to select the ground. The surface soil of our farm varies very much in richness, and we considered that, for experimental purposes, it would be desirable to select as poor a field as possible and one as free as possible from the influence of previous manuring. We therefore chose a large arable field which, within recent times at any rate, had not been under hop or fruit culture, but which had been treated as ordinary arable land. Those who are familiar with the habits of hop farmers will know that, as a rule, no very great affection is lavished by them on such portion of the farm as is not, either presently or prospectively, regarded as hop land. The field in question had been only just sufficiently manured to enable it to bear fairly passable crops in ordinary rotation, while its natural or "inherent" fertility was probably not unfairly indicated by the name which the field bears on the plan of the estate, namely, "Snatchlands."

The soil of our main experimental field, as many readers of this report will already be aware, is a poor clay loam of lightish colour, resting upon a deep bed of heavy clay. The field selected for the experi ments had been under ordinary arable cultivation for a large number of years, and was well known for its natural infertility. On this latter ground it was considered an excellent soil for the purposes of experiment, and it is satisfactory to be able to record that, as an effect of the spade culture which is necessary in experimental plot work like ours, and of assiduous manuring, we have succeeded in converting the field into a fertile market garden.

The natural poverty of the soil will be indicated to chemists by the following analysis, which was made at the beginning of our experimental period:—

Silica and silicious matters undissolved by strong hydrochloric acid from the ignited soil	89·120
Matters dissolved by strong hydrochloric acid from the ignited soil:—	
Oxide of Iron	3·396
Alumina	2·680
Lime	0·313
Magnesia	0·200
Potash	0·219
Soda	0·187
Phosphoric Acid	0·084
Sulphuric Acid	0·034
Water of combination, organic matter, &c.	3·767
	100·000
Nitrogen	0·101

The Potash includes :—

Potash soluble in dilute (1 per cent.) citric acid solution (probably readily "available" potash) . . . . 0·004

The Phosphoric Acid includes :—

Phosphoric Acid soluble in dilute (1 per cent.) citric acid solution (probably readily "available" phosphoric acid) . . . 0·005

It will be seen that the soil is naturally poor in lime; and the quantity of phosphoric acid soluble in dilute citric acid solution clearly indicates the natural need of the field for phosphatic manure, and the proportion of soluble potash is sufficiently low to indicate also the need for potassic manure, and to account for the very marked effect produced by potash salts on some of our crops, especially on those plots on which no dung has been used. It will also be seen that the stock of organic nitrogen derived from the residues of previous crops is also very low, as is also the proportion of total organic matter; the soil is therefore also very well adapted for experiments involving an inquiry into the comparative value of nitrogenous manure for various crops.

A portion of this field which in the autumn of 1893 had been sown with wheat, was ploughed up during the winter and well dug, to prepare it as far as possible for the first season's trials. After the first season—that is to say, at the close of 1894—being poor in lime, it was limed at the rate of 2½ tons of lime per acre, and this treatment was repeated a year later.

General Plan of the Experiments.

The initiation of these experiments, as has been already mentioned, was due to the wish to ascertain how far and under what conditions nitrate of soda could be used to advantage in market gardening. It was clear, however, that experiments properly directed to the elucidation of this problem could not fail to be of value in answering other and wider questions, and it at once became our purpose to so arrange our trials as to render the information derivable from them as wide as possible. The general plan of the experiments is directly designed to obtain answers to the following questions :—

Is it more economical, in the case of any particular market-garden crop, to use light or heavy dressings of purchased dung (stable manure)?

How far can purchased dung, with due regard to economy, be partially replaced by simple chemical fertilisers?

Assuming nitrate of soda to be the nitrogenous fertiliser employed, what quantity is it most economical to use, in conjunction with phosphates and with or without potash, in partial replacement of dung?

Is it possible economically to dispense with dung altogether and to get as good a result simply by using chemical fertilisers?

It is not, be it clearly understood, intended to question the utility and high value of dung produced by animals on the farm and enriched by the consumption of purchased feeding stuffs. The production of such dung is a necessary outcome of the general system of farm management, and is, indeed, an important part of the farmer's business ; and to suggest that the use of such dung should be dispensed with or diminished would of course be ridiculous. But in almost all our market-garden districts farmers, as we have already said, yearly spend very large sums of money in the purchase of town dung and rely mainly upon it for fertilising their soil.

It may be said at once that the result of our experience, thus far, is to show that, for certain crops, the purchase of dung is extravagant, as its place can well be taken by chemical fertilisers ; and that, for most other crops, although the moderate use of dung often presents great advantages and should not be omitted, yet the use of the large dressings of purchased dung ordinarily applied is grossly extravagant. Our experiments will be found to show that the actual plant-feeding properties of dung can usually be purchased more economically in a concentrated form, the chief value of town dung for market-garden purposes depending rather upon its mechanical and physical effects. That these are sometimes of great value, especially in seasons of drought, has been already admitted ; but our experience shows that this advantage may in most cases be sufficiently well obtained, and with much greater economy, by the use of much smaller dressings of dung than are often applied, a sufficient quantity of chemical fertilisers being used in addition in order to supply a proper quantity of plant food.

The following diagram gives the general scheme of experiment followed in the case of most of the crops during the first five years.

Each of our vegetable and fruit crops (with a few exceptions) occupies each year a section divided into six plots, and, as far as can conveniently be arranged, the crops on the different sections are varied in accordance with recognised principles of rotation.

A LIGHT DUNG and PHOSPHATES with 1 cwt. NITRATE per acre.		B LIGHT DUNG and PHOSPHATES with 2 cwt. NITRATE per acre.	
No Potash.	Potash.	No Potash.	Potash.
C NO DUNG ; PHOSPHATES with 4 cwt. NITRATE per acre.		D LIGHT DUNG and PHOSPHATES with 4 cwt. NITRATE per acre.	
No Potash.	Potash.	No Potash.	Potash.
E LIGHT DUNG (25 loads, or $12\frac{1}{2}$ tons, per acre).		F HEAVY DUNG (50 loads, or 25 tons, per acre).	

During later years the dressings of nitrate of soda have in a large number of cases been increased according to the following scheme :—

A LIGHT DUNG and PHOSPHATES with 2 cwt. NITRATE per acre. No Potash. Potash.	B LIGHT DUNG and PHOSPHATES with 4 cwt. NITRATE per acre. No Potash. Potash.
C NO DUNG; PHOSPHATES with 8 cwt. NITRATE per acre. No Potash. Potash.	D LIGHT DUNG and PHOSPHATES with 6 cwt. NITRATE per acre. No Potash. Potash.
E LIGHT DUNG (25 loads, or 12½ tons, per acre).	F HEAVY DUNG (50 loads, or 25 tons, per acre).

Each of our plots, A, B, C, D, E, and F, is, as a rule, one-fiftieth of an acre in area. Each of the first four is subdivided into two, one half-plot receiving potash salts, the other half-plot receiving no potash salts—the dressing otherwise on each half-plot being uniform.

In the case of some crops dung is intermitted, in accordance with ordinary market garden practice. The dung in all cases is purchased town dung from London.

We vary the kind of phosphates by using sometimes superphosphate and sometimes basic slag. Since phosphates are required by all crops and are cheap, no particular interest attaches in market gardening to whether a hundredweight or two more or less of phosphates is used per acre, provided only that a sufficiency be given; and, as no harm is likely to arise from giving an excess, we have given liberal dressings. Of superphosphate we have usually used from 4 cwt. to 6 cwt. per acre, 6 cwt. per acre being adopted latterly. When basic slag has been used, we formerly applied 7 cwt. per acre, but latterly we have increased our dressings to 10 cwt. per acre. The actual dressings of phosphates per acre in the various years were as follows:—

1894. 4 cwt. Superphosphate and 4 cwt. Basic Slag, mixed.
1895. 4 cwt. Superphosphate.
1896. 6 cwt. Superphosphate.
1897. 7 cwt. Basic Slag.
1898. 4 cwt. Superphosphate.
1899. 6 cwt. Superphosphate.
1900. 10 cwt. Basic Slag.
1901. 6 cwt. Superphosphate.
1902. 6 cwt. Superphosphate.

As a source of potash, kainit has sometimes been used, at the rate of 4 cwt. per acre; but latterly we have used sulphate of potash at the rate of 1 cwt. per acre.

It has been necessary, owing to the large number of crops under investigation, to keep our choice of concentrated fertilisers as simple as possible. Thus, we have restricted our choice of phosphates to superphosphate and basic slag; but this is not due to any kind of conviction that these are under all circumstances to be preferred to other forms of phosphatic fertilisers. On the contrary, we believe that, in this kind of farming, guano and bone meal find a specially appropriate place.

Speaking generally of the choice of phosphates, it may be probably laid down as a good rule that, on soils containing sufficient carbonate of lime to effervesce when mixed with dilute mineral acid, the best form of phosphates to use is either superphosphate or some similar form of acid manure, such as dissolved guano or dissolved bones. On soils, however, which are deficient in carbonate of lime, it will be better to use either basic slag, raw Peruvian guano, or bone meal; or a mixture of bone meal and superphosphate; or the material lately introduced into the market, on the suggestion of Mr. John Hughes, under the name of "basic superphosphate," which consists of superphosphate neutralised with lime; or, at any rate, that one or other of these manures be applied alternately with superphosphate.

Similarly, it has been impracticable, as well as beyond the direct scope of our inquiry, to compare the relative efficacy of nitrate of soda with that of other concentrated nitrogenous fertilisers, such as sulphate of ammonia or Peruvian guano, or with that of less rapid but, when properly used, efficacious organic manures like fish guano, rape meal, &c. When it is explained that our scheme of experiments already involves over three hundred separate plots or sub-plots, the produce of each of which has to be gathered and weighed separately, the impossibility of undertaking comparative trials between nearly allied fertilisers will be apparent. Probably many of the results that we have obtained by the use of nitrate of soda and superphosphate or basic slag might have been equally well obtained, on some soils, by the use of sulphate of ammonia, rape dust, or fish guano with bone meal or dissolved bones; or by the use of Peruvian guano, raw or dissolved; each of such manures, of course, being applied in the fashion best suited to its special rate of activity. The results that we are obtaining, however, with the simple materials nitrate of soda, phosphates, and potash salts, will, we hope, show eventually how far we may go in the liberal nitrogenous feeding of vegetable and fruit crops; and we hope that those who are disposed to make comparative trials between the concentrated fertilisers used by ourselves and other fertilisers which have been enumerated, will find that our work has served to indicate to them the most probable lines of successful experiment.

Our scheme of experiments, it will have been gathered, enables us to contrast the effects of light and heavy dunging continuously practised year after year, and also to compare or contrast light and heavy dunging, respectively, with light dunging supplemented by the use, in different quantities, of concentrated chemical fertilisers; and also with the effects of the latter when unaccompanied by dung.

ANOTHER GENERAL VIEW OF EXPERIMENTAL FIELD.

(*To face page* 1003.)

Rainfall.

The rainfall, as indicated by observations made on our farm, has, from the commencement of our experiments, been low as compared with the records of the last twenty years (averaging 28·47 inches) taken in the neighbouring town of Tonbridge, which is only about four miles distant. Hadlow, however, lies in a basin surrounded by hills, and many rain-storms break at the edge of the basin without reaching Hadlow. The observations of the last eight years indicate that the rainfall on our farm is from 1½ inch to 2 inches less than at Tonbridge itself. There can, therefore, be little doubt that our local climate is a dry one, even for the neighbourhood. The following table shows the rainfall on the farm during each year from 1895 to 1902 inclusive :—

	1895	1896	1897	1898	1899	1900	1901	1902
	in.	in.	in.	in.	in.	in.	in.	in.
January . .	2·11	0·72	1·48	0·57	2·94	3·01	0·96	0·97
February . .	0·50	0·30	2·51	1·24	2·41	5·25	1·61	1·22
March . .	1·52	2·44	3·99	1·46	0·93	1·00	2·08	1·60
April . . .	1·91	0·60	1·98	0·91	2·70	0·85	1·70	0·51
May . . .	0·06	0·33	0·92	3·06	1·34	1·14	0·61	2·42
June . . .	0·23	3·23	1·86	1·46	0·97	3·32	1·67	2·15
July . . .	2·85	0·83	0·30	0·46	1·35	1·34	1·91	2·12
August . .	1·66	1·52	2·20	1·22	1·63	2·06	1·69	2·79
September . .	0·38	5·75	2·88	0·35	2·62	0·83	1·03	1·82
October . .	2·89	3·62	0·36	2·72	1·81	2·08	2·33	2·27
November . .	5·63	1·47	1·18	2·59	4·39	2·74	0·72	1·97
December . .	3·81	3·38	3·39	2·21	1·55	2·98	3·95	1·60
Total . .	23·55	24·19	23·05	18·25	24·64	26·60	20·26	21·44

The average yearly rainfall recorded at Tonbridge (four miles away) for twenty years previously was 28·47 inches. This would probably correspond to 26½ inches if registered at Hadlow.

It is well known that throughout the country for the last ten years the rainfall has been much under average, and it therefore is not surprising that at Hadlow itself we have suffered a good deal during several years from drought at some period or another in the summer. In a market garden bad weather, whether due to excessive cold, excessive heat, excessive moisture, or excessive drought, is sure to come at a time critical for some one or other of the many crops cultivated. Even in seasons of drought considerable variations occur in the distribution of the total rainfall over the various months in different years, and though we may have consecutively two or three seasons which may be all classed as dry, yet the drought in one year may occur at such a time as to injuriously affect one crop, in another year at such a time as to affect another crop ; while conversely, even a scanty rainfall may so vary in its distribution as to favour one crop in one year and another crop in another year. And the same remarks are applicable even to wet seasons. It is only by collating and averaging the experience obtained over a number of years that general results can be deduced ; and the larger the number of seasons included in our record, the more trustworthy and the more valuable is the information that we gain.

Both of us, in the earlier years of our work, were sometimes diffident in responding to requests for advice relating to the manuring of some of the crops on which we had experimented. Although we feel, even now, that our work is still young, we are, however, each year in a somewhat better position to make suggestions to those who care for them; and this not merely in virtue of our own enlarged experience, but on account of the wide interest which has been displayed in our work by practical growers of fruit and vegetables on both a large and a small scale all over the country, which happily affords us frequent opportunities of conversing and comparing notes with others as to the practical results which they have obtained from following our methods.

Calculation of Weights of Fertilisers for Small Plots.

In the following pages it will be found that our manurial applications are, for the sake of uniformity of comparison, calculated in quantities per acre. For readers who may wish to manure smaller areas than this, it may be convenient to give at once a short table enabling them to see at a glance what are the corresponding quantities for smaller areas of ground. We have therefore calculated the various dressings from 1 cwt. up to 8 cwt. per acre into their equivalent quantities for—

1 rood ($\frac{1}{4}$ of an acre).
1 square rod or perch ($\frac{1}{40}$ of a rood or $\frac{1}{160}$ of an acre).
1 square yard ($\frac{1}{4840}$ of an acre).

The calculation of dressings per yard is only approximate, but it will be found convenient for the use of readers who wish to make experimental trials on a small scale, or to manure even a few yards of domestic kitchen garden.

The various equivalent dressings are as follows:—

Quantity per acre	Equivalent quantity per		
	Rood	Square rod or perch	Square yard
cwt.	lbs.	lbs.	oz.
1	28	$\frac{3}{4}$	$\frac{3}{8}$
2	56	$1\frac{1}{2}$	$\frac{3}{4}$
4	112	$2\frac{3}{4}$	$1\frac{1}{2}$
6	168	$4\frac{1}{4}$	$2\frac{1}{4}$
8	224	$5\frac{1}{2}$	3

The simple fertilisers used in our experiments can, we may add, be obtained in quite small quantities from any reputable dealer in manures or horticultural requisites.

Cauliflowers (Autumn-cut).

We have recorded, up to 1901, the results of eight years' crops of autumn Cauliflowers.

Our plan of gathering the crop has been to go daily over the ground during the flowering season and to gather and individually weigh each head just as it has reached such a state of maturity that the flower shows signs of beginning to "break." By gathering all the heads at the same state of comparative maturity, the aggregate weights obtained from the different plots are rendered comparable.

The first five crops were grown on our original plan of manuring, and the last three on the later plan, which includes increased dressings of nitrate of soda.

The following table gives the average results obtained over eight years for the plots which were similarly manured during the whole of that time, and it also shows the average for the last three years, including also, in this case, the plots treated with larger dressings of nitrate. In this table are given only the results obtained on the plots which received dung, with or without chemical fertilisers.

CAULIFLOWERS.

Annual manuring per acre	Annual cost of manure per acre			Average for eight years (1894–1901): Average gross yearly weight of heads per acre		Average for eight years (1894–1901): *Average weight per head	Average for three years (1899–1901): Average gross yearly weight of heads per acre		Average for three years (1899–1901): * Average weight per head
	£	s.	d.	tons	cwt.	lbs.	tons	cwt.	lbs.
50 loads (25 tons) London Dung	10	0	0	16	3	3·87	18	1	3·79
25 loads ($12\frac{1}{2}$ tons) London Dung	5	0	0	13	5	3·16	14	1	3·05
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda .	6	15	0	16	11	4·04	18	5	4·01
Ditto, ditto (with Potash) .	7	5	0	17	6	4·17	19	10	4·22
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda .	7	15	0	18	11	4·42	21	15	4·49
Ditto, ditto (with Potash) .	8	5	0	19	2	4·52	23	16	4·93
25 loads Dung, Phosphates (no Potash), and 6 cwt. Nitrate of Soda .	8	15	0	—		—	22	17	4·72
Ditto, ditto (with Potash) .	9	5	0	—		—	23	1	4·78

* The "weight per head" average is not always proportional to the weight per acre, as we have in later years planted our Cauliflowers closer together than in the earlier years.

Whether we regard the gross weight per acre or the average weight per head of the Cauliflowers grown, we see at once that the heavy dressing of dung, although it has increased the crop as compared with the light dressing, has failed to give anything like the good results obtained by the addition of chemical fertilisers to a lighter dressing of dung.

Taking the eight years' average, the weight per head increases with the increase in nitrate of soda up to 4 cwt. per acre.

Taking the average of the last three years, the results are in the same direction, but no advantage has been derived from increasing the nitrate of soda beyond 4 cwt. per acre (used in conjunction with dung, phosphates, and potash).

Potash salts, during the first five years, proved to have little affected our Cauliflowers, but in the last three years they appear to have materially increased the crop, even where dung has been used year by year.

The foregoing table does not show the results obtained on the plots to which no dung has been applied. These are given in the following table, and with them, for comparison, are again given the results of the most important of the dunged plots. The average for the first five years and the average for the last three years are shown separately.

CAULIFLOWERS.

Annual manuring per acre	Annual cost of manure per acre			Average for five years (1894–1898)			Average for three years (1899–1901)		
				Average gross yearly weight of heads per acre		Average weight per head	Average gross yearly weight of heads per acre		Average weight per head
	£	s.	d.	tons	cwt.	lbs.	tons	cwt.	lbs.
50 loads (25 tons) London Dung	10	0	0	15	0	3·94	18	1	3·79
25 loads (12½ tons) London Dung	5	0	0	12	12	3·31	14	1	3·05
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda .	7	15	0	16	13	4·31	21	15	4·49
Ditto, ditto (with Potash) .	8	5	0	16	5	4·31	23	16	4·93
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda .	2	15	0	14	11	3·75	—		—
Ditto, ditto (with Potash) .	3	5	0	15	0	3·94	—		—
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda .	4	15	0	—		—	20	9	4·25
Ditto, ditto (with Potash) .	5	5	0	—		—	22	0	4·59

Taking the first five years' average, it will be seen that the light dressing of dung, with phosphates and 4 cwt. of nitrate of soda per acre, produced a better result than chemical fertilisers alone, the quantity of nitrate of soda used being the same. On the other hand, it is interesting to notice that the chemical fertilisers without dung gave, at little more than a third of the cost, as good a result as even fifty loads of dung alone per acre.

In the last three years the undunged plots received a much larger dressing of nitrate, namely, 8 cwt. per acre, together with phosphates, with or without potash. The results yielded by the last-named plot were not much inferior to those obtained on the plot receiving a light dressing of dung supplemented by chemical fertilisers including 4 cwt. of nitrate of soda per acre, and were far in excess of the crops grown by the unaided use of a heavy dressing of dung.

As has been noticed in earlier reports, the advantage derived from the use of chemical fertilisers is by no means confined to a mere increase in

BROCCOLI, 1895–6.

Crop, 13 tons 10 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

Crop, 18 tons 19 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
4 cwt. Superphosphate,
4 cwt. Nitrate of Soda

(cost £7 10s. per acre).

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the size of the heads. The Cauliflowers grown with the aid of phosphates and nitrate of soda have been uniformly of decidedly better quality than those grown with dung alone, the midribs of the sheathing leaves being so tender and free from tough vascular tissue as to be soft and readily edible, while those of the heads grown with dung only have been comparatively tough and fibrous at the base, as is usually the case in the full-grown Cauliflower of the market.

Summarising our experience thus far, we should for general purposes recommend for Cauliflowers a light dressing of dung (about 12 tons per acre), with from 4 to 6 cwt. of superphosphate, 4 cwt. of kainit (or 1 cwt. of sulphate of potash), and 4 cwt. of nitrate of soda per acre. If the dung supply should run short, then use 6 cwt. of superphosphate and 4 cwt. of kainit, well incorporated with the soil before planting, and sow 4 cwt. of nitrate of soda per acre directly the plants are well established, giving a further top dressing of 2 to 4 cwt. of nitrate per acre a month later. On land deficient in lime, superphosphate may be replaced by basic slag, phosphatic Peruvian guano, or fine bone meal.

Broccoli.

We cut our eighth crop of Broccoli (or Winter Cauliflowers) in 1902. This crop is planted out in the summer and cut during the following spring.

The first five crops were grown on the original plan of manuring and the last three on the newer plan, including larger dressings of nitrate of soda than had been previously used.

The heads are cut and individually weighed just as the "flower" shows signs of beginning to "break."

The results obtained are set out in the following tables:—

BROCCOLI (Dunged Plots).

Annual manuring per acre	Annual cost of manure per acre			Average for eight years			Average for last three years		
				Average gross yearly weight of heads per acre		Average weight per head	Average gross yearly weight of heads per acre		Average weight per head
	£	s.	d.	tons	cwt.	lbs.	tons	cwt.	lbs.
50 loads (25 tons) London Dung	10	0	0	12	16	2·76	15	10	3·21
25 loads (12½ tons) London Dung	5	0	0	11	8	2·44	14	3	2·94
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda .	6	15	0	12	13	2·74	13	9	2·78
Ditto, ditto (with Potash) .	7	5	0	11	16	2·85	14	15	2·98
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda .	7	15	0	14	2	3·04	15	6	3·18
Ditto, ditto (with Potash) .	8	5	0	13	17	2·98	15	13	3·24
25 loads Dung, Phosphates (no Potash), and 6 cwt. Nitrate of Soda .	8	15	0	—		—	16	5	3·37
Ditto, ditto (with Potash) .	9	5	0	—		—	17	1	3·54

BROCCOLI.

(Comparison of Dunged and Undunged Plots.)

Annual manuring per acre	Annual cost of manure per acre	Average for five years (1894-1895 to 1898-1899) Average gross yearly weight of heads per acre	Average for five years Average weight per head	Average for last three years (1899-1900 to 1901-1902) Average gross yearly weight of heads per acre	Average for last three years Average weight per head
	£ s. d.	tons cwt.	lbs.	tons cwt.	lbs.
50 loads (25 tons) London Dung	10 0 0	11 6	2·48	15 10	3·21
25 loads (12½ tons) London Dung	5 0 0	9 14	2·14	14 3	2·94
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda .	7 15 0	13 8	2·94	15 6	3·18
Ditto, ditto (with Potash) .	8 5 0	12 16	2·83	15 13	3·24
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda .	2 15 0	11 7	2·51	—	—
Ditto, ditto (with Potash) . .	3 5 0	11 13	2·59	—	—
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda .	4 15 0	—	—	14 7	2·97
Ditto, ditto (with Potash) .	5 5 0	—	—	15 13	3·25

It appears that, throughout, the least economical crop has been that grown with heavy dung, which has been not a great deal better than that grown with light dung alone. Light dung and chemical fertilisers have given a better crop, but, on surveying all the records up to the present, it appears that in our earlier years the best results were those from light dung, phosphates, and 4 cwt. of nitrate of soda per acre, and in later years those from light dung, phosphates, and 6 cwt. of nitrate of soda per acre.

Chemical fertilisers alone, however, when nitrate is liberally used, seem to answer well without dung; and probably, for land in good condition that has been dunged for a previous crop, any special application of dung for this crop may be dispensed with. But in that case the dressing of phosphates should be liberal, and should be accompanied by a dressing of 4 cwt. of kainit per acre (spread before the land is prepared for planting), and the nitrogenous dressing should be heavy, say 6 to 8 cwt. of nitrate of soda per acre—half applied just before planting out, and the rest in one or more top dressings later in the summer. Possibly, as the crop does not flower until spring, part of the nitrate might with advantage be reserved till after the winter. But this plan we have never tried.

Autumn-cut Cabbages.

These are the Main-crop Cabbage, planted in summer and cut in the autumn. Next to Potatos they form the largest crop of the market gardener. They are well known as what is called an exhausting crop, being "hungry feeders," and both their weight and their quality are readily influenced by manuring. What has been already said of the

BROCCOLI, 1898-9.

Crop, 16 tons 3 cwt. per acre.
Manure per acre.
25 tons London Dung

(cost £10 per acre).

Crop, 16 tons 17 cwt. per acre.
Manure per acre.
No Dung,
4 cwt. Superphosphate,
4 cwt. Kainit,
4 cwt. Nitrate of Soda

(cost £3 per acre).

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AUTUMN CABBAGES.

$12\frac{1}{2}$ tons London Dung per acre

(cost £5 per acre).

No Dung, 6 cwt. Superphosphate,
8 cwt. Nitrate of Soda,
1 cwt. Sulphate of Potash per acre

(cost £5 5*s*. per acre).

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effect of chemical fertilisers on the quality of Cauliflowers is especially the case also with Cabbages. The large, well-developed Cabbages grown with phosphates and a liberal application of nitrate of soda, either with or without dung, are uniformly far less fibrous and more succulent and tender than the plants raised on dung alone, even when as much as 50 loads per acre are used.

We grew five crops on our original plan of experiment, and have recorded three more crops under the newer scheme, including larger dressings of nitrate of soda. On the whole, potash salts have not increased the average yield of this crop in any marked degree on the plots on which dung was used.

Although Autumn Cabbages are a rapidly growing and gross-feeding crop, they seem, like other members of the botanical order of *Brassicaceæ*, to possess great natural facility in availing themselves of the natural potash resources of the soil, even when these are slender.

The following table shows the average results obtained with some of the principal dressings, over a period of eight years; and also, in another column, the results obtained during those years in which the heavier dressings were included :—

AUTUMN-CUT CABBAGES.

Annual manuring per acre	Annual cost of manure per acre			Weight of Cabbages per acre per annum			
				Eight years' average (1894–1901)		Three years' average (1899–1901)	
	£	s.	d.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung .	10	0	0	23	9	24	3
25 loads ($12\frac{1}{2}$ tons) London Dung .	5	0	0	20	11	20	6
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda . . .	6	15	0	24	9	23	12
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda . . .	7	5	0	26	3	24	9
25 loads Dung, Phosphates, and 6 cwt. Nitrate of Soda . . .	8	15	0	—		27	17

It will be seen that, on the eight years' average, the heavy dressing of 50 loads of dung per acre only gave $2\frac{1}{2}$ tons of Cabbages per acre more than the light dressing of dung. When, instead of doubling the dung, the light dressing was supplemented by chemical fertilisers, the increase was much greater—namely, nearly 4 tons per acre when 2 cwt. of nitrate of soda were used, and nearly $5\frac{1}{2}$ tons when 4 cwt. of nitrate were used. During the last three years the average crops obtained with light and heavy dressings of dung were much the same as on the average of the eight years; and here again the chemical fertilisers, in addition to the light dressing of dung, gave very much better results than the heavy dung, the average increase from chemical fertilisers being $3\frac{1}{4}$ tons per acre when 2 cwt. of nitrate of soda were applied, and about 4 tons per acre when 4 cwt. of nitrate were applied. The further increase of the nitrate dressing to 6 cwt. per acre gave a still further increase of nearly $3\frac{1}{2}$ tons, the gain due to chemical fertilisers averaging in this case $7\frac{1}{2}$ tons of Cabbages per acre, or nearly twice the increase obtained by doubling the dung; the expense of the chemical fertilisers being at the same time very much less than that of the extra dung.

In the foregoing table reference has been omitted to the plots on which a crop was grown without any dung at all. These, however, are highly important, indicating as they do that chemical fertilisers, even when used entirely alone, are far more economical for Cabbages than dung is. These results are shown in the following table :—

AUTUMN-CUT CABBAGES.

Annual manuring per acre	Annual cost of manure per acre	Weight of Cabbages per acre per annum: Five years' average (1894–1898)	Weight of Cabbages per acre per annum: Three years' average (1899–1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung .	10 0 0	23 0	24 3
25 loads ($12\frac{1}{2}$ tons) London Dung .	5 0 0	20 14	20 6
No Dung; Phosphates (without Potash) and 4 cwt. Nitrate of Soda	2 15 0	24 14	—
Ditto, ditto (with Potash) . .	3 5 0	24 9	—
No Dung; Phosphates (without Potash) and 8 cwt. Nitrate of Soda	4 15 0	—	24 14
Ditto, ditto (with Potash) . .	5 5 0	—	25 18

These figures speak sufficiently for themselves.

It may be noticed that, during the last three years, where the very heavy dressings of nitrate of soda were used without dung, potash seems to have produced a tangible result, although as a general rule it has not been found by us to benefit this crop.

Roughly speaking, the manures on the plots fertilised entirely by means of chemicals cost only about the same as the 25 loads of dung, or half the sum expended on the 50 loads of dung. Nevertheless, on surveying the whole of the results, it will be seen that there is a decided gain in crop where a light dressing of dung is used in addition to chemical fertilisers, as compared with the plots receiving no dung at all; and probably the best way to grow Autumn Cabbages is to use a light dressing of dung—not more than about 12 tons per acre—and to supplement this with a liberal dressing of phosphates and nitrate of soda. Phosphates are cheap, and it is better to give an abundance—say not less than 6 cwt. of good superphosphate per acre, or 8 to 10 cwt. of basic slag, according to the nature of the soil; while our experience indicates that nitrate of soda can be used with advantage up to 6 cwt. per acre. If this quantity is used, 3 cwt. of it might be applied at planting out, and 3 cwt. a month or two later; or, if the climate happens to be a moist one, the total quantity might be divided into three top dressings instead of two.

Although a moderate quantity of dung appears to be a desideratum for this crop, nevertheless, if dung is scarce, it may be dispensed with; and in this case the nitrogenous dressing may go safely as far as 8 cwt. per acre.

SAVOY CABBAGES, 1895.

Crop, $12\frac{1}{4}$ tons per acre.
Manure per acre.
$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

Crop, $19\frac{1}{2}$ tons per acre.
Manure per acre.
No Dung,
4 cwt. Superphosphate,
4 cwt. Nitrate of Soda

(cost £2 10*s*. per acre).

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Savoy Cabbages.

In 1894 we grew two crops of Savoys (slightly different varieties), and have grown a crop in each year since. Our crop in 1901 was thus our ninth. Up to 1898 we used the original scheme of manuring, but since that year we have extended the dressings of nitrate of soda.

In 1900 the crop was hampered by drought in a critical stage of its growth, and was consequently very small. The small size of this crop reduces the average for the last three years to somewhat small dimensions.

The results are given in the following table :—

SAVOY CABBAGES.

Annual manuring per acre	Annual cost of manure per acre	Weight of Cabbages per acre: Average of 9 crops (1894-1901)	Weight of Cabbages per acre: Average of 3 crops (1899-1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung .	10 0 0	15 19	15 16
25 loads ($12\frac{1}{2}$ tons) London Dung .	5 0 0	13 3	12 16
25 loads Dung, Phosphates (without Potash), and 2 cwt. Nitrate of Soda	6 15 0	17 10	16 1
Ditto, ditto (with Potash) . .	7 5 0	18 5	16 10
25 loads Dung, Phosphates (without Potash), and 4 cwt. Nitrate of Soda	7 15 0	18 5	15 16
Ditto, ditto (with Potash) . .	8 5 0	18 4	16 4
25 loads Dung, Phosphates (without Potash), and 6 cwt. Nitrate of Soda	8 15 0	—	16 7
Ditto, ditto (with Potash) . .	9 5 0	—	17 4

It will be seen that the most extravagant dressing has been the dressing of heavy dung, no matter whether we regard the average of nine crops or that of the last three crops. On the average of the nine crops the difference between the lightly dunged and the heavily dunged crops has been less than 3 tons per acre, while, by the aid of the dressing of chemical fertilisers consisting of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre, the corresponding increase has been over 5 tons per acre.

On the average of the last three years, the increase of nitrate from 4 cwt. to 6 cwt. per acre has produced an extra ton of Cabbages, but in one of the two years the increase was nearly $2\frac{1}{2}$ tons per acre. In 1900 the crop was so small that the heavy dressings produced but little effect on it. In 1899, when the crop was large, and also in 1901, potash produced a good effect, which was rarely the case in our previous experience with this crop.

In the foregoing table we have only considered the effects of different chemical dressings as an adjunct to dung. The following table summarises the results obtained by entirely substituting chemical fertilisers for dung :—

SAVOY CABBAGES.

Annual manuring per acre	Annual cost of manure per acre	Average weight of Cabbages per acre: Six crops (1894–1898)	Average weight of Cabbages per acre: Three crops (1899–1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung	10 0 0	16 0	15 16
25 loads ($12\frac{1}{2}$ tons) London Dung	5 0 0	13 7	12 16
No Dung; Phosphates (without Potash) and 4 cwt. Nitrate of Soda	2 15 0	17 3	—
Ditto, ditto (with Potash)	3 5 0	16 18	—
No Dung; Phosphates (without Potash) and 8 cwt. Nitrate of Soda	4 15 0	—	16 11
Ditto, ditto (with Potash)	5 5 0	—	16 7

Here again the chemical dressings alone will be seen to have consistently produced greater crops than the use of even 50 loads of dung per acre without them.

The heavy dressing of dung, it will be noticed, costs £10 per acre, and even the light dressing costs £5 per acre. The chemical fertilisers used on the first six crops averaged in cost about £3 per acre, and those used in the last three years about £5 per acre. The relative economy of dung and chemical fertilisers for Savoy Cabbages is thus very apparent.

It is singular that, while potash seems to have done good during the last three years on the plots receiving both dung and chemical fertilisers, it has produced little or no effect on the plots receiving chemical fertilisers only. This is possibly attributable to the solvent action of the increased quantity of nitrate of soda on the mineral potash salts of the soil.

Probably, on the whole, the best manuring for Savoys would be a light dressing of dung, a good dressing of phosphates, and 4 cwt. of nitrate of soda per acre. But if dung is scarce it may be omitted, using in that case 6 cwt. of nitrate of soda per acre.

Spring Cabbages.

This crop is sown in the late summer and planted out after some other crop in the autumn, being cut for market in the late spring or early summer. It is usual to apply dung for Spring Cabbages, even when they follow another crop that has been dunged; and, although we are, for several reasons, doubtful as to the general advisability of this course, we have followed the usual custom of the market gardener.

The following table shows the average results obtained on the plots on which dung has been used, with and without chemical fertilisers:—

SPRING CABBAGES.

Annual manuring per acre	Annual cost of manure per acre	Average weight of Cabbages per acre (seven years, 1895–1901)
	£ s. d.	tons cwt.
50 loads (25 tons) London Dung	10 0 0	17 10
25 loads ($12\frac{1}{2}$ tons) London Dung	5 0 0	16 15
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6 15 0	17 14
Ditto, ditto (with Potash)	7 5 0	18 9
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7 15 0	17 15
Ditto, ditto (with Potash)	8 5 0	18 18

SAVOY CABBAGES, 1895.

Crop, 18 tons 2 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
4 cwt. Superphosphate,
4 cwt. Nitrate of Soda

(cost £7 10s. per acre).

Crop 12 tons 6 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
without chemical fertilisers

(cost £5 per acre).

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In 1900 and 1901 we had plots receiving 6 cwt. of nitrate of soda per acre in addition to phosphates and potash salts. In 1900 the extra nitrate did no good, but in 1901 the increase was profitable as compared with the lighter dressings.

It will be seen that, on the average, there has been very little difference between the yields of the lightly and heavily dunged plots, but that the use of moderate dressings of chemical fertilisers, in addition to the light dunging, has produced a decidedly better result than the heavy dunging, and at much less expense. Let us, however, regard the average results obtained with chemical fertilisers alone, as compared with those obtained on the dunged plots :—

SPRING CABBAGES.

Annual manuring per acre	Annual cost of manure per acre	Average weight of Cabbages per acre: Five years (1895–1899)	Average weight of Cabbages per acre: Two years (1900 and 1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung .	10 0 0	16 2	21 0
25 loads ($12\frac{1}{2}$ tons) London Dung .	5 0 0	15 12	19 17
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7 15 0	17 4	19 1
Ditto, ditto (with Potash) . .	8 5 0	18 0	21 3
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda . .	2 15 0	16 13	—
Ditto, ditto (with Potash) . .	3 5 0	17 14	—
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda . .	4 15 0	—	20 6
Ditto, ditto (with Potash) . .	5 5 0	—	20 17

Obviously the most economical plots have been those on which no dung at all was used.

There is very little difference between the plots receiving chemical fertilisers with dung and those receiving chemical fertilisers without dung.

We have already expressed our opinion that for ordinary Autumn Cabbages a light dressing of dung, even when plenty of phosphates and nitrate are used, appears to be of distinct advantage. This would seem to be also the case with Savoys. On the other hand, however, no tangible advantage appears to be derived from applying a special dressing of dung for *Spring* Cabbages. One reason for the difference, probably, is that the life of the ordinary Autumn Cabbage is confined to the summer and autumn. It is raised on the seed-bed in spring and planted out in summer, maturing in the autumn. Its growth thus takes place during the hottest months of the year. The mechanical effects of dung in retaining moisture, therefore, during dry hot weather—apart from the fertilising value that it possesses—may often be of great utility to this crop, and this would partly be the case during the dry seasons that have prevailed during the greater part of our experimental period. It is quite possible, however, that in wet seasons, or in wetter districts, the use of dung for Autumn Cabbages might not show so great an advantage.

The Spring Cabbage, however, is planted out in the autumn, and makes little growth until the growing season sets in in the spring. It is therefore not liable to suffer to any great extent from drought in its early stages, its principal enemy, indeed, being the cold of the winter. Then its active growth, when it does begin, takes place during the late spring and early summer ; and here again, having already established itself, it is much less likely to suffer from drought than the other kinds of Cabbages that are planted out in the heat of summer.

Another reason, to which we have already given expression, is that dung when applied to autumn-planted Cabbages may possibly feed the plant too much in its early stages. As has been already pointed out, all that the crop has to do during the winter is to keep alive, and all that is really needed, in order to give it a good chance of welfare, appears to be to get it well established before the winter sets in. But it seems desirable that the young plant should not be too advanced in its growth before the winter.

Should the winter chance to be mild and open, doubtless early forwardness of growth may prove to be an advantage in bringing on early maturity ; but if the winter happens to be long or hard, an early advance in growth may be a positive disadvantage, rendering the plant less able to stand the perils of frost. Plants that are killed or crippled by frost during the winter have to be replaced by successors transplanted from a reserve seed-bed, which is necessarily crowded ; and they will necessarily be poor, stunted plants as compared with those that had become properly rooted in the open space of the field. Moreover, it takes such plants some time to recover from the processes of unseasonable transplantation in the spring instead of in the autumn.

It will probably, therefore, be found best to apply *no dung at all* for Spring Cabbages, but to plant them out after the removal of some other crop that has been dunged ; giving a liberal dressing of superphosphate or basic slag or bone meal, and 4 cwt. of kainit or 1 cwt. of sulphate of potash per acre, these fertilisers being well mixed into the soil during preparation for planting. Nitrate of soda may then be applied, at the rate of 4 cwt. or more per acre, during the spring, either all at once or in two top dressings, according to the nature of the soil and season.

Red Cabbages.

A simple experiment was made in 1902 to see whether the effect of nitrate of soda upon the red pickling Cabbage would resemble that observed in the case of other varieties.

A bed of Red Cabbages was planted, manured with a light dressing of London dung, together with 6 cwt. of superphosphate and 1 cwt. of sulphate of potash per acre. One half of this bed was dressed with 4 cwt. of nitrate of soda per acre, the other half being left without nitrate. Each plot, of course, contained the same number of plants. The yields of Cabbages on the two halves respectively were as follows :—

SAVOY CABBAGES. 1902.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
6 cwt. Superphosphate,
6 cwt. Nitrate of Soda

(cost £8 15s. per acre).

No Dung.
6 cwt. Superphosphate,
8 cwt. Nitrate of Soda,
1 cwt. Sulphate of Potash

(cost £5 5s. per acre).

Manure per acre.

25 tons London Dung

(cost £10 per acre).

$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

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RED CABBAGES.

Manuring per acre	Annual cost of manure per acre			Weight of Cabbages per acre	
	£	s.	d.	tons	cwt.
25 loads ($12\frac{1}{2}$ tons) London Dung, 6 cwt. Superphosphate, and 1 cwt. Sulphate of Potash (without Nitrate of Soda)	6	5	0	13	19
25 loads ($12\frac{1}{2}$ tons) London Dung, 6 cwt. Superphosphate, and 1 cwt. Sulphate of Potash, with 4 cwt. Nitrate of Soda	8	5	0	20	9

Brussels Sprouts.

This is one of the most important crops of the market gardener, and one which experiments show to be very heavily affected by manuring. Extensive areas of Brussels Sprouts are grown every autumn in the market gardens near our great cities, and for the growth of these crops considerable sums of money are annually spent in the purchase of town dung. Such purchases, we believe, from the results of our experiments, to be both extravagant and unnecessary. If dung is used, it would be more economical to use far less than is usual; but, as we have shown, Sprouts may be much more profitably grown *without dung at all*, if recourse be had to common concentrated fertilisers.

We are now able to give the records of eight seasons' experience with this crop. The results are shown in the following table, stated in terms of "sieves" per acre, a "sieve" being the well-recognised English market term for a weight of 40 lbs. of Sprouts.

BRUSSELS SPROUTS—Eight Years' Results.

Annual manuring per acre	Annual cost of manure per acre			Average of eight years' crops (1894–1901 inclusive)	Excess over yield of lightly dunged plot obtained by use of extra manure
	£	s.	d.	Sieves per acre	Sieves per acre
50 loads (25 tons) London Dung .	10	0	0	279	52
25 loads ($12\frac{1}{2}$ tons) London Dung .	5	0	0	227	—
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	290	63
Ditto, ditto (with Potash) . .	7	5	0	292	65
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	288	61
Ditto, ditto (with Potash) . .	8	5	0	297	70

The market value of Brussels Sprouts varies from about 1*s*. up to 4*s*. per sieve. On the whole, probably 1*s*. 6*d*. is a fair average value to take, for a grower who is reasonably near a market, for Sprouts of good quality marketed early and in good condition.

It will be seen that the average advantage obtained, over the eight years, by increasing the quantity of dung from 25 loads to 50 loads per acre, was 52 sieves of Sprouts, worth, at the market price of 1*s*. 6*d*. per sieve, £3 18*s*.; while the cost of the extra 25 loads of dung was no less than £5. An annual average increase of 65 sieves, worth £4 17*s*. per acre, has, however, been obtained by substituting for the extra dung a dressing of chemical fertilisers consisting of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre, costing £2 5*s*. per acre. We thus obtained, on the average of eight years, about £1 worth more produce per acre, and at the same time saved £2 15*s*. per acre in manure, making a total average saving of about £3 15*s*. per acre. In some individual years it has been much more.

So much for the economy of using a mixture of a light dressing of dung with a dressing of chemical fertilisers, as against the more usual plan of giving a heavy dressing of dung. But we have now to consider the average results that are obtained on other plots on which *no dung at all* has been used, as compared with the results obtained on the plots receiving a heavy dressing of dung. The figures necessary for this comparison are given in the following table:—

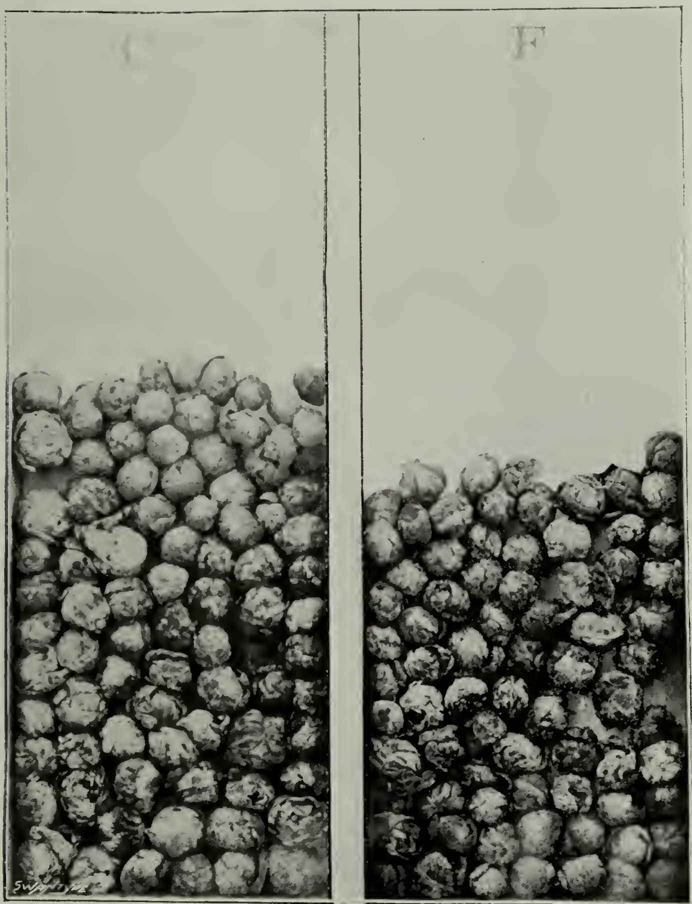
BRUSSELS SPROUTS.

Annual manuring per acre	Annual cost of manure per acre	Five years' average, 1894–1898	Three years' average, 1899–1901
	£ s. d.	Sieves per acre	Sieves per acre
25 loads ($12\frac{1}{2}$ tons) London Dung . .	5 0 0	244	200
50 loads (25 tons) London Dung . .	10 0 0	279	274
Phosphates (no Potash) and 4 cwt. Nitrate of Soda . . .	2 15 0	260	—
Ditto, ditto (with Potash) . . .	3 5 0	292	—
Phosphates (no Potash) and 8 cwt. Nitrate of Soda . . .	4 15 0	—	275
Ditto, ditto (with Potash) . . .	5 5 0	—	268

In the case of the five years' average, the mean of the two chemically fertilised plots shows a yield of 276 sieves per acre, as against 279 sieves grown with the heavy dressing of dung alone. There was thus practically no difference in the yield. But the cost of the heavy dressing of dung was £10 per acre per annum, while that of the chemical fertilisers was only £3, an average annual saving being thus effected of at least £7 per acre by the total substitution of chemical fertilisers for dung.

In the three following years the mean of the two chemically fertilised plots shows a yield of 271 sieves per acre, that is to say, nearly the same as the heavily dunged plot. The average cost of the chemical dressings was in this case £5 per acre, while the heavy dressing of dung cost £10, so that we have in the three years an average advantage of £5 per acre in favour of the chemical fertilisers.

While, on the whole, our experiments point to the general desirability, in market gardening, of moderate dunging, supplemented by chemical fertilisers, Brussels Sprouts appear to be a crop to which it is extravagant to apply dung directly at all. The undunged plots in various parts of our field, on which we have obtained such excellent results with chemical manures alone in the case of Brussels Sprouts, are, it is to be remembered, BRUSSELS SPROUTS (average yield of five Seasons).



291 Sieves (of 40 lb.) per acre.

Manure per acre.

No Dung, Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda

(cost £3 5*s*. per acre).

269 Sieves (of 40 lb.) per acre.

Manure per acre.

25 tons London Dung, without chemical fertilisers

(cost £10 per acre).

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plots which are never dunged for any crop. In the ordinary market garden there will be, in every field in every season, the residual dung of previous years ; and our general advice to the market gardener with regard to Brussels Sprouts would be to use no dung beyond what is already left in the ground unconsumed by previous crops, but, for the immediate manuring of the Sprouts, to rely wholly upon chemical fertilisers : 6 cwt. of superphosphate—or 8 cwt. of basic slag—and 4 cwt. of kainit per acre (or other phosphatic and potash dressings equivalent thereto) should be well incorporated with the soil before the plants are set. As soon as the plants are established, from 2 to 3 cwt. of nitrate of soda per acre may be sown between the rows, and an additional dressing of from 2 to 3 cwt. per acre should be applied a month later. We can confidently predict that in this way the market gardener will grow a larger quantity of Sprouts than he would with a dressing of even 50 loads (25 tons) of dung per acre without the aid of chemical fertilisers; and he will at the same time effect the very substantial saving of from £5 10*s.* to £6 10*s.* per acre in the cost of manure.

Summer Lettuces.

In four of our experimental years, drought and the ravages of wire-worm combined to prevent our getting anything like a regular plant of Summer Lettuces. But in four seasons we grew very successful crops. Indeed, in 1897 we were able to get two crops of Summer Lettuces in succession off the same plots, without any additional manuring.

The average results of the principal plots are set forth in the following table :—

SUMMER LETTUCES.

Annual manuring per acre	Annual cost of manure per acre			Average weight per Lettuce (five crops)
	£	*s.*	*d.*	oz.
50 loads (25 tons) London Dung	10	0	0	12·6
25 loads (12½ tons) London Dung	5	0	0	10·7
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	13·1
Ditto, ditto (with Potash)	7	5	0	12·7
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	13·0
Ditto, ditto (with Potash)	8	5	0	13·5

In 1900 we also tried increasing the nitrate of soda used, in conjunction with dung and phosphates, to 6 cwt. per acre, but with no advantage to the weight of the crop.

It will be seen that the light dressing of dung (25 loads per acre) has been on the average insufficient to produce a full crop; and this has been the case in every individual season of which the yields have been averaged. In every one of the years the yield has been increased by increasing the dung, but the increase thus obtained has not only cost an extravagant sum of money, but has been decidedly inferior to the increase obtained on plots on which the lighter dressing of dung has been supplemented by chemical fertilisers.

The most economical, though not quite the largest, results appear to have been obtained by the use of dressings including 2 cwt. of nitrate of soda per acre.

Potash has not, on the average, increased the crop, but in 1900 it produced very decided results where no dung was used, as will presently be seen.

It also appears, as the result of our experiments, that Summer Lettuces can be grown satisfactorily without the use of dung at all, though the Lettuces do not attain to quite the same dimensions as those grown under more liberal treatment.

The following results summarise our experience of growing Summer Lettuces with and without dung. It is necessary, however, in order to make the results strictly comparative, to average the first four crops and to consider the last one separately, for in 1900 the dressing used on the undunged plots was more liberal than in the earlier years.

SUMMER LETTUCES.

Annual manuring per acre.	Annual cost of manure per acre	Average weight per plant	
		Four crops (during 1896–1898)	Crop of 1900
	£ s. d.	oz.	oz.
50 loads (25 tons) London Dung	10 0 0	9·5	25·1
25 loads (12½ tons) London Dung	5 0 0	7·8	22·0
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda	6 15 0	10·3	24·3
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda	7 15 0	10·4	23·7
No Dung; Phosphates (without Potash) and 4 cwt. Nitrate of Soda	2 15 0	9·0	—
Ditto, ditto (with Potash)	3 5 0	9·3	—
No Dung; Phosphates (without Potash) and 8 cwt. Nitrate of Soda	4 15 0	—	18 0
Ditto, ditto (with Potash)	5 5 0	—	22·6

It will be seen that chemical dressings alone produced better results than did the lighter dressing of dung; and, although they did not give quite such good results as heavy dressings of dung, the cost of the manure, even on the most heavily dressed chemical plots, was only about half that of the heavy dunging. Nevertheless, as the welfare of Summer Lettuces depends largely upon a suitably moist condition of the soil soon after the time of planting, the application of a moderate dressing of dung, in addition to chemical fertilisers, seems desirable, in order to diminish the dangers attendant upon possible dry weather.

Winter Lettuces.

Winter Lettuces were grown for four years—namely, from 1895 to 1898 inclusive—on our original plan of experiment. Since 1898 we have included plots more heavily dressed with nitrate of soda, but the heavier dressings have not very materially improved on the already satisfactory results obtained with the more moderate applications.

It should be mentioned that, as Winter Lettuces are planted out after a crop removed in the summer, we have followed ordinary market-garden practice in not applying another dressing of dung specially for this crop.

In the following summary of results, therefore, it will be understood that the dung mentioned was applied not directly to the Lettuces, but to the previous crop.

WINTER LETTUCES, 1895–1901 (Seven Crops).

Annual manuring per acre	Annual cost of manure per acre			Average weight of crop per acre per annum		Average weight per Lettuce
	£	s.	d.	tons	cwt.	oz.
50 loads (25 tons) London Dung (applied to previous crop)		nil		13	3	16·4
25 loads (12½ tons) London Dung (applied to previous crop)		nil		10	13	13·5
25 loads Dung (to previous crop); Lettuces dressed with Phosphates (no Potash) and 2 cwt. Nitrate of Soda	1	15	0	12	14	16·2
Ditto, ditto (with Potash)	2	5	0	12	17	16·5
25 loads Dung (to previous crop); Lettuces dressed with Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2	15	0	12	17	16·0
Ditto, ditto (with Potash)	3	5	0	13	7	16·7

It will be seen that the best average yield has been very nearly reached on the land which was previously treated with the heavier dressing of dung. Nevertheless, in nearly every one of the individual crops of the series, some one or other of the other plots gave better results. It has already been shown, in connection with other crops, that such heavy dunging as 50 loads per acre is unprofitable for the main crop to which it is applied; and, although it appears from these experiments that, if the extravagance of heavy dunging has been committed for the preceding crop, Winter Lettuces following that crop need not be further manured, we ought rather to consider the case in which the most prudent mode of manuring has been previously followed, namely, the application of a light dressing of dung supplemented by chemical fertilisers. On the whole, when this is the case, it would seem on the average that phosphates, potash salts, and 2 cwt. of nitrate of soda per acre have produced the most economical results. Potash, although it has produced little or no effect on Summer Lettuces when grown with dung, has sometimes proved to be useful for Winter Lettuces.

During the first four years our totally undunged plots, receiving only chemical fertilisers (including 4 cwt. of nitrate of soda per acre)—the records of which are not included in the foregoing table—gave less satisfactory results than did the plots on which the chemical fertilisers followed an application of dung to the previous crop. The same observation was made in later years, when the quantity of nitrate of soda applied to the undunged plots was increased to 8 cwt. per acre.

The average results obtained during 1900 and 1901 are given in the following table :—

WINTER LETTUCES, 1900 AND 1901.

Annual manuring per acre	Annual cost of manure per acre			Total average weight of Lettuces per acre		Average weight per Lettuce
	£	s.	d.	tons	cwt.	oz.
50 loads (25 tons) London Dung (applied to previous crop)	nil			13	17	19·7
25 loads ($12\frac{1}{2}$ tons) London Dung (applied to previous crop)	nil			11	15	16·7
25 loads Dung (to previous crop); Lettuces dressed with Phosphates (no Potash) and 2 cwt. Nitrate of Soda	1	15	0	15	1	21·4
Ditto, ditto (with Potash)	2	5	0	14	3	21·8
25 loads Dung (to previous crop); Lettuces dressed with Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2	15	0	14	12	20·7
Ditto, ditto (with Potash)	3	5	0	14	12	20·7
25 loads Dung (to previous crop); Lettuces dressed with Phosphates (no Potash) and 6 cwt. Nitrate of Soda	3	15	0	15	0	21·4
Ditto, ditto (with Potash)	4	5	0	15	7	21·7
No Dung to previous crop; Lettuces dressed with Phosphates (no Potash) and 8 cwt. Nitrate of Soda	4	15	0	11	3	15·9
Ditto, ditto (with Potash)	5	5	0	12	3	17·5

GLOBE (OR THISTLE-HEADED) ARTICHOKES.

We have recorded five crops, from the same plantation, of Globe (or Thistle-headed) Artichokes—the edible heads or buds of which must not be confounded with the tuberous roots of the Jerusalem Artichokes.

The result was to show a very large increase in the number of "heads" cut during the earlier part of the season when chemical fertilisers were used in partial substitution for dung. Early maturity is a matter of very great importance in regard to this crop as far as market purposes are concerned. It happens that there is a large demand for Globe Artichokes during what is called the London season, and there is then no difficulty in disposing of the heads at good prices in the London market. Some time in July, however, the demand usually falls off, so that the heads are no longer saleable in the principal markets at prices remunerative to the grower, who has to pay for carriage and other sale expenses. It is therefore important, in the case of this particular crop, if we are to appreciate the full effect of the different systems of manuring, to regard not only the total number of heads cut during the season, but also the proportion which is produced in the earlier part of it, when the produce is in demand. On this account we have each year differentiated between the total number of heads cut and those cut before what may be called the "closing of the market" in July.

Potash salts have, on the whole, consistently produced so useful an effect on this crop that the non-potash plots may be for the moment omitted, but they will be subsequently considered.

The following table gives the average yield obtained on six of our plots in the five seasons, 1896, 1897, 1898, 1899, and 1900, showing the total weight and total number of heads gathered per acre and also the number of "early" or readily marketable heads cut during the remunerative part of the season :—

GLOBE ARTICHOKES.

Annual manuring per acre	Average yield per acre per annum over five years (1896–1900 inclusive)		
	Average annual weight of total heads per acre	Average annual number of total heads per acre	Average annual number of "early" heads per acre
	tons cwt.		
50 loads (25 tons) London Dung . .	3 15	17,440	9,830
25 loads (12½ tons) London Dung . .	2 14	12,170	6,240
25 loads Dung, Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda * . . .	3 19	18,820	11,400
25 loads Dung, Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda † . . .	3 12	16,980	10,180
25 loads Dung, Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda ‡ . . .	3 17	18,180	11,030
No Dung; Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda § . . .	2 18	13,320	6,940

* 2 cwt. Nitrate in 1900. † 4 cwt. Nitrate in 1900.
‡ 6 cwt. Nitrate in 1900. § 8 cwt. Nitrate in 1900.

It will be seen by the foot-notes that the quantity of nitrate of soda was increased in 1900 in the case of each plot on which nitrate of soda was used, but the increase was not followed by any further increase on the average yields.

On looking down the figures the first thing obvious to notice is that the plot getting 25 loads of dung only per acre per annum has been much under-manured. On the plot on which 50 loads of dung have been applied per acre, 43 per cent. more of total heads have been grown, and nearly 58 per cent. more "early" heads. A very much greater increase, however, has been produced on the three plots on which the smaller dressing of dung, instead of being doubled, has been supplemented by the use of chemical fertilisers. On these three plots, the total increase obtained by the chemical fertilisers used in addition to dung has averaged 48 per cent., while the increase in "early" heads has been no less than 74 per cent. On the plot where no dung at all has been applied the crop has been smaller than on the heavily dunged land, but better than on the lightly dunged land where no chemical fertilisers were used.

Clearly, then, the successful plots are those on which the light dressing of dung has been supplemented by nitrate of soda, phosphates, and potash salts. The following table shows the actual increase of heads, both total and "early," as compared with the plot receiving the light dressing of dung only :—

GLOBE ARTICHOKES.

Manure annually applied in addition to 25 loads Dung per acre	Five years' average EXTRA yield of Globe Artichokes per acre, due to extra manure in excess of 25 loads Dung per acre		
	Increase in total weight per acre	Increase in total heads per acre	Increase in "early" heads per acre
	ton cwt.		
25 extra loads Dung (50 in all) . . .	1 1	5,270	3,590
Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda *	1 5	6,650	5,160
Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda *	18	4,810	3,940
Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda *	1 3	6,010	4,790

* See note to previous table.

It may be observed that it is the number rather than the size of the heads which is affected by the manuring, the average size or weight of the heads having been very nearly the same throughout the plots. On the average it will be seen that the plot receiving only 1 cwt. of nitrate of soda per acre (in conjunction with phosphates and potash) has given somewhat better results than its neighbours which received larger quantities of nitrate. Although, however, this has been the case on the average of years, nevertheless in two of the seasons the largest number of early heads was yielded by the plot receiving 4 cwt. of nitrate of soda per acre, and we should be inclined at present to recommend either 2 cwt. or 4 cwt. per acre.

The average cost of the chemical fertilisers on the three plots referred to in the foregoing table has been about £2 10*s.* per acre per annum, as against £5 for the extra 25 loads of dung on the dunged plot. On the other hand, the extra yield of "early" heads has averaged 4,630 as against 3,590. We have therefore not only an average saving of £2 10*s.* per acre per annum in the cost of manure by the substitution of the chemical fertilisers in place of extra dung, but we have also on the average a greater increase of produce by no less than 1,040 heads, or, say, 80 "market" dozen. The price we have actually obtained for our Artichokes has varied from as little as 6*d.* to as much as 2*s.* 6*d.* per dozen, and in one year averaged as much as 1*s.* 5*d.* after deduction of cost of carriage and sale expenses. If, however, we take the value at 1*s.* per dozen, the 80 dozen extra heads would at that rate be worth £4, which, added to the average saving of £2 10*s.* per acre in manure, makes a profit of £6 10*s.* per acre due to the partial substitution of chemical fertilisers for dung. This is an average result; but in one year—1897—when the plants were in their second year of bearing, the profit per acre actually obtained by the partial substitution of chemical fertilisers for dung was considerably more than twice that sum.

The effect of potash on this crop has been already alluded to. In the case of Globe Artichokes, even when dung has been used, the effect of potash salts has been remarkable, and indicates, as will be seen from the following table, that no grower should attempt to grow this crop, even where dung is used, without a liberal supply of potash manure in addition to phosphates and nitrogenous manure.

GLOBE ARTICHOKES.

	Total heads	"Early" heads
Average annual yield per acre over five years, from three plots manured with Dung, Phosphates, and Nitrate of Soda, but *without Potash Salts*	15,666	8,620
Ditto, ditto, with the addition of 4 cwt. Kainit or 1 cwt. Sulphate of *Potash* per acre	17,993	10,870
Increase due to *Potash Salts*	2,327	2,250

The use of 1 cwt. of sulphate of potash, costing 10*s*., per acre, in addition to the other fertilisers, produced no less than 2,250 of "early" heads, or, say, 173 market dozen—worth, at 1*s*. per dozen, more than £8 per acre. Evidently neither dung, phosphates, nor nitrate of soda are capable of enabling the Globe Artichoke plant to produce either a good or an early crop without a supply of potash in some easily available form.

JERUSALEM ARTICHOKES.

These are the ordinary tuberous-rooted Artichokes, of which, up to the end of 1901, we have grown eight crops. We have grown them each year without any special application of dung, but on land previously dunged for the preceding crop, except for the plots which on every section are permanently left without dung.

The following table shows the average of eight years' crops on the principal plots, and also the average of the last three years, when increased dressings of nitrate of soda were included:—

JERUSALEM ARTICHOKES.

Annual manuring per acre	Annual cost of manure per acre			Average weight of roots or tubers per acre			
				Eight years (1891–1901)		Three years (1899–1901)	
	£	*s.*	*d.*	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung (applied to previous crop)		nil		11	8	13	12
25 loads (12½ tons) London Dung (applied to previous crop)		nil		9	0	11	9
25 loads Dung (to previous crop); Phosphates (no Potash) and 2 cwt. Nitrate of Soda (applied to Artichokes)	1	15	0	10	5	11	0
Ditto, ditto (with Potash)	2	5	0	11	4	12	8
25 loads Dung (to previous crop); Phosphates (no Potash) and 4 cwt. Nitrate of Soda (applied to Artichokes)	2	15	0	10	11	12	0
Ditto, ditto (with Potash)	3	5	0	11	5	13	4
25 loads Dung (to previous crop); Phosphates (no Potash) and 6 cwt. Nitrate of Soda (applied to Artichokes)	3	15	0	—		11	10
Ditto, ditto (with Potash)	4	5	0	—		13	4

In order to examine the results obtained on the continuously undunged plots, it is necessary to state separately the average results obtained during the first five years and during the last three years, as the dressings on the undunged land have been increased during the last three years. The results obtained in the case of these plots are shown in the following table :—

JERUSALEM ARTICHOKES.

Annual manuring per acre.	Annual cost of manure per acre	Average weight of roots or tubers per acre	
		Five years (1894–1898)	Three years (1899–1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung (applied to previous crop)	nil	10 2	13 12
25 loads (12½ tons) London Dung (applied to previous crop)	nil	7 12	11 9
No Dung to previous crop; Phosphates (no Potash) and 4 cwt. Nitrate of Soda (applied to Artichokes)	2 15 0	7 10	—
Ditto, ditto (with Potash)	3 5 0	9 18	—
No Dung to previous crop; Phosphates (no Potash) and 8 cwt. Nitrate of Soda (applied to Artichokes)	4 15 0	—	8 9
Ditto, ditto (with Potash)	5 5 0	—	11 7

The results, on the whole, appear to indicate that, if the market gardener has been extravagant enough to use as much as 50 loads of dung per acre for any other crop, and wishes subsequently to grow Jerusalem Artichokes, he had better plant them there without further manuring, since on land thus manured chemical fertilisers have not, on the average of our experiments, produced any material increase in yield. The results obtained in 1900, it is true, showed an advantage from the usual chemical fertilisers, but the increase was not sufficient to affect the average of years.

The general results of our manuring experiments, however, as will be seen over and over again in the course of this report, indicate that heavy dunging of this kind is, for most crops, wasteful and unprofitable, and that a much lighter dressing of dung, supplemented by chemical fertilisers, is the best application; and when land is farmed on this principle it would appear that the most economical crops of Artichokes are raised by a simple dressing of phosphates (say 4 to 6 cwt. of superphosphate) with 1 cwt. of sulphate of potash (or 4 cwt. of kainit) per acre, with a top dressing of 2 cwt. of nitrate of soda per acre.

When, however, we have to deal with land that has not been previously dunged, the nitrate of soda may be increased to 4 cwt. per acre.

The effect of potash on this crop is remarkable. On the average of eight years, the use of potash has produced an increase in the weight of tubers per acre amounting to nearly a ton in one series of plots, and to nearly three-quarters of a ton on another series, even on the dunged land. On the plots on which no dung has been applied during the whole of the series of experiments, the use or omission of potash has made a difference of nearly $2\frac{1}{2}$ tons per acre over the first five years, and nearly 3 tons per acre over the last three years.

The effect of potash is even greater on the tops than on the roots, as will be seen from the following short table :—

JERUSALEM ARTICHOKES (TOPS ONLY).

	Average yield of tops per acre over five years	
	tons	cwt.
Without Potash	6	8
With Potash	9	9

This has been evident every year, though it is only during the last five years that we have actually weighed the tops as well as the roots. The difference is worth recording in view of the fact that in some countries Jerusalem Artichokes are largely grown as a fodder crop for the sake of the green tops, quite apart from the value of the roots. It is evident that this crop makes a heavy demand on the potash of the soil as well as on other manurial constituents.

Carrots.

Carrots we have grown every year but one, but we have eliminated from our records the results obtained in our first year—1894—for the reason that the plants were not "singled out" in such a way as to leave a like number of roots on each plot, with the result that the produce of the different plots was not fairly comparable.

In 1895, 1896, and 1897 we grew good experimental crops, and also in 1899 and 1900. In 1898 alone we failed, owing to drought, to get a sufficiently regular plant for experimental purposes, and the plant was therefore dug up.

Our custom in manuring Carrots has been to apply no dung directly to this crop, but to grow them after a crop for which dung has been applied. This is in accord with farm practice. We have really set ourselves to answer the question whether, when Carrots are grown after a dunged crop but without receiving dung themselves, it is economical or not to treat them with chemical fertilisers; and, if so, what are the best dressings to use.

It will be seen that chemical fertilisers have proved to be of very great value, and that both nitrate of soda and potash salts, in conjunction with phosphates, have produced great and economical effects when applied to this crop.

We have also each year included plots to which no dung has been applied at any time during the progress of the experiments.

The variety of Carrots which we have grown has usually been of the "intermediate" or "stump-rooted" type.

The following table shows the average crops produced on some of our plots during six seasons, and also the average results obtained during the last three years, in which we have used extended dressings of nitrate of soda on some of the plots :—

CARROTS.

Annual manuring per acre	Annual cost of manure per acre	Annual weight of Carrots per acre: Average of six seasons	Annual weight of Carrots per acre: Average of three seasons (1899–1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung (applied to previous crop)	nil	15 2	15 10
25 loads (12½ tons) London Dung (applied to previous crop)	nil	12 15	12 6
25 loads Dung (to previous crop); Carrots dressed with Phosphates (without Potash) and 2 cwt. Nitrate of Soda	1 15 0	13 8	10 13
Ditto, ditto (with Potash)	2 5 0	15 14	13 2
25 loads Dung (to previous crop); Carrots dressed with Phosphates (without Potash) and 4 cwt. Nitrate of Soda	2 15 0	14 11	12 7
Ditto, ditto (with Potash)	3 5 0	16 2	14 11
25 loads Dung (to previous crop); Carrots dressed with Phosphates (without Potash) and 6 cwt. Nitrate of Soda	3 15 0	—	11 17
Ditto, ditto (with Potash)	4 5 0	—	14 10

It appears that, on the average, the residue of even a heavy dunging of 50 loads per acre applied to the previous crop has been insufficient to grow a full crop of Carrots, while the residue of a smaller dressing of dung has been still less effective. The application to the Carrots of chemical fertilisers, consisting of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre, has resulted in a gain, over six years, of nearly 3 tons of Carrots per acre per annum, while the addition of 2 cwt. more of nitrate per acre has further raised the increase. During some years the dressing of nitrate has given a much more substantial advantage. The further increase of the nitrate to 6 cwt. per acre has not increased the crop.

The effect of potash on Carrots throughout our experiments has been remarkable, even on the plots to which 25 loads of dung per acre have been applied nearly every previous year during our experimental period. Thus, in looking at the five years' averages, we find that, in round numbers, the use of potash on the plots receiving phosphates and 2 cwt. of nitrate of soda per acre (although dung had been applied in most other years for some crop or other) has resulted in an average increase of nearly 2¼ tons of Carrots per acre. During the last three years, in which the land has presumably become more potash-exhausted than in the earlier years, we find that, on the three dunged plots, potash produced a much larger increase. There is no reason, however, for supposing that potash salts alone would have given anything like this increase in the crops. This must be attributed to the action of the phosphatic manure and of the nitrate of soda as well as to that of the potash. The point, however, is that phosphates and nitrate of soda, even when applied in the most liberal abundance, have shown themselves,in the absence of a good supply of potash, powerless to produce anything like the maximum crop of which the ground has proved itself capable in the various seasons.

We may now consider the crops obtained on the plots to which no dung at all has been applied for many years. The results obtained on these plots are shown in the following table:—

CARROTS.

Annual manuring per acre	Annual cost of manure per acre	Annual weight of Carrots per acre: Average of three seasons (1895–1897)	Annual weight of Carrots per acre: Average of three seasons (1899–1901)
	£ s. d.	tons cwt.	tons cwt.
50 loads (25 tons) London Dung (applied to previous crop) . .	nil	14 13	15 10
25 loads (12½ tons) London Dung (applied to previous crop) . .	nil	13 5	12 6
No Dung for many years; Phosphates (without Potash) and 4 cwt. Nitrate of Soda . .	2 15 0	11 9	—
Ditto, ditto (with Potash) . .	3 5 0	16 9	—
No Dung for many years; Phosphates (without Potash) and 8 cwt. Nitrate of Soda . .	4 15 0	—	7 14
Ditto, ditto (with Potash) . .	5 5 0	—	11 18

It will be seen that, on the average of the first three years, chemical fertilisers alone, on land that had not been dunged for many years, gave much better crops than land which had been heavily dunged for the crop preceding the Carrots, but not directly manured for the Carrot crop. On the average of the last three years this was not the case, owing mainly to the effect of drought during a critical stage of the crop, which was specially marked on the land which had been kept without dung. The effect of potash on the undunged land and the impotence of the phosphates and nitrate to produce a maximum quantity of Carrots without its aid, are truly remarkable in the case of these undunged plots.

During the first three years the use or non-use of potash has produced, on the average, no less a difference than 5 tons of Carrots annually per acre; while during the last three years the difference, even when the crops were hampered by drought, has amounted to over 4 tons per acre per annum.

So far as our experience goes, it seems best, presuming that Carrots are grown after a dunged crop and without any fresh dressing of dung, to give them first a dressing of, say, 4 to 6 cwt. of superphosphate or 8 cwt. of basic slag, and either 1 cwt. of sulphate of potash or 4 cwt. of kainit per acre. These should be well incorporated with the soil before seedtime. After the Carrots are sown, 2 cwt. of nitrate of soda per acre may be broadcasted, and a further 2 cwt. later, after the rows are hoed out and the plants have made good substantial growth. We are for the moment presupposing that the application of dung to the previous crop has been moderate, say 25 loads (12 to 15 tons) per acre. If a larger dressing has been used, say 50 loads (or 25 tons) per acre, probably 2 cwt. of nitrate of soda will suffice—preceded, of course, by the dressing of phosphates and potash salts above mentioned.

Parsnips.

Our Parsnip crop has failed only once. We have grown this crop on the same principle as Carrots, namely, without any direct application of dung, but following a crop to which dung had been applied.

For the first four crops the chemical dressings were arranged on our original plan ; but in 1899 and since we have included plots on which increased dressings of nitrate were given. The results of the first four years' experience were practically to the effect that, on land that had been previously dunged, 4 cwt. of nitrate per acre did not give better results than 2 cwt. We were therefore prepared to find that the further increase of nitrate to 6 cwt. per acre would be of little use to the crop, and this proved to be so in two seasons out of the three.

In the following table we give the average results of seven years' trials :—

PARSNIPS, 1894–1901 (no crop in 1897).

Annual manuring per acre	Annual cost of manure per acre £ s. d.	Weight of Parsnips per acre, average of seven crops tons cwt.
50 loads (25 tons) London Dung (applied to previous crop)	nil	11 4
25 loads (12½ tons) London Dung (applied to previous crop)	nil	9 1
25 loads Dung (to previous crop); Parsnips dressed with Phosphates (no Potash) and 2 cwt. Nitrate of Soda	1 15 0	10 2
Ditto, ditto (with Potash)	2 5 0	11 1
25 loads Dung (to previous crop); Parsnips dressed with Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2 15 0	9 9
Ditto, ditto (with Potash)	3 5 0	11 0

The most economical result appears, on the whole, to have been obtained by the use of chemical fertilisers including phosphates and potash and 2 cwt. of nitrate of soda per acre; and this is not only the case in the average results, but has been so in most of the individual seasons averaged.

The need of potash for Parsnips, even on land previously dunged, comes out very clearly in both series of chemically fertilised plots, there being an average difference of from 1 to 1½ ton per acre in favour of the potash plots.

This need for potash is still more strikingly seen on other plots on which we have grown Parsnips on land which has not been previously dunged. Although our experience does not lead us to recommend this method of growth for Parsnips, it is interesting nevertheless to record the results, which are shown in the following table :—

PARSNIPS.

Annual manuring per acre	Annual cost of manure per acre			Weight of Parsnips per acre			
				Average of first four seasons		Average of last three seasons	
	£	s.	d.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung (applied to previous crop)		nil		10	18	11	11
25 loads ($12\frac{1}{2}$ tons) London Dung		nil		9	3	8	18
25 loads Dung (to previous crop); Parsnips dressed with Phosphates (no Potash) and 2 cwt. Nitrate of Potash	1	15	0	10	19	8	18
Ditto, ditto (with Potash)	2	5	0	11	5	10	15
No previous Dung; Parsnips dressed with Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2	15	0	7	10	—	
Ditto, ditto (with Potash)	3	5	0	8	11	—	
No previous Dung; Parsnips dressed with Phosphates (no Potash) and 8 cwt. Nitrate of Soda	4	15	0	—		4	6
Ditto, ditto (with Potash)	5	5	0	—		8	6

It will be here seen that, on land from which dung has been *continuously* withheld, potash, in the last three years, nearly doubled the crop, although phosphates were applied in liberal abundance, and nitrate of soda to so large an extent as 8 cwt. per acre. In their special demand for potash, Parsnips resemble Carrots and Onions, and are in striking contrast to most of the crops of the Cabbage tribe, as evidenced by our already reported experience.

Celery.

We have before pointed out that our soil happens to be anything but an ideal soil for Celery growing. Celery likes a loose, friable, sandy soil, while ours is a stiff agricultural clay loam. It is also a crop which, in ordinary market gardening, is far more heavily dunged than perhaps any other market garden crop. Indeed, when grown in the kitchen garden, it may be said to be frequently grown rather *in* than *with* dung. Nevertheless, for five years we cultivated each year a series of Celery plots in the same manner as our other vegetables, the only difference being that the chemical fertilisers were sown in the trenches in which the Celery was planted instead of being spread broadcast.

The dry weather which we experienced during those five seasons aggravated the natural unkindness of our soil towards a crop like Celery. Nevertheless the crop, though small, was in most of the seasons sufficiently large to be marketable, and the results were on the average sufficiently interesting to be worth recording. It will be seen that chemical dressings in addition to 25 loads of dung per acre did little or no good unless the quantity of nitrate of soda amounted to 2 cwt. per acre, and that 4 cwt. of nitrate per acre (with phosphates, of course) gave the best results, particularly when potash salts were added. A few hundredweights of superphosphate or basic slag, 4 cwt. of nitrate of soda, and 4 cwt. of kainit (or 1 cwt. of sulphate of potash) added to 25 loads of dung per acre, increased the average weight of the plants by over 40 per cent., while 25 loads of extra dung per acre raised the average weight by only about 20 per cent. Still, during these five years, we only once reached, on our best plot, an average of $19\frac{1}{2}$ ounces per plant as pulled for market, while the best average of the five seasons was only 12 ounces.

CELERY, 1894–1898.

Annual manuring per acre	Average weight per plant when "pulled" (five seasons, 1894–1898 inclusive)
	oz.
50 loads (25 tons) London Dung	10·4
25 loads ($12\frac{1}{2}$ tons) London Dung	8·5
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	8·7
Ditto, ditto (with Potash)	8·6
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	10·3
Ditto, ditto (with Potash)	9·4
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	11·1
Ditto, ditto (with Potash)	12·0
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	5·5
Ditto, ditto (with Potash)	7·5

Although, therefore, the results present considerable interest, the attempt to grow satisfactory plants with so little dung in dry seasons was clearly unsuccessful. We therefore determined to approach more nearly the ordinary custom of the market grower, and to use a much larger quantity of dung placed in the trenches. This we have done since, at the same time increasing the quantity of nitrate of soda.

During the last three years the weather, on the whole, was propitious, and we have grown really fine Celery. The following table gives the average results:—

CELERY, 1899, 1900, and 1901.

Annual manuring per acre	Weight per plant when "pulled" (three years' average)
	oz.
100 loads (50 tons) London Dung (placed in trenches) . .	36·7
50 loads (25 tons) London Dung (placed in trenches) . .	32·3
50 loads Dung, Phosphates (6 cwt. Superphosphate in 1899 and 1901; 10 cwt. Basic Slag in 1900), and 2 cwt. Nitrate of Soda	30·3
Ditto, ditto, with 1 cwt. Sulphate of Potash	34·0
50 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda . .	31·0
Ditto, ditto, with 1 cwt. Sulphate of Potash	30·5
50 loads Dung, Phosphates, and 6 cwt. Nitrate of Soda . .	32·0
Ditto, ditto, with 1 cwt. Sulphate of Potash	33·2
No Dung; Phosphates and 8 cwt. Nitrate of Soda . . .	12·9
Ditto, ditto, with 1 cwt. Sulphate of Potash	22·8

The figures shown here do not in themselves warrant any very clear conclusion. In each of the three years the heaviest crop has been grown on the most heavily dunged plot; but the difference between the effect of 100 loads and 50 loads of dung per acre, when placed in the trenches, is incommensurate with the very large cost of the extra dung. Nor, if we regard weight alone, can it be said that the addition of the chemical dressings to the lighter dressing of dung has been very effective, though in two years out of the three it was nearly as productive as the extra dung, and at a far less cost. But quality must be regarded as well as weight; and we have frequently observed that the plants raised by dung and chemical fertilisers mixed have been crisper and more tender than those grown with dung alone. The nitrate of soda appears to render the growth more rapid and to diminish the strength and toughness of the fibro-vascular bundles, and to develop rather the growth of soft or parenchymatous tissue.

In 1900 we grew a fine crop without the use of any dung at all, by using as much as 8 cwt. of nitrate of soda per acre, in addition to phosphates and potash salts; but the Celery thus grown, although equal in quality to any of the rest, weighed less than that produced on the plots on which dung was used; and, on the average of the three years, the fully manured chemical plot without dung has grown a much smaller crop than the dunged plots.

Spinach.

Summer Spinach is a crop the growth of which is much dependent upon summer rain, and several of our crops of this vegetable have, in consequence, been small, though in other years we have grown very good ones.

Of Winter Spinach we have only, up to 1901, grown two crops.

Spinach is heavily affected by chemical fertilisers, and, by a liberal application of them, can in favourable seasons be grown well without dung. Nevertheless, a light dressing of dung is desirable for the mechanical purpose of retaining moisture in the soil.

The following table shows the average results obtained by us with Summer Spinach over seven years (1895 to 1901 inclusive), and also shows separately the average results obtained during the last three years, when heavier dressings of chemical fertilisers were included in the experiments :—

SUMMER SPINACH.

Annual manuring per acre	Annual cost of manure per acre			Average annual yield of Spinach per acre			
				Seven years (1895–1901)		Last three crops (1899–1901)	
	£	s.	d.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung . . .	10	0	0	5	0	6	8
25 loads (12½ tons) London Dung. . .	5	0	0	4	3	4	16
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	5	17	7	16
Ditto, ditto (with Potash)	7	5	0	6	3	8	0
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	6	14	8	15
Ditto, ditto (with Potash)	8	5	0	6	8	8	7
25 loads Dung, Phosphates (no Potash), and 6 cwt. Nitrate of Soda	8	15	0	—		8	19
Ditto, ditto (with Potash)	9	5	0	—		9	10
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda.	4	15	0	—		6	11
Ditto, ditto (with Potash)	5	5	0	—		8	1

Considering first the seven years' average, it will be seen that the doubling of the dung from 25 loads to 50 loads per acre resulted in an average increase of less than a ton per acre. When the additional dung was replaced by chemical fertilisers, however, including 2 cwt. of nitrate of soda per acre, the increase averaged 2 tons per acre; while, with the further increase of nitrate of soda to 4 cwt. per acre, the increase of Spinach per acre was over $2\frac{1}{4}$ tons.

If we look at the average of the later years, when the seasons were more favourable to the growth of Spinach and the crops were consequently larger, we find even more striking results. While the 25 additional loads of dung raised the yield by about $1\frac{1}{2}$ ton per acre, this increase was doubled by using, in place of the additional dung, chemical fertilisers including only 2 cwt. of nitrate of soda per acre. Where 4 cwt. of nitrate was applied, the average increase is over $3\frac{1}{2}$ tons per acre; while with a further increase of the dressing of nitrate to 6 cwt. per acre we get an increase in crop of about $4\frac{3}{4}$ tons per acre, as compared with about $1\frac{1}{2}$ ton obtained by the use of the extra dung.

Even on the plots on which no dung at all was used, but on which the dung was replaced entirely by chemical fertilisers consisting of phosphates, potash salts, and 8 cwt. of nitrate of soda per acre, the crop grown was twice as large as that grown with 25 loads of dung per acre without chemical fertilisers, although the chemical fertilisers cost only a few shillings per acre more than the dung which they replaced.

WINTER SPINACH.

Grown in 1898 and 1901 after the crops of Summer Spinach were removed.

Manure applied per acre each year *to previous crop of Summer Spinach*	Yield of Winter Spinach per acre			
	1898		1901	
	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung	17	19	7	5
25 loads ($12\frac{1}{2}$ tons) London Dung	16	0	4	16
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	18	9	—	
Ditto, ditto (with Potash)	16	12	—	
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	17	3	7	19
Ditto, ditto (with Potash)	17	0	10	3
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	22	16	9	6
Ditto, ditto (with Potash)	21	12	9	16
25 loads Dung, Phosphates (no Potash), and 6 cwt. Nitrate of Soda	—		12	6
Ditto, ditto (with Potash)	—		13	4
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	15	0	—	
Ditto, ditto (with Potash)	13	10	—	
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda	—		3	12
Ditto, ditto (with Potash)	—		10	11

The use of potash for Summer Spinach has proved decidedly advantageous on the plots on which no dung was used, and in numerous instances during our experience it has also appeared to be useful even on the plots manured with a moderate dressing of dung, although in many

BEETROOTS, 1900.

Crop, 10 tons 8 cwt. per acre.
Manure per acre.
25 tons London Dung
(cost £10 per acre).

Crop, 12 tons 1 cwt. per acre.
Manure per acre.
No Dung,
10 cwt. Basic Slag,
1 cwt. Sulphate of Potash,
8 cwt. Nitrate of Soda
(cost £6 5s. per acre).

other cases such has not been the case. Our experience, however, with the heavier crops of 1899, 1900, and 1901, leads us to the conclusion that, even when a moderate quantity of dung is used, it is wise, on soils that are naturally poor in potash, to apply an occasional dressing of potash salts to land on which Spinach is grown.

Our two crops of Winter Spinach in 1898 and 1901 were taken after the crop of Summer Spinach, but the manures were applied only once each year. It will be seen that the effect of the liberal use of chemical fertilisers as an addition to dung is well brought out, and that the heaviest increase has been obtained with dung and chemical fertilisers including the heavy dressing of 6 cwt. of nitrate of soda per acre.

It ought to be mentioned that in order to obtain our records for Spinach we have not gathered the crops leaf by leaf, as they would be gathered in ordinary market gardening, but have allowed the crop to stand undisturbed until it reached the flowering stage, when we cut and weighed the entire crop of green stuff. We consider that this gives, for this crop, equally good comparative results, although the actual weights per acre are probably not the same as those that would be obtained by plucking the leaves singly during the life of the plant.

Beetroots.

Our culture of Beetroots has not been uniformly satisfactory, owing to the difficulties which we have sometimes had to encounter by reason of drought during the spring, and also through wireworm. Sometimes the plant has failed us, or the seed has come up so irregularly as to necessitate a second or third sowing. In 1894, for instance, the plant wholly failed; and in 1895, although we obtained, in one sense, an excellent crop, the roots, owing to the necessity of re-sowing, were of different ages, destroying the comparative value of the different plots for experimental purposes.

Up to 1898 we grew the crop on the original system of manuring, with dressings of nitrate of soda running up to 4 cwt. per acre. In 1899, 1900, and 1901, we increased the dressings of nitrate according to our later scheme. In the two former years no material increase was obtained from the larger dressings of nitrate when dung was used; but in 1901, when the crop was heavier than usual, there was a substantial advantage from the larger dressings.

The following table gives average results for six years:—

BEETROOTS—Six Years' Average.

Annual manuring per acre	Annual cost of manure per acre			Average of six crops of Beetroots per acre	
	£	s.	d.	tons	cwt.
50 loads (25 tons) London Dung	10	0	0	13	11
25 loads (12½ tons) London Dung	5	0	0	11	13
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda (without Potash)	6	15	0	12	10
Ditto, ditto, ditto (with Potash)	7	5	0	12	13
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda (without Potash)	7	15	0	13	15
Ditto, ditto, ditto (with Potash)	8	5	0	13	16

It will be seen that, on the average, potash has produced little or no effect when applied in addition to dung, although on the plots on which dung was not used (recorded in previous reports but not shown in the above table) there was an average increase of 2 tons per acre due to potash. In the later years, however, potash has told even on the dunged plots.

On the whole, it will be seen that great economy has been shown in avoiding a large quantity of dung, using in its place a small quantity of dung with phosphates and 4 cwt. of nitrate of soda per acre.

The following table shows the results obtained in the season 1901 :—

BEETROOTS—SEASON 1901.

Annual manuring per acre	Cost of manure per acre			Weight of Beetroots per acre.	
	£	s.	d.	tons	cwt.
50 loads (25 tons) London Dung	10	0	0	18	3
25 loads (12½ tons) London Dung	5	0	0	14	0
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda (without Potash)	6	15	0	15	0
Ditto, ditto, ditto (with Potash)	7	5	0	16	14
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda (without Potash)	7	15	0	18	0
Ditto, ditto, ditto (with Potash)	8	5	0	19	5
25 loads Dung, Phosphates, and 6 cwt. Nitrate of Soda (without Potash)	8	15	0	20	9
Ditto, ditto, ditto (with Potash)	9	5	0	21	0
No Dung; Phosphates and 8 cwt. Nitrate of Soda (without Potash)	4	15	0	11	15
Ditto, ditto, ditto (with Potash)	5	5	0	11	18

Although the crop was so good a one where dung and chemical fertilisers were used together, the undunged plot did badly, owing to the young plant having languished for want of moisture in its earlier stages; and in this case potash salts failed to produce the substantial increase which it had shown in the case of the undunged plots in previous years.

We would suggest, as a good general dressing for this crop, 25 loads (*i.e.* 12½ tons) of dung, 4 to 6 cwt. of superphosphate, and 4 cwt. of nitrate of soda per acre, 2 cwt. of nitrate per acre being applied either at sowing time or after the plant is up, according to the general dryness of the climate, and a further quantity of 2 cwt. per acre given as a top dressing a month or so afterwards. If dung is scarce, the crop should be grown on land which has been dunged for the previous crop, and should, in addition to superphosphate and nitrate of soda, receive 4 cwt. of kainit or 1 cwt. of sulphate of potash per acre, well mixed with the soil during the preparation of the seed bed or earlier. In this case, after applying nitrate of soda as above recommended, an additional top dressing may be given, bringing the total quantity of nitrate of soda up to, say, 6 cwt. per acre.

Rhubarb.

Our first plantation was made in 1895, four varieties being selected, namely, three of small Rhubarb and one of large or coarse. The small varieties were 'Albert,' 'Paragon,' and 'Johnson's St. Martin'; the large

BEETROOTS, 1900.

Crop, 10 tons 8 cwt per acre.	Crop, 12 tons 14 cwt. per acre.
Manure per acre.	*Manure per acre.*
25 tons London Dung	$12\frac{1}{2}$ tons London Dung, 10 cwt. Basic Slag, 1 cwt. Sulphate of Potash, 4 cwt. Nitrate of Soda
(cost £10 per acre).	(cost £8 15*s*. per acre)

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VICTORIA RHUBARB.

Crop 49 tons 11 cwt. per acre.

Manured with 4 cwt. Superphosphate and 4 cwt. Nitrate of Soda per acre, costing £2 10s. per acre.
No Dung used.

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variety being the well-known 'Victoria.' Equal numbers of plants of the different varieties were planted on each plot.

The "pullings" were necessarily irregular during the first one or two seasons, so we did not begin a systematic record of our results until 1897. We recorded the crops of four seasons, after which we "grubbed" the section and made a new plantation for future experiment.

The records of the small and large varieties were kept separately, as the large varieties crop nearly twice as heavily as the smaller ones. The manuring, however, on each plot was the same for both small and large varieties.

The following results show the average records of the four seasons 1897 to 1900 inclusive; and it may be worth while to record, as a better indication of the scale on which the experiments are conducted than may be derived from a mere knowledge of the area of land under cultivation, that the results represent the actual produce of 300 plants. It will be seen, therefore, that the experiments are on a scale sufficiently large to practically eliminate the difference due merely to variations in the size of individual plants.

RHUBARB—Small or Fine Varieties.

Annual manuring per acre	Annual cost of manure per acre			Average annual crop per acre for four years (1897, 1898, 1899, and 1900)		
				No. of stalks or "sticks" pulled per acre	Total weight per acre	
	£	s.	d.		tons	cwt.
50 loads (25 tons) London Dung	10	0	0	105,875	19	9
25 loads ($12\frac{1}{2}$ tons) London Dung	5	0	0	61,900	12	8
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	6	5	0	79,825	12	5
Ditto, ditto (with Potash)	6	15	0	87,330	13	14
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	99,350	17	0
Ditto, ditto (with Potash)	7	5	0	101,430	19	3
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	93,440	21	3
Ditto, ditto (with Potash)	8	5	0	93,950	19	9
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2	15	0	66,575	13	2
Ditto, ditto (with Potash)	3	5	0	79,800	12	17

It is seen that 25 loads of London dung per acre has been in itself quite an insufficient dressing. Doubling the dung went far towards doubling the average crop, but very nearly the same yield was obtained by retaining the smaller dressing of dung and adding chemical fertilisers consisting of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre. The dressing including the larger quantity of 4 cwt. of nitrate of soda per acre distinctly increased the average weight, but not the average number of leaf stalks or sticks, per acre; and, on the whole, the moderate dressing including 2 cwt. of nitrate per acre appears to have produced the best results.

The use of chemical fertilisers without dung gave decidedly better results than the use of 25 loads of dung per acre without any chemical fertilisers, but the yield, on the average, was much smaller than in those cases where we used a moderate quantity of dung in conjunction with a moderate quantity of chemical fertilisers.

The following short table shows the increase obtained, beyond the crop grown with 25 loads of dung per acre only, by the addition of 25 further loads of dung on the one hand and of mixtures of chemical fertilisers on the other:—

Annual manuring (in addition to 25 loads Dung) per acre	Cost of extra manure per acre			Average INCREASE per acre of Rhubarb (small varieties) over and above the yield obtained with 25 loads Dung per acre only		
	£	s.	d.	Sticks	tons	cwt.
25 extra loads Dung	5	0	0	43,975	7	1
Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda	1	15	0	25,430	1	6
Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda	2	5	0	39,530	6	15
Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda	3	5	0	32,050	7	1

The relative economy of chemical fertilisers, as compared with an additional quantity of dung, is very manifest, as is also the relative economy of using different quantities of nitrate of soda; the best result on the whole, as has already been indicated, being that obtained by the use, in addition to 25 loads of dung per acre, of 2 cwt. of nitrate of soda per acre in conjunction with phosphates and potash salts.

In the case of the large variety, the average results obtained during the four years were as follows:—

RHUBARB—LARGE OR COARSE VARIETY ('VICTORIA').

Annual manuring per acre.	Annual cost of manure per acre			Average annual crop per acre for four years (1897, 1898, 1899, and 1900)		
				No. of stalks or "sticks" pulled per acre	Total weight per acre	
	£	s.	d.		tons	cwt.
50 loads (25 tons) London Dung	10	0	0	97,310	38	15
25 loads (12½ tons) London Dung	5	0	0	70,440	27	0
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	6	5	0	93,210	37	6
Ditto, ditto (with Potash).	6	15	0	84,175	33	12
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	87,600	36	2
Ditto, ditto (with Potash).	7	5	0	99,500	37	12
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	112,420	45	3
Ditto, ditto (with Potash).	8	5	0	96,050	40	16
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	2	15	0	92,860	37	16
Ditto, ditto (with Potash).	3	5	0	94,640	37	0

Here again light dressing of dung was quite insufficient to obtain anything like a full crop, and the doubling of the dung produced nearly half as much again. But a far greater increase was obtained by adding chemical fertilisers in liberal quantity to the smaller dressing of dung, the

VICTORIA RHUBARB (1897 and 1898).

(The scale shows inches.)

Average crop per acre.
40 tons 3 cwt.

Manure per acre.
$12\frac{1}{2}$ tons London Dung,
4 cwt. Nitrate of Soda,
4 cwt. Superphosphate

(cost £7 12*s.* per acre).

Average crop per acre.
30 tons $7\frac{1}{2}$ cwt.

Manure per acre.
25 tons London Dung without chemical fertilisers

(cost £10 per acre).

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POTATOS (1900) ('UP-TO-DATE').

Crop, 7 tons 7 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

Crop, 9 tons 9 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
10 cwt. Basic Slag,
1 cwt. Sulphate of Potash,
2 cwt. Nitrate of Soda

(cost £7 15*s*. per acre).

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increase of nitrate of soda having, in the case of this large or coarse variety of rhubarb, been productive up to 4 cwt. per acre. And it will be noticed that even chemical fertilisers alone, including 4 cwt. of nitrate of soda per acre, produced very nearly as good results as those obtained by the very heavy dressing of dung without the aid of chemical fertilisers.

An examination of the results obtained in individual years shows that, on the whole, potash exercised a beneficial influence on the crop in the case of the small varieties. In the case of the large variety, however, potash salts, on the whole, do not seem to have produced a useful effect. Probably the larger root development of the plants enables them to seek mineral food at greater depths than can the smaller varieties, and thus enables them, even when no dung is used, to obtain an adequate supply of potash from the natural resources of the soil.

In the following summary table, therefore, showing briefly the increase obtained and the relative economy of different methods of manuring, we have selected for comparison the plots which did not receive potash : —

Annual manuring (in addition to 25 loads Dung) per acre	Cost of EXTRA manure per acre			Average INCREASE per acre of Rhubarb (large variety) over and above the yield obtained with 25 loads Dung per acre only		
	£	s.	d.	Sticks	tons	cwt.
25 extra loads Dung	5	0	0	26,870	11	15
Phosphates and 1 cwt. Nitrate of Soda . .	1	5	0	22,770	10	6
Phosphates and 2 cwt. Nitrate of Soda . .	1	15	0	17,160	9	2
Phosphates and 4 cwt. Nitrate of Soda . ..	2	15	0	41,980	18	3

Here the figures are so very striking that they require no comment.

It is important, however, to add that, both with the large and with the smaller varieties, the great economy of production by the proper use of chemical fertilisers is only one of the features brought out by these experiments. Another great and important feature, which cannot be expressed numerically, is the *far better quality* of the heavier crops grown rapidly with the aid of a liberal quantity of nitrate of soda, as compared with that of the produce grown with dung alone. This superiority of quality consists mainly—as in the case of Cabbages and other vegetables already referred to—in a far greater degree of tenderness, due to a greater development of soft cellular tissue and a corresponding decrease in tough vascular fibre. The chemically dressed rhubarb, when raw, is far more crisp or tender ; and repeated trials show that it takes less time to cook, and is, when cooked, much more pleasant to eat, than the Rhubarb grown more slowly by the use of dung alone.

We have made a new plantation of Rhubarb on which our experiments will be repeated and continued.

Potatos.

We have recorded seven crops of early Potatos and eight crops of late or "main-crop" varieties. The early varieties were, during the four years 1895 to 1898 inclusive, 'Windsor Castle'; and during the three years 1899 to 1901 inclusive, Webber's 'White Beauty.' As late or main-crop Potatos we grew, in 1894, 'Beauty of Hebron'; in 1895, 'Magnum

Bonum'; in 1896, 'Imperator'; in 1897 and 1898, 'Magnum Bonum'; and in 1899, 1900, and 1901, 'Up-to-date.'

The results of our experience over the fifteen crops are summarised in the following table :—

POTATOS.

Annual manuring per acre	Annual cost of manure per acre			Average annual yield of Potatos per acre			
				Early varieties (seven years' average)		Late varieties (eight years' average)	
	£	s.	d.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung	10	0	0	7	7	10	6
25 loads ($12\frac{1}{2}$ tons) London Dung	5	0	0	5	14	8	15
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	6	4	9	13
Ditto, ditto (with Potash)	7	5	0	6	9	10	9
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	6	7	10	5
Ditto, ditto (with Potash)	8	5	0	6	10	11	3
* *No Dung*; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	3	5	0	3	6	5	8
Ditto, ditto (with Potash)	3	15	0	4	10	8	0

* 8 cwt. Nitrate in 1900 and 1901.

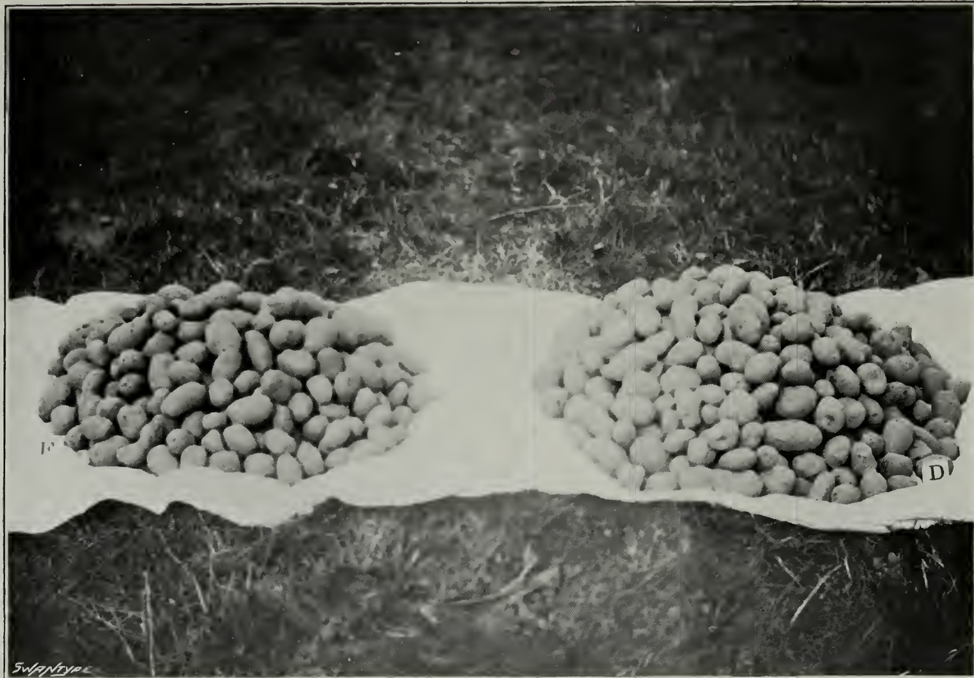
As far as early varieties are concerned, the best results have been obtained with a very heavy dressing of dung. This has been the case not only on the average, but in every one of the seven seasons. This experience, having regard to our results with other vegetables, is exceptional, and is no doubt to be attributed to the extra dung keeping the soil moist in the series of years in which the summers have on the average been exceptionally dry, the growth of early Potatos being entirely confined to the period of summer.

Having regard, however, to the cost of the extra dung—namely, 4*s*. per load or 8*s*. per ton—it would seem that the smaller crop grown with the aid of a moderate dressing of dung accompanied by a mixture of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre, has been on the average not much less economical. Nevertheless in some years the advantage, even from an economical point of view, has been decidedly with the heavy dung, for early Potatos; and, as the value of this crop very often depends upon its earliness, this seems to be a case in which the extravagance of heavy dunging is on the whole probably justified, at all events *on such stiff or heavy soils as we have at Hadlow.*

When, however, we come to the late or main-crop Potatos, no advantage seems to lie with heavy dunging; for the average crop produced by 50 loads of dung per acre over eight years is no greater than that produced at a considerably less cost by a light dressing of dung in conjunction with a dressing of phosphates, potash salts, and 2 cwt. of nitrate of soda per acre. The addition of 2 cwt. more of nitrate per acre, making 4 cwt. in all, has still further increased the average yield of Potatos, and has increased in considerably greater ratio than the extra cost of manure.

Potash has throughout increased the crop, but the increase due to it on the dunged plots has been much less in the case of early Potatos than

POTATOS (1900) ('UP-TO-DATE').



Crop, 9 tons per acre.	Crop, 12 tons per acre.
Manure per acre.	*Manure per acre.*
25 tons London Dung	$12\frac{1}{2}$ tons London Dung, 10 cwt. Basic Slag, 1 cwt. Sulphate of Potash, 4 cwt. Nitrate of Soda
(cost £10 per acre).	(cost £8 15*s.* per acre).

in the case of late or main-crop varieties. In fact, the application of potash for the early varieties has not paid when a dressing of dung has been used. In the case of the late or main-crop varieties, however, the good effect of potash has been very great. The well-known need of Potatos for potash is strikingly brought out in both the early and late varieties on those plots on which no dung has been used.

Although we have each year included chemically manured plots receiving no dung at all, our crops of early Potatos grown in this way have been unsatisfactorily small, except in one year when we grew nearly 9½ tons of 'Windsor Castle' Potatos of good quality without the use of any dung at all; this, however, was exceptional. With the late varieties we have obtained many good crops without the aid of dung; but the average differences between the crops grown solely with the aid of chemical fertilisers and those grown by the combined use of chemical fertilisers and dung has been considerably more valuable than the sum saved by withholding the dung.

In 1900 and 1901 increased dressings of nitrate of soda were tried; but when dung was used no advantage was gained by using more than 4 cwt. of nitrate per acre, with phosphates and potash salts.

On our soil the most satisfactory manuring for early Potatos seems to be heavy dunging, which might probably be well supplemented by a light dressing of chemical fertilisers. For late varieties, however, we counsel, for such soils, the use of 25 loads (say 12 or 15 tons) of dung, 4 to 6 cwt. of superphosphate, 1 cwt. of sulphate of potash, and 4 cwt. of nitrate of soda per acre. The dung, superphosphate, and potash should be well mixed into the soil before planting. The nitrate may be applied, 2 cwt. per acre at the time of planting, and 2 cwt. after earthing up.

The nature of the soil, however, is a very important factor in the manuring as well as in the general management of the Potato crop.

Tomatos.

The following simple experiment was made during the last two years, to ascertain the effect of nitrogenous manure upon Tomatos. The plants were grown out in the open, and were manured with dung at the rate of 25 loads (12½ tons) per acre, together with 6 cwt. of superphosphate and 1 cwt. of sulphate of potash per acre. One plot was left without any further nitrogenous manure than was comprised in the dung; the other received a dressing of 2 cwt. of nitrate of soda per acre. The results were as follows:—

TOMATOS.

Annual manuring per acre	Annual cost of manure per acre			Weight of Tomatos per acre			
				1901		1902	
	£	s.	d.	tons	cwt.	tons	cwt.
25 loads (12½ tons) London Dung, 6 cwt. Superphosphate, and 1 cwt. Sulphate of Potash (without Nitrate of Soda) . .	6	5	0	6	0	7	16
25 loads (12½ tons) London Dung, 6 cwt. Superphosphate, and 1 cwt. Sulphate of Potash, with 2 cwt. Nitrate of Soda . .	7	5	0	6	16	8	14

Spring (or Summer) Onions.

While we have been very successful in growing Winter Onions, Spring (or Summer) Onions have proved a difficult crop to grow in several years, owing to the difficulty of getting a good plant in stiff soil during the dry seedtime. Drought and wireworm—one or both—rendered the crops so irregular and unsatisfactory in some years that they were really not worth recording. In 1900 and 1901, however, we succeeded in raising really fine crops. The results for these two years are shown in the following table :—

SPRING (OR SUMMER) ONIONS.

Annual manuring per acre	Annual cost of manure per acre			Weight of Onions per acre			
				1900		1901	
	£	s.	d.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung . . .	10	0	0	8	11	10	7
25 loads ($12\frac{1}{2}$ tons) London Dung . . .	5	0	0	7	0	11	11
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	6	15	0	7	7	9	12
Ditto, ditto (with Potash)	7	5	0	8	16	11	16
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	7	15	0	8	18	9	15
Ditto, ditto (with Potash)	8	5	0	9	10	8	14
25 loads Dung, Phosphates (no Potash), and 6 cwt. Nitrate of Soda	8	15	0	10	2	10	12
Ditto, ditto (with Potash)	9	5	0	10	0	11	8
No Dung; Phosphates (no Potash) and 8 cwt. Nitrate of Soda	4	15	0	1	6	5	2
Ditto, ditto (with Potash)	5	5	0	6	1	8	0

It will be seen that chemical fertilisers, used in addition to a moderate quantity of dung, produced in 1900 a highly valuable return, and that it proved advantageous in that season to use as much as 6 cwt. of nitrate of soda per acre. Even 2 cwt. of nitrate per acre, in conjunction with phosphates, potash salts, and a light dressing of dung, gave a better yield than the heavy dressing of dung, showing once again the danger of relying upon town dung without the aid of further fertilisers if we are to be sure that the soil will give its best yield. In 1901, however, the use of chemical fertilisers yielded no profit, for, for some reason or other, the light dressing of dung produced a full crop alone.

Chemical fertilisers alone, without the aid of dung, gave much less satisfactory results than when a moderate quantity of dung was used in conjunction with them. The great dependence of Onions not only upon phosphates and nitrogen, but also upon potash salts, is strongly shown in both years on the plot which has been throughout the experiments kept without dung.

Tripoli (Winter) Onions.

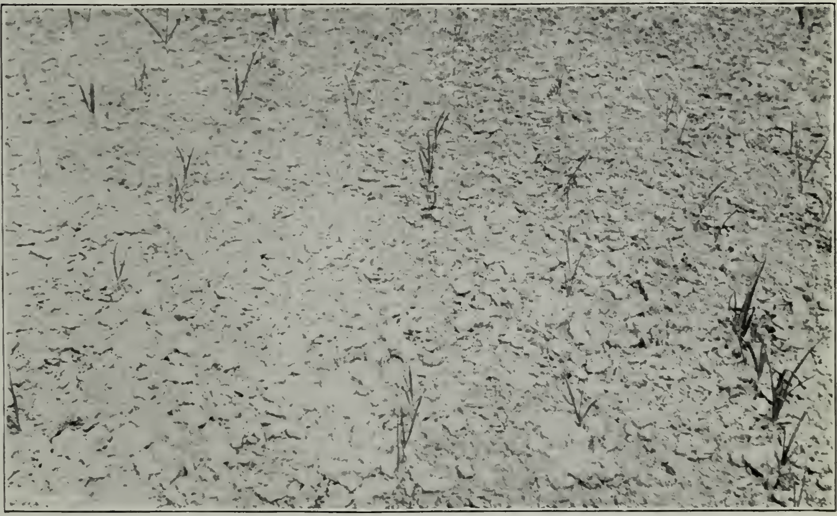
Tripoli Onions have failed us only in two seasons, namely, in 1895 and 1899, owing to drought. From 1896 to 1900 we grew excellent crops, and in 1900 only a light crop.

Tripoli Onions are sown in the summer, and live in the ground through the winter, maturing in the following summer; and the results

SUMMER ONIONS.

(Illustrating complete failure of crop owing to non-supply of Potash in the absence of Dung.)

Manured with Superphosphate, Nitrate of Soda, and *Sulphate of Potash.*



Similarly manured, but *without Potash.*

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of our experiments, in all of the seasons during which we have grown this crop, show that it is unsatisfactory to attempt to dispense altogether with the use of dung. By far the best results have been obtained by the use, in conjunction, of a light dressing of dung and of a suitable quantity of chemical fertilisers. Very heavy dunging, on the other hand, has, as in so many other cases, proved to be not only extravagant but unsatisfactory as compared with the mixed system of manuring.

In our first three series of experiments the quantities of nitrate of soda used in conjunction with other fertilisers were 1 cwt., 2 cwt., and 4 cwt. per acre respectively, the 4 cwt. giving, on the average, the best crop. For the crop of 1900 the dressings of nitrate were 2 cwt., 4 cwt., and 6 cwt. per acre. The increase, however, from 4 cwt. to 6 cwt. did not give, on the average, any remunerative result.

The following table exhibits the average results obtained in the five seasons with dung alone (in heavy quantity and in light quantity), and with light dung supplemented by a mixture of chemical fertilisers including 2 cwt. and 4 cwt. of nitrate of soda per acre respectively.

It will be observed that the results are given in three columns. The first column shows the total weight of Onions per acre; the second column shows the weight of sound marketable bulbs; and the third shows the quantity of unsound or unmarketable bulbs. In some seasons, as is well known to market gardeners, a certain proportion of Tripoli Onions become "bull-necked," or start a second growth. Such Onions will not keep, and although, if grown in a kitchen garden, they may be used at home, they would not be saleable in the market, since dealers will only take sound bulbs which may be relied upon not to go soft or bad. We have therefore, in dealing with our Tripoli Onions, always taken care to sort out the marketable bulbs from the unmarketable bulbs, and the quantities of both are recorded in the following table. It is notable that in the years 1900 and 1901 no such division was necessary, as the whole of our crop was marketable. But this is an unusually good condition of things with Tripoli Onions.

TRIPOLI ONIONS.

Annual manuring per acre	Annual cost of manure per acre			Average weight of Onions per acre per annum (five seasons)					
				Total weight of bulbs		Sound marketable bulbs		Unsound or unmarketable bulbs	
	£	s.	d.	tons	cwt.	tons	cwt.	tons	cwt.
50 loads (25 tons) London Dung .	10	0	0	12	9	10	10	1	19
25 loads (12½ tons) London Dung .	5	0	0	8	12	7	16		16
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda .	6	15	0	12	11	11	3	1	8
Ditto, ditto (with Potash) . . .	7	5	0	12	14	11	7	1	7
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda .	7	15	0	12	16	10	14	2	2
Ditto, ditto (with Potash) . . .	8	5	0	13	9	11	1	2	8

It will be seen that the heaviest total crop was, on the average, produced by the plots which, in addition to a moderate dressing of dung, have received a mixture of chemical fertilisers consisting of phosphates, potash salts, and 4 cwt. of nitrate of soda per acre, but that the most remunerative crop, on the whole, was that obtained when the dressing of nitrate of soda was 2 cwt. per acre.

In most of the years potash has shown very marked and valuable results on some, if not all, of the plots on which it has been used, even in the presence of dung; but the effect in 1900—when, owing to climatic conditions, the crop grew more freely—was less apparent, and, as a result, the average results for the five seasons do not fully indicate the advantage which may sometimes be derived from the use of potash manures for this crop.

That Tripoli Onions, like Summer Onions, are strongly dependent upon a full supply of potash in some form or other has been shown very strikingly on the undunged plots, especially in 1900. In that season, by the aid of a dressing of 6 cwt. of superphosphate, 1 cwt. of sulphate of potash, and the somewhat heroic quantity of 8 cwt. of nitrate of soda per acre, we raised over $10\frac{1}{4}$ tons of Tripoli Onions per acre without any dung at all, on land which had not been dunged for years; and the *whole* of the Onions so grown were sound or marketable bulbs.

On the other half of the plot, however, which received no potash and which, it may be added, has received no potash in any form during the period of our experiments, the plants failed to produce any bulbs at all worth gathering or weighing.

We may at once say, however, that our experience indicates that it is very unwise to grow Onions without dung, however liberal the supply of chemical fertilisers.

Returning to the various dunged plots, the comparative effect of heavy dung and of chemical fertilisers used in conjunction with the lighter dressing of dung may be seen in the following table, in which, from the average yield of each plot, a deduction has been made of the weight of Onions produced by the 25 loads of dung alone.

TRIPOLI ONIONS.

Annual manuring (in addition to 25 loads Dung) per acre	Average annual INCREASE per acre over five seasons		
	Increase in total weight of bulbs	Increase in weight of sound marketable bulbs	Annual cost of extra manure per acre
	tons cwt.	tons cwt.	£ s. d.
25 additional loads Dung	3 17	2 14	5 0 0
Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda	4 2	3 11	2 5 0
Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda	4 17	3 5	3 5 0

The relative economy of the different systems of manuring as here set out speaks for itself.

LEEKS.

We have grown leeks for four years on a plan of experiment differing from the scheme applied in most of our trials, inasmuch as it includes a plot treated with chemical fertilisers without the use of nitrate. This plan was adopted on account of our experience with Leeks in earlier

TRIPOLI ONIONS, 1896.

Crop, 11 tons 6 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung,
4 cwt. Superphosphate,
1 cwt. Nitrate of Soda

(cost £6 per acre).

Crop, 6 tons 7 cwt. per acre.

Manure per acre.

$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

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seasons, which seemed to indicate that Leeks are less influenced by nitrogenous manure than most vegetables. As will be seen from the following results, our subsequent experience is in the same direction.

LEEKS.

Average results of four seasons, 1897–1898, 1898–1899, 1899–1900, 1900–1901.

Annual manuring per acre	Average weight per plant
	oz.
50 loads (25 tons) London Dung	8·6
25 loads (12½ tons) London Dung	8·2
25 loads Dung, Phosphates, and Potash Salts (no Nitrate of Soda) .	9·6
25 loads Dung, Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda .	9·5
25 loads Dung, Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda .	9·4
25 loads Dung, Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda .	9·1

It will be seen that the chemical fertilisers have considerably improved on the yield of dung alone, the size of the plants being on the average 10 per cent. greater; but the inclusion of nitrate of soda has on the average given no better results than the use of phosphates and potash salts without it, when a light dressing of dung has been used.

Asparagus.

Asparagus is usually supposed to grow best upon light sandy soil, and many experienced growers of this valuable crop would probably, after an inspection of our experimental field, pronounce its growth on our close sticky clay soil to be an impossibility. Nevertheless we are now growing splendid crops of Asparagus on it at the rate, on our best plots, of from 2,500 to 3,000 bundles per acre.

We constructed our beds in the year 1895 by cutting deep trenches the width of ordinary beds, wide enough to contain three plants abreast. A portion of the lowermost clay subsoil was removed and replaced with brick rubble and old hopbine for drainage purposes. The upper subsoil was then replaced, being liberally mixed, in all the beds, with dung, the surface soil being then replaced above this. Each of our six plots (each being one-hundredth of an acre in area) contains three beds, and 40 loads of stable dung were used for the eighteen beds, which is at the rate of, roughly speaking, 300 tons per acre. This dung, it is to be remembered, was buried in the subsoil.

The variety of Asparagus used was Sutton's 'Palmetto.' The plants, three years old, were planted in April 1895. Unhappily, during the first year, we lost a considerable proportion of our plants owing to summer drought, and these had to be replaced in 1896.

We commenced regular cropping in 1897, and the crop of 1902 was therefore our sixth.

Our manuring has been on the same general principles as on the other plots. One plot receives annually a heavy dressing of dung, one a light dressing, and three others receive a light dressing of dung with the addition of chemical fertilisers, while one plot receives chemical fertilisers without any dung.

Since Asparagus has the reputation of being a salt-loving plant, we have treated one half of each plot (including the dunged plots) with salt. On the chemically fertilised plots the salt has been applied in each case to the half-plot which receives no potash. The potash sown on the other half of each chemically manured plot is given in the form of kainit, which contains a good deal of salt. The quantity of salt used is 2 cwt. per acre on the salt plots, while the kainit on the potash plots is at the rate of 4 cwt. per acre.

For the first three crops nitrate of soda was used at the rate of 1 cwt., 2 cwt., and 4 cwt. per acre. Since 1899 the quantity on the respective plots has been increased to 2 cwt., 4 cwt., and 6 cwt. per acre, and was as much as 8 cwt. per acre on the plot to which no dung is annually applied.

The value of an acre of Asparagus is dependent upon three different factors: firstly, the number of shoots or bundles cut from it; secondly, the size and weight of the shoots; and thirdly, their quality. A "bundle" of Asparagus, it may be observed, consists of 50 shoots, and is the ordinary unit of the market.

All of these three factors—numerical quantity, weight, and quality—are not necessarily controlled by the system of manuring. The Asparagus on our beds is cut every day during the season by an experienced gardener, who cuts each shoot just when it is in full condition for market, the shoots cut from each of the beds being at once placed in a separate receptacle, the respective contents being forthwith counted and weighed. The judgment of the grower has to be exercised, however, towards the end of the season in deciding how many shoots shall be left uncut on each crown to grow and form the foliage by which the plant carries on its life and builds up its strength to send up the shoots of next year. Sometimes it may be desirable to leave more shoots on one plant than on another. In order to preserve the bed in good condition, the grower must exercise his discretion in this regard as well as he can; but he may obviously under-estimate the strength or vigour of one plant or crown, or he may over-estimate that of another, and leave to one crown fewer shoots than he should and to another more than he need. The exact number of shoots, however, cannot very easily be regulated. It follows that the quantity of Asparagus cut for market on one bed may for these reasons be more or less than that cut on a neighbouring bed; and this will affect the numerical yield of bundles per acre. Moreover, the number of shoots left on any particular crown may well influence the vigour and vitality of the plant as a whole during the growing season in such a way as to affect the number of marketable shoots that may be thrown up for cutting during the next season. Although every care is exercised to treat the beds as uniformly as circumstances will allow, there is nevertheless necessarily considerable variation in the number of shoots left to form the above-ground portion of the plant; and this must have a large influence on the mere question of the number of bundles produced by any bed in an individual season.

Furthermore, as has been already stated, some of the plants failed owing to drought in the early history of the plots, and had to be subsequently replaced by new ones; so that the average age of the plants on all the plots is not quite the same.

The *mere number of bundles* produced on a bed, therefore, is not to be taken as having any necessary connection with the mode of manuring adopted; nor is it necessarily a good index by which to judge the value or quality of the crop.

Many of the shoots produced on any bed are always thin and small, and a plant throwing up a number of thin shoots may be much less valuable than one throwing up a few strong shoots. Our records of total bundles include all shoots cut, but there is on every Asparagus bed a certain proportion of thin stuff, which has to be sold at a very small price compared with that obtained for bundles of substantial shoots. In judging, therefore, of the effect of manuring, we must rather have regard to the average *size* of the shoots expressed as "weight per bundle" than to the actual number of bundles grown.

Effect of Salt.—The following summary shows the results obtained over six years, with and without salt, on the dunged plots receiving no other fertilisers:—

ASPARAGUS—Six Years' Average.

Annual manuring per acre	Bundles per acre	Weight per bundle
		oz.
50 loads London Dung, with 2 cwt. Salt	1,916	18·1
50 loads London Dung, without Salt	2,045	17·9
25 loads London Dung, with 2 cwt. Salt	2,160	18·6
25 loads London Dung, without Salt	2,086	18·2

The influence of the salt appears to be inconsiderable. It will be noticed also that the heavier dunging has not added either to the quality or to the weight of the produce.

Effect of Potash Salts.—As kainit contains a good deal of salt, we can, by comparing the salt and kainit plots, estimate the effect produced by potash. This is seen in the following table:—

ASPARAGUS.

	Average of first three years		Average of last three years	
	Bundles per acre	Weight per bundle	Bundles per acre	Weight per bundle
		oz.		oz.
Average of various plots annually receiving Phosphates, Nitrate of Soda, and Dung, *without Potash* .	1,174	19·1	2,607	19·0
Average of similar plots *with Potash*	1,306	20·4	2,663	18·5
Average of various plots annually receiving Phosphates and Nitrate of Soda but no Dung, *without Potash*	1,040	19·3	2,098	20·3
Average of similar plots *with Potash*	1,168	21·7	2,341	19·9

On the whole the results appear to show that potash is a useful fertiliser for Asparagus, and one which should not be neglected if the best results are to be obtained.

Effect of Chemical Fertilisers as an adjunct to, or substitute for, Dung.—The following table shows the average crop of Asparagus produced during the first three years. For simplicity's sake the salt or non-potash plots are omitted.

ASPARAGUS.

Average of first three seasons (1897 to 1899).

Plot	Annual manuring per acre	Annual cost of manure per acre	Bundles per acre	Weight per bundle
		£ s. d.		oz.
F	50 loads (25 tons) London Dung . .	10 0 0	1,296	17·6
E	25 loads ($12\frac{1}{2}$ tons) London Dung . .	5 0 0	1,324	17·3
A	25 loads Dung, Phosphates, Potash, and 1 cwt. Nitrate of Soda	6 15 0	1,355	19·9
B	25 loads Dung, Phosphates, Potash, and 2 cwt. Nitrate of Soda	7 5 0	1,073	20·6
D	25 loads Dung, Phosphates, Potash, and 4 cwt. Nitrate of Soda	8 5 0	1,490	20·7
C	*No Dung*; Phosphates, Potash, and 4 cwt. Nitrate of Soda	3 5 0	1,168	21·7

During these three years the effect of chemical fertilisers in increasing the size of the shoots, as compared with those obtained with dung only, was most marked; and though, for reasons already discussed, we cannot attach a great deal of value to the indications afforded by the number of bundles obtained per acre, it is nevertheless worth noting that the most liberal treatment, namely that on plot D, actually gave the best results in quantity as well as in weight.

During the next three years, as the plant became more vigorous and its demand for food presumably greater, we increased the supply of nitrate on each plot; but, curiously enough, the effect of the chemical fertilisers during the last three years on the dunged plots has not been appreciable, either as regards numerical yield or as regards the weight per bundle.

The results obtained during the last three years are shown in the following table:—

ASPARAGUS.

Average of last three seasons (1900 to 1902).

Plot	Annual manuring per acre	Annual cost of manure per acre	Bundles per acre	Weight per bundle
		£ s. d.		oz.
F	50 loads (25 tons) London Dung . .	10 0 0	2,795	18·3
E	25 loads ($12\frac{1}{2}$ tons) London Dung . .	5 0 0	2,848	19·1
A	25 loads Dung, Phosphates, Potash, and 2 cwt. Nitrate of Soda	7 5 0	2,628	18·9
B	25 loads Dung, Phosphates, Potash, and 4 cwt. Nitrate of Soda	8 5 0	2,643	18·6
D	25 loads Dung, Phosphates, Potash, and 6 cwt. Nitrate of Soda	9 5 0	2,719	18·1
C	*No Dung*; Phosphates, Potash, and 8 cwt. Nitrate of Soda	5 5 0	2,341	19·9

It seems not improbable that the plants have by this time made such growth that their roots are feeding in the still abundant dung which was originally buried in the subsoil during the trenching and preparation of the beds as already described; and that, in consequence, they have ceased to respond as they did during the earlier seasons to the effect of readily available manures applied at the surface. The retentive nature of our subsoil and the low average rainfall during our experimental years, must, of course, have tended to conserve such subsoil fertility to a far greater extent than would be the case on less retentive soils, such as those on which Asparagus is more commonly grown.

We are nevertheless continuing for the present the annual applications of the manures which told so well in the earlier years, and the chronicle of our results will be continued in a future report.

So far we have only referred to the quantity and weight of the produce grown, and have now to speak of the third factor in the value of Asparagus, namely, its quality.

After several seasons' experience and after many comparative observations, we have not the slightest hesitation in saying that the tenderness, flavour, and general quality of the Asparagus grown with the aid of chemical fertilisers have been markedly superior to those of the Asparagus grown with the aid of London dung alone. This agrees with our experience recorded in connection with many other vegetable crops.

At no time during our experiments has the heavy dressing of town dung, costing £10 per acre, given any better results than the light dressing, costing £5 per acre.

Having regard to our general experience, we should be inclined to recommend for Asparagus a light dressing of dung, not exceeding 25 loads (or, say, 12½ tons) per acre, supplemented by a dressing of from 4 to 6 cwt. of superphosphate, 4 cwt. of kainit (or 1 cwt. of sulphate of potash), and 4 cwt. of nitrate of soda per acre. The superphosphate and kainit (or sulphate of potash) should be applied in the winter, and the nitrate in the spring.

It should be noted that the direct effect of the manure is probably not to feed the shoots that are cut for market, but to encourage a vigorous season's growth in the vegetative shoots that are allowed to come to maturity after the cutting season is over. It is presumably owing to the metabolic processes carried on during this period that the plant stores up in its roots the nutriment necessary for producing, at the beginning of the following season, a rapid and vigorous growth of the shoots which constitute the crop.

In soils poor in lime it is not advisable to use superphosphate too often. It is better to use some non-acid phosphatic manure such as basic slag or Peruvian guano or bone meal, or the neutralised or so-called "basic" superphosphate introduced by Mr. Hughes. The trouble with regard to manures of low solubility, for a crop like Asparagus, is that the manure must always be applied at the surface, and cannot be dug in to any great depth as it can in the case of crops the roots of which are no longer required to remain undisturbed. For this reason, if we were constructing a fresh bed of Asparagus in a soil poor in lime, we should be inclined, during the construction and trenching of the bed, to incorporate with both soil and subsoil a quantity of either basic slag or bone meal as large as would be used collectively in several years' ordinary annual dressings. Where, however, there is sufficient lime in the soil, an annual dressing of superphosphate is probably all that need be used.

In Asparagus culture, as in the case of all other crops, the market grower will probably like to vary the nature of his artificial or concentrated fertilisers from time to time; on which question, however, the reader is referred back to our introductory remarks on an earlier page.

Leguminous Crops.

The great discovery of the power of leguminous plants to assimilate free nitrogen from the air through the medium of the micro-organisms inhabiting the tubercular nodules found on their roots, has led a great many teachers of agricultural chemistry to assume that the supply of nitrogen thus naturally obtainable is necessarily sufficient to enable such plants to dispense altogether with the aid of nitrogenous manure. In some cases—as, for instance, when a crop like Red Clover is grown in the course of an ordinary four-crop rotation—such a view is no doubt well grounded. Not, however, because Clover neglects to avail itself of manurial nitrogen existing in the soil. Indeed, it has been abundantly proved by the Rothamsted investigations that Red Clover, as well as other kinds of Clover, feeds abundantly upon nitrogen in the form of nitrates. The residues, however, of the dung and other nitrogenous manures applied to other crops in the rotation are probably generally sufficient, together with what the crop absorbs for itself from the air, to enable it to grow to perfection.

No doubt the degree to which leguminous crops are benefited by or indifferent to direct applications of manurial nitrogen depends to a considerable extent upon whether the micro-organisms necessary for the tubercular formation and for free nitrogen assimilation are present in the soil in sufficient abundance, and upon whether the circumstances are such as to encourage their free development.

It having come to our knowledge some years since that both in Spain and in America nitrate of soda had been freely and profitably used in the cultivation of Lucerne, or 'Alfalfa,' we had the curiosity to lay down four plots of land with Lucerne by the side of our market-garden crops, manuring them with mineral manures with and without the addition of nitrate of soda. The results of our six years' experience with these plots are given in the following table. Practically they corroborate, as regards the efficiency of nitrogenous manuring, the results of the Lucerne experiments carried out by Dr. Voelcker on smaller plots at Woburn, and show very clearly that Lucerne is capable of responding freely to the application of nitrogenous manure. It will be seen that, on the average of six seasons, the addition of 2 cwt. of nitrate of soda per acre to the phosphates and potash has produced an extra yield amounting to $4\frac{3}{4}$ tons of green Lucerne per acre over and above that given by the phosphates and potash salts alone.

LUCERNE, 1901 (showing the first cutting of the Season).

Total season's crop, 15 tons $13\frac{1}{2}$ cwt. per acre.

Manure per acre.

6 cwt. Superphosphate,
1 cwt. Sulphate of Potash,
No Nitrate.

Total season's crop, 22 tons 19 cwt. per acre.

Manure per acre.

6 cwt. Superphosphate,
1 cwt. Sulphate of Potash,
2 cwt. Nitrate of Soda.

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LUCERNE, 1897 to 1902.

Annual manuring per acre	Annual cost of manure per acre			Total green fodder per acre													
				1897		1898		1899		1900		1901		1902		Average of six seasons	
	£	s.	d.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Phosphates and Potash only . .	1	5	0	3	1	11	16	14	14	11	11	15	14	18	1	12	9
Phosphates, Potash, and 1 cwt. Nitrate of Soda .	1	15	0	2	19	13	11	19	15	15	9	19	3	22	11	15	11
Phosphates, Potash, and 2 cwt. Nitrate of Soda .	2	5	0	3	10	14	14	21	5	17	3	23	0	23	13	17	4
Phosphates, Potash, and 4 cwt. Nitrate of Soda .	3	5	0	3	17	13	4	17	16	17	3	22	2	22	19	16	3

This repeated experience with so free-growing a crop as Lucerne has led us to make some experiments to see whether nitrogenous manure in the form of nitrate of soda would have in ordinary market-garden practice any appreciable value for some of the ordinary vegetable crops—Peas or Beans—belonging to the same family. The results of our experiments up to the present year are here given.

Dwarf French Beans.

We have now grown this crop for three seasons. In each season two plots were devoted to the crop, both receiving London dung at the rate of 25 loads (or 12½ tons) per acre, together with a dressing of 6 cwt. of superphosphate per acre. One plot received no nitrate of soda; the other was dressed with nitrate at the rate of 2 cwt. per acre.

The following table shows the results of the three years, together with the average.

The individual Bean pods were plucked green day by day as they attained what was considered to be the best market size and condition.

DWARF FRENCH BEANS.

Annual manuring per acre	Annual cost of manure per acre			Weight per acre of Green Beans as picked for market								Average weight of haulm per acre harvested as straw	
				1900		1901		1902		Average of three years			
	£	s.	d.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.	tons	cwt.
Dung, Phosphates, and Potash (no Nitrate of Soda)	6	5	0	2	13	2	17¼	3	17	3	2½	1	11½
Dung, Phosphates, Potash, and 2 cwt. Nitrate of Soda . . .	7	5	0	4	6	3	15¼	5	10	4	10½	2	1

It will be seen, therefore, that in every year a very substantial advantage was gained by the use of 2 cwt. of nitrate of soda per acre for this crop, the average gain over the three years being 1 ton 8 cwt. of Green Beans per acre per annum, or an increase of nearly 45 per cent.

The haulm, weighed as straw, also averaged nearly ½ ton more per acre on the nitrated plot.

The result of this experiment appears to us particularly interesting and important to market gardeners.

Scarlet Runners.

Last year—1902—we also put down two plots of Scarlet Runners under a similar scheme of treatment. But, owing to a mistake, the dressing of superphosphate given was only 2 cwt. per acre, the plots being laid out, without additional phosphates, on land which had been partly manured for wheat with 2 cwt. of superphosphate per acre, but on which the crop, being uneven, was "grubbed."

We obtained a good crop of Beans, but, except that the nitrated plot grew a few hundredweights of haulm (weighed as straw) per acre more than the unnitrated plot, there was very little difference, the Beans as gathered for market being about 6 tons per acre on both plots.

Possibly a more liberal supply of phosphatic manure might have enabled the plant to give a better account of the nitrogen supplied to it. We hope, however, to repeat the experiment during the present season.

Green Peas.

We have also experimented with Green Peas during three seasons, but have obtained little advantage as regards quantity from the use of nitrate of soda, although there was a very marked influence on the quality of the Peas.

In 1900 and 1901 the Peas were of the variety Sharpe's 'Victor,' and in 1902 Veitch's 'Perfection.'

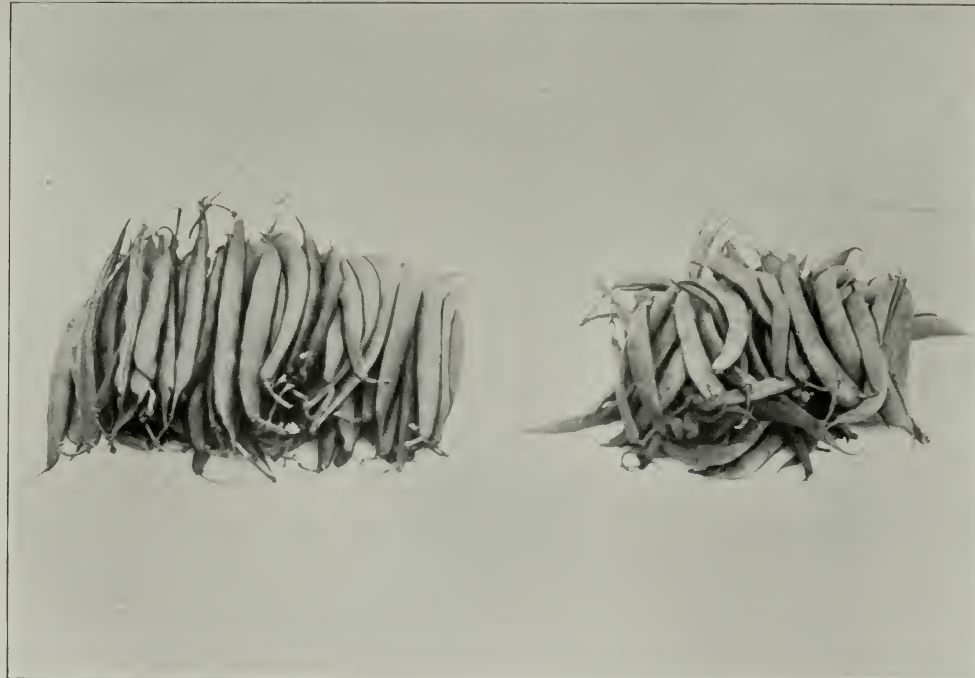
The results are as follows :—

GREEN PEAS.

Annual manuring per acre	Annual cost of manure per acre	Weight per acre of Green Peas in pod as picked for market				Average weight of haulm per acre harvested as straw
		1900	1901	1902	Average of three years	
	£ s. d.	tons cwt.	tons cwt.	tons cwt.	tons cwt.	tons cwt.
Dung, Phosphates, and Potash (no Nitrate of Soda)	6 5 0	2 16	1 3¼	4 2	2 13¾	1 16¾
Dung, Phosphates, Potash, and 2 cwt. Nitrate of Soda . . .	7 5 0	2 14	1 8	4 2½	2 14¾	1 16

It will be seen that the average increase that can be attributed to the use of nitrate of soda does not exceed 1 cwt. per acre.

FRENCH BEANS, 1900.



Crop, 4 tons 6 cwt. per acre.	Crop, 2 tons 13 cwt. per acre.
Manure per acre.	*Manure per acre.*
$12\frac{1}{2}$ tons London Dung,	$12\frac{1}{2}$ tons London Dung,
6 cwt. Superphosphate,	6 cwt. Superphosphate,
4 cwt. Kainit,	4 cwt. Kainit,
2 cwt. Nitrate of Soda	no Nitrate of Soda
(cost £7 5*s*. per acre).	(cost £6 5*s*. per acre).

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Careful observations, however, have been made on the quality of the Peas, by cooking the produce of each plot separately under the same conditions. The Peas manured with nitrate of soda have been, when cooked, distinctly softer, much sweeter, and of brighter colour than those grown without the use of nitrate. Since matters of flavour depend upon individual taste, we have, in this experiment, relied not merely on our own judgment but on that of four children, who tasted the Peas separately and without knowing anything about them ; and the children all independently expressed the same views as to the relative sweetness of the Peas.

Our experiments with Peas will also be continued.

Gooseberries.

Our Gooseberry plantation was made in 1898. A small crop was gathered in 1899, but this, although already showing the influence of the various systems of manuring, should scarcely be taken into account. We got a fairly good crop in 1900, and a very good crop in 1901. In 1902 the crop, like most fruit, was much affected by a late frost, which caused a large number of the berries to drop off prematurely.

The crop in 1902 was gathered and weighed green, but in 1900 and 1901 the berries were allowed to become ripe.

The experiments were conducted on the same lines as the majority of our vegetable experiments, and we believe that these are the first manurial trials which have been made on anything like an extensive scale on the growth of Gooseberries, each plot being of an area of one-fiftieth of an acre.

The results we have obtained up to the present are shown in the following table :—

GOOSEBERRIES (planted only in 1898).

Annual manuring per acre	Total weight of Gooseberries per acre			
	1900	1901	1902	Three years' average
	lbs.	lbs.	lbs.	lbs.
50 loads (25 tons) London Dung . . .	670	2,325	850	1,282
25 loads (12½ tons) London Dung . . .	550	975	250	592
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	450	1,050	250	583
Ditto, ditto (with Potash).	750	1,800	700	1,083
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	350	600	150	367
Ditto, ditto (with Potash).	450	1,300	500	750
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	800	1,950	400	1,050
Ditto, ditto (with Potash).	700	2,825	800	1,442
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	650	650	50	450
Ditto, ditto (with Potash).	725	1,900	250	958

In the first place it will be noticed that in every year the increase of the dung from 25 loads to 50 loads per acre gave a large increase in the yield of fruit. In two out of the three years, however, this increase was very considerably exceeded by the use, in place of the extra dung, of a liberal dressing of chemical fertilisers.

The use of chemical fertilisers alone (that is to say, without dung) has not on the average given such satisfactory results as when their use was combined with that of dung.

The average comparative effect of extra dung and of chemical fertilisers used in addition to a smaller quantity of dung is as follows:—

Average annual *increase* of fruit per acre, over three years, obtained by doubling 25 loads of Dung per acre . .	690 lbs.
Average annual *increase* of fruit per acre, over three years, obtained by supplementing 25 loads of Dung per acre with Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda per acre	850 lbs.
Average *excess* of fruit per acre in favour of chemical fertilisers as a supplement to light dunging . . .	160 lbs.

Perhaps, however, the most remarkable point brought out in the experiments is the great influence of potash salts on this crop. This remarkable influence of potash salts will be seen on every plot in each of the three years. Averaging the whole of the potash and non-potash plots, we get the following results:—

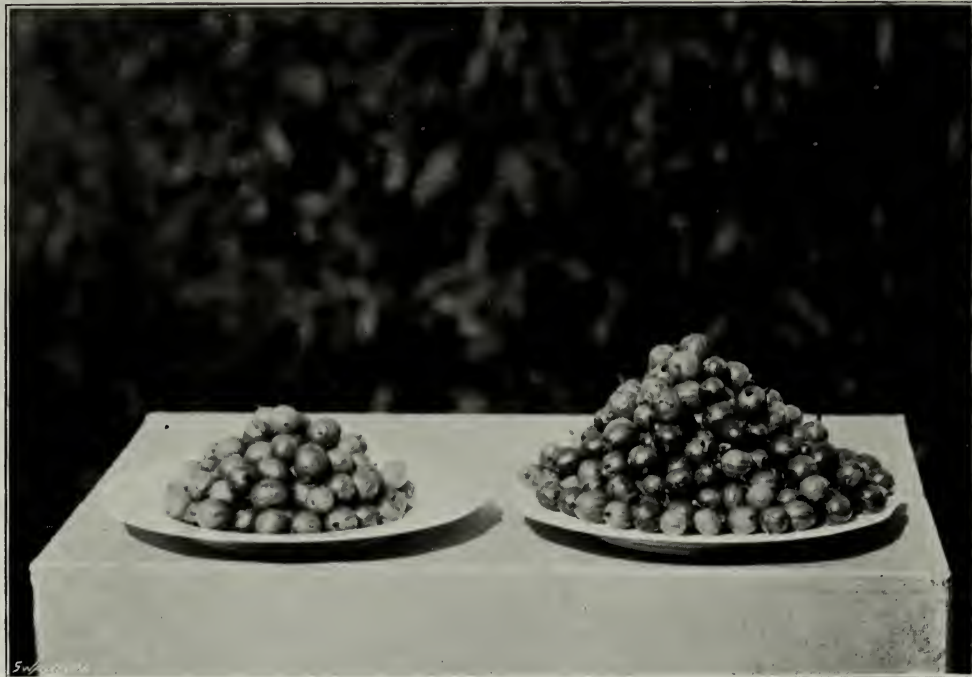
Average yield of fruit per acre over three years of four plots receiving Phosphates and Nitrate of Soda but no Potash Salts	817 lbs.
Average yield of fruit per acre over three years of four plots receiving Phosphates and Nitrate of Soda and also Potash Salts	1,411 lbs.
Average *increase* of fruit per acre due to the use of 1 cwt. Sulphate of Potash, costing 10*s*., per acre . . .	594 lbs.

In the case of the crops grown on the well-manured plots, it should be stated that the increase is not so much in the number of berries produced as in their size and fineness. For instance, it was found in one trial that a pound of fruit grown on the plot manured with 25 loads of dung per acre contained 128 Gooseberries; while a pound of the fruit grown with a dressing of dung supplemented with phosphates, potash salts, and nitrate of soda, averaged only 84 Gooseberries; the individual berries, therefore, being on the average half as large again in virtue of the extra manuring.

Currants (Black and Red).

Our plantations of Currants bore first in 1900, but the plants were too immature and the crop altogether too small to be worth recording. In 1902 the Currants, both Black and Red, were completely cut up by frost and not worth picking. In 1901, however, we gathered fair crops, considering the extreme youth of the plantation. The following are the results. Each full plot is one-fiftieth of an acre in area.

GOOSEBERRIES, 1901 (third year after Planting).



Crop, 1,037 lb. per acre.
Annual manure per acre.
$12\frac{1}{2}$ tons London Dung

(cost £5 per acre).

Crop, 2,150 lb. per acre.
Annual manure per acre.
No Dung,
4 cwt. Superphosphate,
1 cwt. Sulphate of Potash,
4 cwt. Nitrate of Soda

(cost £3 per acre).

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CURRANTS, 1901 (planted only in 1898).

Annual manuring per acre	Weight of fruit per acre	
	Black Currants	Red Currants
	lbs.	lbs.
50 loads (25 tons) London Dung	337	312
25 loads ($12\frac{1}{2}$ tons) London Dung	312	350
25 loads Dung, Phosphates (no Potash), and 1 cwt. Nitrate of Soda	175	250
Ditto, ditto (with Potash)	275	300
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	225	350
Ditto, ditto (with Potash)	200	425
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	200	625
Ditto, ditto (with Potash)	275	450
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	300	300
Ditto, ditto (with Potash)	300	500

In the case of the Black Currants, slightly the best result was given by the heavily dunged plot. The plot, however, which received no dung at all, but only a liberal dressing of chemical fertilisers, was not much behind it. The combination of dung with chemical fertilisers, as far as Black Currants were concerned in this particular year, did no good.

With Red Currants, however, the case was very different. The most heavily dunged plot has given a smaller yield than the lightly dunged plot, while the addition of chemical fertilisers consisting of phosphates, potash salts, and nitrate of soda has produced a very large increase. The best yield of all was obtained on the most heavily dressed chemically manured plot, on which no dung at all was used.

In three out of the four series of plots on which chemical dressings were used, the influence of potash on the yield of Red Currants seems to have been considerable.

The above results are merely given for what they may be worth. It is altogether premature to draw conclusions from such small crops.

Victoria Plums.

We laid down a plantation of Victoria Plums in 1898, on our general manuring scheme, each plot being one-fiftieth of an acre in area. The trees are, of course, still very young and small, but during the last three years—namely, 1900 to 1902—we have gathered and weighed such fruit as has been produced.

The crop of 1902 was, like most fruit in the neighbourhood, very badly cut up by frost, and irregularities due to such causes as this, and to the immaturity of the trees, make it altogether premature to attach any precise signification to the results; but, as far as we have gone, it will be seen, from the figures given in the following table, that the least satisfactory plot of all has been the heavily dunged plot.

VICTORIA PLUMS.

Annual manuring per acre	Average annual weight of Plums per acre over three years (1900 to 1902)
	lbs.
50 loads (25 tons) London Dung	92
25 loads (12½ tons) London Dung	245
25 loads Dung, Phosphates (no Potash), and 1 cwt. of Nitrate of Soda	125
Ditto, ditto (with Potash)	237
25 loads Dung, Phosphates (no Potash), and 2 cwt. Nitrate of Soda	163
Ditto, ditto (with Potash)	192
25 loads Dung, Phosphates (no Potash), and 4 cwt. Nitrate of Soda	429
Ditto, ditto (with Potash)	331
No Dung; Phosphates (no Potash) and 4 cwt. Nitrate of Soda	298
Ditto, ditto (with Potash)	327

The influence of the use of potash salts in 1900 was very uniformly favourable throughout the series of plots; but the general irregularity of the crop in the subsequent seasons has been such that this good effect does not come out very uniformly in the foregoing averages.

Raspberries.

Our plantation of Raspberries has yielded no results yet, owing to the failure of many of the canes originally planted, which necessitated a replanting of all the beds.

Strawberries.

We made a plantation of 'President' Strawberries in the year 1894. These were cropped for six seasons before the plants were considered worn out.

The plots were manured according to our usual plan, and the following table shows the average yield of fruit per acre obtained from the various plots over six years :—

STRAWBERRIES ('President').

Annual manuring per acre	Annual cost of manure per acre			Average annual yield of Strawberries per acre over six years (1895 to 1900 inclusive)
	£	s.	d.	lbs.
50 loads (25 tons) London Dung	10	0	0	3,416
25 loads (12½ tons) London Dung	5	0	0	4,704
25 loads Dung, Phosphates, and 1 cwt. Nitrate of Soda	6	5	0	4,592
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda	6	15	0	5,040
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda	7	15	0	4,088
No Dung; Phosphates and 4 cwt. Nitrate of Soda	2	15	0	3,052

It would appear from this set of experiments as though Strawberries did not require very heavy manuring. The lighter dressing of dung has given a persistently better yield than the heavy dressing; and the quantity of fruit yielded by a light dressing of dung has, on the average, not been increased to any considerable extent by the addition of chemical fertilisers. Where the chemical manuring has been unduly heavy, indeed, the crop has diminished. Altogether the best results were given by a light dressing of dung supplemented by phosphates and 2 cwt. of nitrate of soda per acre.

The use of chemical fertilisers, however, appears to have the great advantage of producing earlier maturity, a point to which we shall return again presently.

In 1897 we made another plantation, this time of 'Paxton' Strawberries, and these we cropped for five years. The plants were practically worn out, however, in the fifth year—1902; and, moreover, their fruiting was very much interfered with by frost. We therefore eliminate this year's crop from our record of the results obtained from this plantation, and in the following table give the average of the four full crops grown from 1898 to 1901.

STRAWBERRIES ('Paxton').

Annual manuring per acre	Annual cost of manure per acre			Average annual yield of Strawberries per acre over four years (1898 to 1901 inclusive)
	£	s.	d.	lbs.
50 loads (25 tons) London Dung . . .	10	0	0	3,248
25 loads ($12\frac{1}{2}$ tons) London Dung . . .	5	0	0	2,940
25 loads Dung, Phosphates, and 1 cwt. Nitrate of Soda	6	5	0	3,024
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda	6	15	0	2,240
25 loads Dung, Phosphates, and 4 cwt. Nitrate of Soda	7	15	0	2,492
No Dung; Phosphates and 4 cwt. Nitrate of Soda	2	15	0	2,324

Although this variety ('Paxton') is a very favourite one, it has not done by any means so well in our stiff soil as the 'President' variety.

On this plantation the heavier manuring with dung gave rather better results than the lighter dressing, but no material addition to the total weight of the crop has accrued from the use of chemical fertilisers. But, as in the case of the 'President' plantation, we have found that the use of chemical fertilisers conduces to earliness.

It will have been noticed that, in giving the results of both sets of experiments, the potash plots have been omitted. The 'President' Strawberries during the first two years were manured with potash salts in the same way as most of our other crops; but in every case the potash plots were so markedly inferior in yield, and the development of the plants appeared to be so unsatisfactory as compared with that of the plants on the non-potash plots, that we resolved to withhold potash salts in future.

Although we thus discontinued the use of potash, the plants on the plots which had previously been dressed with potash salts continued to grow inferior crops until the plantation was exhausted.

For the 'Paxton' plantation no potash was directly applied, but the plant was grown on plots which had been previously manured with potash for other crops. The ground, however, had of course been thoroughly dug and cultivated between the last application of potash and the planting of the Strawberries, and in this case no appreciable deleterious effect was found on the plots that had received potash.

We made, however, in 1898 another plantation of Strawberries (variety 'Royal Sovereign'), for the special purpose of further testing the question of the effect of potash salts. This plantation consisted of two plots only, both manured with 25 loads of London dung per acre, with phosphates (6 cwt. superphosphate per acre in 1899 and 10 cwt. basic slag in 1900), and with 2 cwt. of nitrate of soda per acre. One plot received in addition 1 cwt. of sulphate of potash per acre, and the other none. We gathered crops from this plantation in 1899 and in 1900, after which the plots became irregular and the plant was grubbed. The results were as follows :—

STRAWBERRIES ('Royal Sovereign').

Annual manuring per acre	Average annual yield of Strawberries per acre over two seasons (1899 and 1900)
	lbs.
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda (*without Potash*)	3,304
25 loads Dung, Phosphates, and 2 cwt. Nitrate of Soda (*with Potash*)	2,884

Not only was the crop in both years distinctly smaller where sulphate of potash was applied, but it was also appreciably later.

On the whole our experience leads us at present to recommend for Strawberries a moderate dressing—not more than 25 loads ($12\frac{1}{2}$ tons) per acre—of London dung, together with a good dressing of phosphates and an early dressing of 2 cwt. of nitrate of soda per acre.

We have already referred to the question of *earliness*. It is to be remembered that this is a very important factor in the valuation of the Strawberry crop. It is, indeed, of much greater moment than total weight, since the market value of the fruit is very much greater at the beginning than at the end of the very short Strawberry season, the price per pound diminishing rapidly as the fruit becomes more abundant. We have found that the dressing we recommend gives, on the average, not only the best crop but also the *earliest* crop; and the average increase in crop obtained by the use of such a chemical dressing as that above mentioned, in addition to a light dressing of dung, represents a much greater increase in the money value of the fruit yielded than is indicated by its mere total weight. A striking instance of this may be given from the record of our crop of 'President' Strawberries in the year 1898, one of the heaviest Strawberry years of recent times. In that year the plot dressed only with light dung gave the enormous crop of 4 tons 4 cwt. per acre. When this dressing was supplemented by chemical fertilisers including 2 cwt. of nitrate of soda per acre, the total crop was increased only to the extent of 3 cwt., being 4 tons 7 cwt. per acre. But in the first few days of picking we gathered from the chemically manured plot *nearly 700 lbs. more fruit* per acre than from the dunged plot; and during this time the market value of the Strawberries per pound was at least *twice* that of the fruit picked during the succeeding days. This is a matter of very vital importance to a large grower.

Apples.

In the winter of 1900–1901 we planted an experimental Apple orchard, an acre in extent. This orchard is divided into six plots, each of which contains a number of varieties of Apple trees. All the varieties are represented on each of the six plots, an equal number of trees having been planted of each variety.

The plan of manuring followed in the other fruit experiments has been adopted and is being carried out year by year.

Although some of the young trees are bearing very promisingly, they are, of course, too immature to give any experimental value to the relative weights of Apples gathered.

Kentish Cob-nuts.

These experiments, as well as those on Damsons, have been carried out on the fruit farm of our friend and neighbour, Mr. Godwin, of East Peckham.

One portion of the plantation is manured in alternate years with 15 cwt. of wool waste per acre, this being the customary mode of manuring practised in this neighbourhood for nuts for many years. During the experimental period of six years this plot has been three times thus dressed with wool waste, one plot has been left wholly unmanured, and four other plots have received dressings of phosphates and potash salts with and without various quantities of nitrate of soda; while on one plot the potash salts have been omitted, phosphates and nitrate of soda only being applied.

Although the mode of manuring distinctly affects the growth and appearance of the trees, it has not, on the average of the six seasons, produced any very great effect on the actual quantity of nuts yielded per acre.

The results are shown in the following table:—

KENTISH COB-NUTS.

Annual manuring per acre	Average annual yield of Cob-nuts per acre over six seasons (1897 to 1902)
	cwt.
Unmanured since 1896	7
15 cwt. Wool Waste in alternate years	6½
Phosphates and Potash Salts only	6¾
Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda	7
Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda	7½
Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda	7
Phosphates (without Potash Salts) and 2 cwt. Nitrate of Soda	6¾

It will be seen that the greatest average weight of nuts was obtained on the plot receiving a dressing of phosphates and potash salts with 2 cwt. of nitrate of soda per acre.

Where potash has been omitted the average crop has not been so good, and the same thing is observed where nitrate of soda has been omitted.

A more important point, however, than quantity, affecting the market value of Kentish Cob-nuts, is the length of the "beard" or cupule (the calyx-like envelope of the nut). For some reason or other, nuts with a fine "beard" realise a much better market price than others, even though the nuts within may be of the same size. Mr. Godwin has found that the nuts from the plots manured with phosphates, potash salts, and nitrate of soda have realised in the market as much as 5*s*. per cwt. more than nuts grown merely with wool waste.

Our experiments up to the present do not afford any precise information as to what is the most remunerative quantity of nitrate of soda to employ, in conjunction with phosphates and potash salts, for this crop.

Damsons.

The Damsons are grown on precisely the same plan of manuring as the Cob-nuts, and in the same field. This crop is, unhappily, subject to many influences, both general and local, which interfere sadly with its regularity from the experimental point of view. Some of the trees are nearer than others to a hedge, which in certain directions of the wind affords some protection from frost, and this in some critical seasons may largely affect the yield of the favoured trees. Then, again, the birds are great enemies of experiments on fruit, since they will capriciously select some particular trees for attack, while leaving others more or less alone. Then, again, the crop differs enormously in different seasons. For instance, in 1897 our yield averaged about 50 "sieves" per acre; in 1898 over 400 "sieves"; in 1899 about 30 "sieves"; and in 1900 as much as 600 "sieves" per acre. A "sieve," it should be mentioned, is the market weight of 56 lbs.

The season of 1900 was indeed so prolific a one with regard to Damsons that the greater part of the crop in many Damson orchards was left unpicked and allowed to fall and manure the ground. Our friend Mr. Godwin left the greater part of his Damsons unpicked, and, although most of our experimental plots were carefully picked in order to obtain our records, by some misunderstanding the wool waste plot was left unpicked, thus making it impossible to include its results in our four years' average. Its three years' average is, however, given in the table which follows.

In 1901 the crop partially failed; and in 1902, owing to a late and severe frost, there were no Damsons at all to gather. The results indicate on the average a great advantage from the use of nitrate of soda in conjunction with phosphates and potash salts; but, owing to the more or less chance influences to which a crop like this is exposed, a longer experience is necessary before we can form an opinion as to what is on the whole the most favourable quantity of nitrate to use.

DAMSONS.

Annual manuring per acre	Average annual yield of Damsons per acre	
	Three years' average	Four years' average
	"Sieves" of 56 lbs.	"Sieves" of 56 lbs.
Unmanured since 1896	178	244
15 cwt. Wool Waste in alternate years	177	—
Phosphates and Potash Salts only	104	213
Phosphates, Potash Salts, and 1 cwt. Nitrate of Soda	155	304
Phosphates, Potash Salts, and 2 cwt. Nitrate of Soda	187	295
Phosphates, Potash Salts, and 4 cwt. Nitrate of Soda	197	288
Phosphates (without Potash Salts) and 2 cwt. Nitrate of Soda	165	308

It may be observed that, both for the Damsons and for the nuts, the phosphatic dressings used were :—

In 1897, 8 cwt. Superphosphate per acre.
In 1898, 6 cwt. Superphosphate per acre.
In 1899, 6 cwt. Superphosphate per acre.
In 1900, 9 cwt. Basic Slag per acre.
In 1901, 6 cwt. Superphosphate per acre.
In 1902, 6 cwt. Superphosphate per acre.

Hops.

We have an acre of experimental Hops in which we have now carried on systematic experiments during eight seasons ; but, as the record of these is agricultural rather than horticultural, the results are published elsewhere. We shall, however, be glad to send copies of our Hop records to any reader who may be interested in the matter if he will write to either of us.

Conclusion.

We may add that Mr. Shrivell, on our joint behalf, will be pleased, during the growing season, to see by appointment and to show over the experimental plots any of our readers who may feel disposed to pay him a visit. His postal address is "Thompson's Farm, Golden Green, Tonbridge" ; and for the information of intending visitors we may mention that the village of Golden Green is near Hadlow, and about five miles by road from Tonbridge Junction station on the South Eastern Railway.

AMERICAN HYBRID CONFERENCE.

The International Plant-Breeding Conference which took place at New York in the autumn of 1902 was a remarkable success. It will be remembered that the first conference especially devoted to the subject of plant-breeding was held in London in 1898 at the invitation of the Royal Horticultural Society. Many who attended on that occasion felt that the interests of plant-breeders might be greatly promoted if similar conferences were periodically held in various countries, and the American delegates, headed by Professor Webber, expressed the hope that the next conference might assemble in the United States.

The suggestion then made took formal shape in 1901, when the newly founded Horticultural Society of New York decided to inaugurate the first year of its existence by inviting those interested in practical plant-breeding to assemble at New York in September 1902.

The Conference was held under the presidency of Mr. James Wood, of Mount Kisco, N.Y., and was attended by about eighty members. It is well known that State-equipped research in plant-breeding has been organised in the United States on a scale far exceeding anything attempted in Europe, and the gathering was therefore an exceptionally interesting one. Among the representatives of the State Experiment Stations were men from every climate of the Union. Nebraska, Texas, Kansas, California, Michigan, Wisconsin, Missouri, Minnesota, South Dakota, and Indiana were all represented, but naturally the majority of the members were residents of the Eastern States. The Agricultural Department of Washington sent a strong contingent, though Professor Webber, who is perhaps the best known member of the Washington Staff, was unfortunately prevented from attending.

Owing to the great distance, comparatively few foreigners could be present. The Royal Horticultural Society deputed Mr. W. Bateson, F.R.S., V.M.H., Mr. G. Nicholson, V.M.H., and Capt. C. C. Hurst as its representatives, but the last-named delegate was at the last moment detained at home. Dr. Morris, C.M.G., of Barbados, and Mr. W. Fawcett, of Jamaica, represented the West Indian school of plant-breeding, and Dr. W. Saunders, Director of Agricultural Stations, and especially of the Central Experimental Farm, Ottawa, with Messrs. C. E. Saunders, Hutt, Zavitz, and Macoun, of Ontario, attended on behalf of the Canadian stations.

The papers were throughout of a strictly professional character, and it was evident that the audience was keenly interested in the subjects discussed. To those who are accustomed to the sometimes apathetic reception which such communications may receive in London, the close attention of the New York meeting and the animated discussions which frequently followed the papers were most stimulating. No account of the proceedings which failed to take note of this characteristic of the meeting would be complete. Those who came did not do so out of compliment or sense of duty, but strictly with a view to business.

The following was the official programme, which was gone through in the order given, though, owing to the shortness of the time available, several papers had to be taken as read:

1. "Practical Aspects of the New Discoveries in Heredity," W. Bateson, Cambridge University, England.
2. "Notes on New Hybrids," John H. Wilson, St. Andrews University, Scotland.
3. "Recent Experiments in Hybridisation," C. C. Hurst, England.
4. "Selection *versus* Hybridism," F. W. Burbidge, Dublin, Ireland.
5. "Artificial Atavism," Hugo de Vries, Director, Botanical Gardens, Amsterdam.
6. "Some Conclusions," Max Leichtlin, Baden-Baden, Austria.
7. "Suggestions for the Classification of Hybrids," R. I. Lynch, Curator, Botanic Garden, Cambridge, England.
8. "Some Laws of Plant-Breeding," Herbert J. Webber, in charge of Plant-Breeding Laboratory, U. S. Department of Agriculture.
9. "Breeding for Intrinsic Qualities," W. M. Hays, Agriculturist, State Experiment Station, St. Anthony Park, Minn.
10. "On Variation in Plants," J. P. Norton, Plant-Breeding Laboratory, U. S. Department of Agriculture.
11. "Principles of Plant-Breeding," Luther Burbank, Experimentalist, Santa Rosa, Cal.
12. "On the Breeding of Disease-Resistant Varieties," W. A. Orton, Assistant Pathologist, U. S. Department of Agriculture.
13. "Evolution under Domestication," O. F. Cook, Botanist in charge of Tropical Agriculture, U. S. Department of Agriculture.
14. "Individual Prepotency," Will W. Tracy, Detroit, Mich.
15. "Cytological Aspects of Hybrids," W. A. Cannon, Columbia University, New York City.
16. "Correlation between different Parts of the Plant in Form, Colour and other Characteristics" (illustrated by specimens), S. A. Beach, Horticulturist, New York State Experiment Station, Geneva, N. Y.
17. "Some Possibilities," C. L. Allen, New York.
18. "Fertile Hybrids of Teosinte and Maize," John W. Harshberger, University of Pennsylvania.
19. "Bud Variation in the Strawberry Plant," R. M. Kellogg, Three Rivers, Mich.
20. "A Study of Grape Pollen, and what the Results indicate," N. O. Booth, Assistant Horticulturist, N. Y. State Experiment Station.
21. "Cross Fertilisation of the Sugar-cane," D. Morris, C.M.G., Imperial Commissioner of Agriculture for the West Indies, Barbados.
22. "The Improvement of Corn by Breeding," C. P. Hartley, Plant-Breeding Laboratory, U. S. Department of Agriculture.
23. "Improvement of Crops for Arid Regions and Alkali Soils," Thomas H. Kearney, in charge of Alkali Investigations, U. S. Department of Agriculture.
24. "Improvement of Oats by Breeding," J. B. Norton, Plant-Breeding Laboratory, U. S. Department of Agriculture.
25. "A Medley of Pumpkins," L. H. Bailey, Horticulturist, Cornell University, Ithaca, N.Y.
26. "Improvement of Roses by Bud Selection," L. C. Corbett, Horticulturist, U.S. Department of Agriculture.
27. "Improvement of Cotton by Breeding," Herbert J. Webber, in charge of Plant-Breeding Laboratory, U. S. Department of Agriculture.
28. "Practical Points from the Breeding of Strawberries and Bush Fruits," F. W. Card, Horticulturist, State Experiment Station, Kingston, R. I.
29. "Advantages of Conjoint Selection and Hybridisation and Limits of Usefulness in Hybridisation among Grapes," T. V. Munson, Nurseryman, Denison, Texas.

30. "Hand Pollination of Orchard Fruits," H. C. Price, Horticulturist, State College, Ames, Iowa.
31. "Wine Ferments," W. B. Alwood, Mycologist, &c., Polytechnic Institute, Blacksburg, Va.
32. "Crossing Species of *Salix*," S. W. Fletcher, Horticulturist, Experiment Station, Pullman, Washington.
33. "Hybridising Gladiolus Species" (illustrated), W. van Fleet, Little Silver, N. J.
34. "Notes on Breeding Hardy Apples," J. Craig, Ithaca, N. Y.
35. "The Everbearing Strawberry," Ph. de Vilmorin, Paris.
36. "Breeding of Native North-Western Fruits," N. E. Hansen, Horticulturist, State Experiment Station, Brookings, S. D.
37. "The Musk-Melon," F. W. Rane, Horticulturist, State Experiment Station, Durham, N. H.
38. "Study of the Variations in the Second Generation of *Berberis* Hybrids," C. E. Saunders, Ottawa, Can.
39. "Results in the Breeding of Species of *Ricinus*." E. Mead Wilcox, Biologist Alabama Polytechnic Institute, Auburn, Ala.
40. "On Orchid Hybrids" (illustrated by specimens of the parents and progeny), Oakes Ames, Ames Botanical Laboratory, North Easton, Mass.
41. "Hybrid Beans," R. A. Emerson, Horticulturist, Agricultural Experiment Station, University of Nebraska, Lincoln, Neb.
42. "Hybrid Plums," F. A. Waugh, Horticulturist, Hatch Experiment Station, Amherst, Mass.
43. "Cross Breeding of Cinchonas," H. H. Rusby, Botanist, College of Pharmacy, New York.
44. "Breeding Florists' Flowers," (a) E. G. Hill, Richmond, Ind.; (b) C. W. Ward, Queens, L. I., N. Y.; (c) A. Wintzer, West Grove, Pa.
45. "Cereal Breeding in Kansas," H. F. Roberts, Botanist, State College, Manhattan Kansas.
46. "Results of Hybridisation and Plant-Breeding in Canada" (illustrated by specimens), William Saunders, Director of the Central Experimental Farm, Ottawa, Canada.
47. "Notes on Plant-Breeding in California," E. J. Wickson, Horticulturist, Agricultural Experiment Station, University of California.
48. "Plant-Breeding in New Jersey" (illustrated by specimens), B. D. Halsted, Professor of Botany in Rutgers College, New Brunswick, N. J.
49. "The Wild Hybrids of the North American Flora" (illustrated by specimens of the parents and progeny), David George, Museum Aid, New York Botanical Garden.
50. "Plant-Breeding Work in Germany," J. C. Whitten, Horticulturist, University of Missouri, Columbia, Mo.
51. "Hybrids and Diseases," L. H. Pammel, Botanist, State College, Ames, Iowa.

In the first paper Mr. W. Bateson gave a brief account of the discoveries in heredity due to Mendel, showing how these discoveries may assist the breeder in his efforts to obtain and perpetuate pure strains of desirable forms. A paper by Capt. C. C. Hurst on the same subject followed, and in the subsequent papers and discussions the significance of the Mendelian principles naturally was a prominent topic of debate. It was especially interesting to learn that Professor Spillman, of the Department of Agriculture, had independently discovered the regularity of the segregation occurring in the offspring of cross-breds.* He had been led to this discovery by his extensive series of experiments on Wheats. Unfortunately he had not prepared a paper for the Conference, but those who had an

* See Bull. 115, Off. Exp. Sta. U.S. Dept. Agric. p. 88.

opportunity of seeing his photographs could form some idea of the great interest of the work.

Professor de Vries communicated an account of his *Antirrhinum* experiments, since published in the *Mutationstheorie*, vol. ii.

Mr. R. I. Lynch, of Cambridge, sent practical suggestions as to nomenclature of hybrids, and a committee was appointed to consider this and cognate questions.

Professor Willet Hays, who will be remembered as an active delegate to the London Conference, described the Minnesota experiments and gave useful advice to plant-breeders on a variety of topics connected with their art.

It was much regretted that Mr. Luther Burbank, whose achievements in breeding are now famous, could not attend to read his paper (since published in the *Gardeners' Chronicle*). The foreign delegates had greatly hoped to make the acquaintance of this pioneer in the economic branch of the subject.

The paper of Mr. Orton, of the Washington Station, recorded some remarkable successes in raising a disease-resisting variety of Cotton. In large plantings of Cotton where nearly every plant succumbed to the Cotton-wilt disease, a few plants remained standing. By saving the seed of these a race was immediately produced by one selection only, capable of withstanding the disease. It was understood that the commercial qualities of this immune strain are satisfactory, and great results are hoped for from the work. To the naturalist the very striking photographs shown by Mr. Orton were most suggestive.

A preliminary communication was made by Dr. Cannon, of Columbia University, indicating the way in which he is disposed to think the Mendelian principles are in accord with the facts observed by the American school of cytologists. This is a subject of exceptional importance at the present moment, when the relation of Mendelian segregation of characters and differentiation of germ-cells to the visible phenomena of cell-division is a question of far-reaching interest. The solution of this part of the problem of heredity is eagerly awaited by both zoologists and botanists, and the announcement even of a possible interpretation is an event.

Professor Beach, the head of the plant-breeding section of the Geneva Station of the State of New York, showed a fine series of photographs illustrating a practical problem of great magnitude. How may the breeder, of Grapes for example (a special subject of the Geneva work), tell by inspection of his multitude of seedlings which are worth growing to maturity? By the nature of the case he can only grow comparatively few. Is there, then, any correlation between characters visible in the seedlings and the qualities wanted in a serviceable vine? The question can of course only be settled by elaborate research and recording, and it is to be feared that the answer will, as Professor Beach anticipates, be frequently negative. Nevertheless indications of such correlation had been met with in the Peach, large leaves indicating large fruits. Several colour correlations had been noticed, White Raspberries having paler foliage and stems, white-fleshed Peaches also having paler leaves, &c.

Some valuable notes on the variations in the Strawberry obtained by selection of runners were read by Mr. Kellogg, who has had wide experience of the subject. The details and photographs in illustration should certainly be published, as this particular field is one but little explored.

Mr. Booth gave an account of some very practical experiences on the length of time the pollen of various Grapes will keep good, and in the discussion others related their experience on the same subject in various species. The matter is one of great importance to the breeder, and a record of the many experiments communicated to the meeting would be of value. It appeared that great difference of opinion existed, and it is evident that diversity of conditions has a material influence.

It is understood that the Department of Agriculture is instituting systematic experiments in order to determine the best methods of preserving pollen of different species and varieties.

Professor Norton described the beginning which the Washington school has made in Oat-breeding, from which hereafter it is likely that such results as Dr. Saunders has accomplished for Canadian Oats may ensue.

A very interesting description of the progress made in Sugar-cane breeding was read by Dr. Morris, C.M.G., of Barbados. The work has been watched with a special attention in this country, and, as is well known, much is expected from the West Indian experiments. Dr. Morris illustrated his paper by a fine set of Canes, specially brought to New York for the purpose. Several new seedlings have been raised and distributed to planters, and strict tests are being applied to these novelties grown on a commercial scale.

Professor Bailey of Cornell, whose books are familiar to English readers, gave an entertaining account of experiments made to determine the laws of heredity and variation in Pumpkins and Squashes. The complexity of the result had been such that Professor Bailey told the Congress he had been led to one conclusion only, never to try again!

Among the practical papers one of the most important was that of Mr. Munson, who showed some of the results obtained in Grape-breeding, and the English representatives were enabled to form some conception of the magnitude of the undertaking and the value of the Grape crop in the States.

Dr. Hansen described what is being done in South Dakota towards producing fruit-trees suited to the peculiar conditions of that State, and in particular of the steps he is taking with a view to the production of a Plum which shall both endure the climate and be productive.

The paper on *Berberis* hybrids by Mr. C. E. Saunders bore on a subject which attracted much interest at the London Congress, when Capt. C. C. Hurst exhibited his remarkable series illustrating the second generation derived from a *Berberis* cross. We hope that Mr. Saunders will follow Capt. Hurst in the attempt to express his results in numerical form.

Dr. William Saunders, who has taken the leading part in creating the extensive governmental organisation for scientific agriculture in Canada, gave a summary of the long series of experiments made by the experiment stations under his direction. The value of this work is well known to English agriculturists especially through the success obtained by the Canadians in Oat-breeding. This, however, was only one of the many plants that have been successfully dealt with; though most of them, the Apple especially, having been improved with a view to the needs of Canada, are of course less suited to the English climate. The series of Apples and of Crab-Apples shown by Dr. Saunders was one of great interest to American fruit-growers.

A special evening meeting was arranged to enable the Conference to see the beautiful lantern slides illustrating the series of *Gladiolus* produced by Mr. van Fleet. These slides were probably unique of their kind, and were declared by competent judges to be the finest representations of flowers ever made for exhibition to a large audience. They were photographs made in the ordinary way, and then hand-painted by Mrs. van Fleet. The skill displayed in the work reached the highest degree of perfection; and, as faithful portraits of natural objects, these slides will have a permanent value to posterity. It was suggested that they should be preserved in some public collection as a record of the actual state of the flower at the present time.

Subsequently Mr. Ward exhibited a remarkable series of Carnations produced by himself. It was stated that this strain, ranging through most of the colour types known in Europe, has been evolved in America independently of the European Carnations for an indefinite period. The habit of the American plants differed considerably from that of our own. Mr. Ward has preserved a record of his crosses, and it is greatly to be wished that the details of his work may be published, many of the phenomena witnessed having a direct bearing on the problems of breeding, and illustrating the principles of heredity obtaining in the case of the Carnation.

The above notes, together with the list of papers, will give the readers of this JOURNAL some conception of the wide range of topics brought under the notice of the meeting. It is understood that the text of these papers will in most cases be published in a special volume, being the Report of the Conference.

An excursion was made to the New York Botanical Garden at Bronx Park, and here, on the walls of one of the rooms in the Museum building, were exhibited mounted specimens of "The Wild Hybrids of the North American Flora (illustrated by specimens of the parents and progeny)." Mr. David George, the author of the paper on this subject (No. 49 in the list), is a member of the staff of the New York Botanical Garden; probably his exhibit was the most comprehensive series of the natural hybrids of the flora of any country ever brought together. In one of the propagating-houses, too, were to be seen growing a whole series of Professor Hugo de Vries's mutations of *Œnothera*. A few words here on the New York Botanical Garden may not be out of place. It covers an area of about 250 acres, and exhibits considerable diversity in character. The River Bronx, which practically forms one of its boundaries, at one place flows through a beautiful ravine, the bank on one side forming the edge of a natural bit of forest which is to be retained untouched; here the Hemlock (*Tsuga canadensis*) is the prevailing tree. Glacier-striated rocks, pot-holes, &c., add greatly to the beauty and the picturesqueness of this portion. Higher up, the river widens out into a sort of marsh, which is being partially drained in order to find space for the collection of Willows and other water-loving trees, &c. The collection of herbaceous plants occupies beds in a broad glade, along which flows a stream of water in which are grown in taxonomic sequence the aquatic relatives of the plants to be found in the beds. The new Pinetum will fill the hillside between the Museum building and the great group of plant-houses. The Museum is Italian Renaissance in style, with a front of 308 ft., a height to the top of the dome of 110 ft., and is fireproof throughout. It is said to be the largest, most elegant, most satisfactorily illuminated, and, for its purpose, the best adapted of any similar edifice in the world. The windows on the main museum floors are of greater width, and about the same area as the intervening piers—this having been made a special feature of the design from its inception. Like the plant-houses, it is heated by steam from a power-house some distance from both. On the basement there is a lecture theatre to seat seven hundred persons, also spacious halls for special exhibits, flower-shows, &c. When necessary, these halls can be utilised for permanent museum space. The first floor is devoted to economic botany; the second to general museum, *i.e.* the cases contain types of all the families of plants from the most simple to the most complex. The third floor contains the library, herbarium, &c., and laboratories.

The great group of plant-houses covers about an acre of ground; all the different houses are connected with each other—the central house of the group being a hundred feet in diameter and eighty feet high, without any central pillars to interfere with the general view. This house, in which there is no staging, is devoted principally to Palms, of which a considerable number of good specimens of genera and species—many of them fruiting annually—have been got together. From the Palm-house on each side a number of other houses diverge; these are furnished with slate staging. As a rule the plants of a certain family are grown together; the *Myrtaceæ*, *Proteaceæ*, &c. occupy each its share of shelving, and are thus easily compared and studied. Taken all round the plants were very well grown, and some, not a few, remarkable specimens were noted. Considering the short time that has elapsed since the houses were built, the conditions and extent of the collections were wonderful.

A recent development in the work of the New York Botanical Garden is worthy of special mention: *i.e.* the founding of the Desert Botanical Laboratory of the Carnegie Institution. Dr. Cannon, one of the Aids, has been appointed resident Director, and Dr. D. T. Macdougal one of the two members of the Advisory Board. The Desert Botanical Laboratory has been founded for the thorough investigation of the physiological and morphological features of plants under the unusual conditions to be found in desert regions, with particular reference to the relations of the characteristic vegetation to water, light, temperature, and other special factors. North America contains more than a million square miles of territory known to the geologist, geographer, and botanist as desert. No similar inquiry to that above outlined having yet been instituted in any part of the world, it is unnecessary to insist on its great importance.

A second excursion was a trip by steamboat up the Hudson to Poughkeepsie. Here carriages were provided which took the members of the Hybrid Conference to the house and gardens of Mr. Newbold, who entertained the party at lunch. After paying due honours to Mr. Newbold's beautiful garden the carriages were again requisitioned and a visit was paid to Hyde Park, the residence of Mr. F. W. Vanderbilt. Hyde Park was formerly the seat of Dr. Hosack, the founder of the Elgin Botanic Garden at the beginning of last century. It was celebrated as one of the finest specimens of the modern style of landscape gardening in America. "Nature has, indeed, done much for this place, as the grounds are finely varied, beautifully watered by a lively stream, and the views are inexpressibly striking from the neighbourhood of the house itself, including as they do the noble Hudson for sixty miles in its course through rich valleys and bold mountains." So far Downing in his *Landscape Gardening.* What was true when Downing wrote is equally true at the present moment. The grounds were laid out by Parmentier, and both the native trees and those imported from Europe during the last century are well cared for. The consequence is that here are to be found remarkably fine specimens of exotic trees rarely seen in the northern United States. Mrs. Vanderbilt kindly acted as guide.

The organisation of the Congress was in the hands of a committee consisting of Dr. Britton, Chairman, Messrs. Hexamer, Siebrecht, and de Wolf, with Mr. Leonard Barron as Secretary. The arrangements, which must have been very difficult to make, were admirably carried out, and, partly owing to the foresight of the Committee and partly to the tact of the President, the lengthy programme was disposed of in the time allotted.

A special word of praise is due to Mr. L. Barron, who discharged the secretarial duties with great discretion and ability, and the success of the meeting was in great measure attributable to his faculty for organisation. Readers of this Journal will be interested to know that Mr. L. Barron is a son of Mr. A. F. Barron, V.M.H., who was so long Superintendent at the gardens of the Society at Chiswick.

In addition to the work of the Conference, Mr. Bateson paid a visit to the Agricultural Station of the State of New York at Geneva, one of the best equipped in the United States. The Director, Professor Jordan, and Professor Beach, the head of the Plant-breeding Section, furnished many interesting details with regard to the organisation and scope of the work. Some idea of the magnitude of the undertaking may be gathered from the fact that the yearly income appropriated to this station alone is about $70,000 a year, the original cost of buildings and other permanent installations being provided in addition. The object of these stations, of which at least one now exists in each State in the Union, is to provide agriculturists of the State with information on every point of scientific or practical interest relating to their industry, and secondly to investigate special agricultural problems, chemical, botanical, zoological, having an economic bearing. As regards plant-breeding, the most important experiments in progress at Geneva are directed to the improvement of Grapes, Apples, and Rubi. Extensive series of these orders were to be seen, and Professor Beach demonstrated the many interesting points they illustrated.

Subsequently a visit was paid to the Department of Agriculture at Washington, where Professor Galloway, chief of the Plant-breeding Section, showed the laboratories and temporary offices of the Department. The relation of this central bureau to the experiment stations endowed by the several States was explained, and figures were given showing the extent and resources of the organisation. Throughout, the primary object is economic, and the advancement of the science of breeding, though an inseparable consequence of such experiments, cannot be admitted as an aim in itself.

The work of raising or introducing new breeds and varieties, with us a field for private enterprise almost entirely, is, together with the distribution of information, a main purpose of these State-endowed stations. That vast opportunities for investigating the problems of breeding are thus continually provided will be evident, and great consequences are anticipated. Nevertheless the scientific work of these institutions is admittedly hampered by the incessant need for economic successes, and some doubt may be felt whether the two objects, scientific and practical, can be effectively combined on so large a scale.

However that may be, the sight of this huge institution, in touch with posts of observation scattered throughout the various climates of the States, with incalculable possibilities, cannot fail to make a profound impression on an English visitor. Englishmen are well aware that an immense organisation for experimental agriculture has been built up in the United States, but probably few who have not visited some of the institutions themselves can have any real idea of the significance of the effort which is being made.

Another vital part of the agricultural organisation is the existence, in all the chief agricultural States, of technical schools, State-endowed, for the training of the young men who intend to pursue agriculture. These colleges are generally in association with the experiment-stations, and have a complete equipment for technical education in farming. The teaching provided is free to all residents in the State, and it is declared that the consequences of this system, in the improvement of farm-management and in the general position of the farmers, are already evident, at all events in the Western States.

Whether the slender provision that we at home have made for the attainment of these objects can be regarded as adequate or safe, in the interests of the community, is a thought very often present to the mind of the visitor from England.

ROSE-GROWING NEAR LARGE TOWNS.

By H. E. Molyneux, F.R.H.S.

Read before the Horticultural Club, December 9, 1902.

It is a matter of general comment that amongst the many signs of progress this generation has made may be fairly reckoned an increased interest that its individual members have taken in things horticultural; and one looks for, and finds, this taking the form of an improved appearance in the gardens of our suburban householders. It does not do, I am afraid, to go any deeper than the surface, and to ask whether this improved appearance means an intelligent interest, or whether it is another form of what Carlyle calls, somewhat harshly, 'that terrible cancer,' for the sake of appearances. Jones has a respectable-looking garden because Smith has. But it is a fact, be the reason what it may, that there is this increased interest in the garden; and it is the aim, I take it, of the Royal Horticultural Society, and indirectly, therefore, of this Club, to endeavour to seize hold of this interest and to make it something more—a desire to cultivate flowers for their own sake. And what flower will be most likely to assist in this desired end? What flower is likely to be the most interesting from the ordinary individual's point of view? What flower will he be most proud of when he can grow it to perfection? Is there any doubt as to the correct answer to these questions? Surely it is the Rose; and what then are the reasons why we do not find the queen of flowers in every garden? Are the reasons reasonable? Are they tenable? Or are the difficulties of its culture too great? Is the rose such a flower that it can only be grown, like the orchid, under special conditions and at great cost? Is it a hopeless task to attempt its culture near large towns? These are a few of the queries that naturally arise, for one must admit that, taken as a whole, one finds but few roses in the gardens round London; and the attitude which that important person—important by reason of his numbers—the ordinary individual, adopts towards Rose-growing in his own garden is, I am afraid, one of two kinds: either he approaches the matter with extreme diffidence, so extreme that he is afraid to grow Roses at all, or if a few Roses are to be found, they are far from what they should be. An inquiry elicits the statement that he "has tried a few standards, they were a failure; it is quite useless to grow Roses in his garden—he is too near London—the soil is bad," and so on. Any reason is given except the correct one, that he is simply too lazy to take the slight amount of trouble necessary to find out how to grow Roses in his own particular garden.

What, then, is the correct way to go to work to grow Roses near large towns? To take the natural order of things, we have first of all the ground, then the plant, then the combination of the two—the planting, leading up to the pruning, cultivation, and so on to the flower. And I am inclined to think that in this natural order is to be found the order of their relative importance.

With reference to the ground and its preparation, the first question is the position of the bed or beds. One finds Roses planted anywhere ; if there is a vacant spot in an already crowded, worn-out shrubbery, a Rose is put in, a standard for preference—under trees, on shady borders, with no possibility of the sun ever reaching the plant, anywhere and everywhere. This will not do. At the same time there are few aspects that some Rose will not grow in, if other essentials have been attended to. But the queen of flowers deserves kinder treatment than this. Let her have the best, and in proportion as you give it her so will be your reward. A site should be chosen which the morning sun can reach, protected from the north and east; but there must be no coddling ; let there be as free a circulation of air as possible. The centre of the suburban garden is often occupied by a poor attempt at a lawn; here, in all probability, will be found the best site for your bed or beds ; and if, instead of two paths, one on each side of the garden, with narrow borders against the fences, a path, winding if possible, were taken down the centre of the garden and the old paths thrown into the herbaceous borders, making them of decent width, Roses or Rose beds could be made each side of the centre path, and under these circumstances success would be more frequent, I am sure, than it now is.

Having chosen the site, the next matter that claims attention is the proper preparation of the same, and here not a little depends on your subsoil. If you are favoured with a loamy soil, little preparation is necessary, and as you get away from this soil to clay, gravel, or chalk, so will the necessity for more preparation increase. With gravel and chalk and kindred subsoils there need be no difficulty about drainage ; in all probability you will have too much of it—but with heavy clay, drainage is essential. The soil such as you are likely to find in an ordinary garden in the suburbs of London is very poor stuff, and where you cannot go to the expense of entirely removing it to the depth of 18 inches to 2 feet and putting in the best loam or top spit that you can get, you must improve it as far as possible. Light soils can be improved by the addition of heavier, even with clay and plenty of rotten cow manure. Heavy soils are much benefited by the addition of sifted road sweepings, a grand material that is too often wasted.

Let your beds be thoroughly prepared two months, if possible, before your Roses are planted, and take care that they are well rammed so that the plant can be planted firmly in the soil.

Next, as to the selection of trees. This is far more important now than formerly, for this reason, that within the last decade has been introduced a type of Rose that has entirely altered the character of the Rose-tree as considered from the point of view of an effective garden plant, and I feel sure that it is to the non appreciation of this new fact that Roses are not grown in the numbers that they should be.

Far be it from me to cry down the old Roses and the grand flowers that can be gathered from the hybrid perpetuals ; but even their keenest admirers—and I would desire to be counted among such—must admit that they are not the most suitable Roses to grow from the point of view of a man who wants a Rose from June to October to wear in his buttonhole or put upon his table.

Such a Rose can now be had for the asking, and it is to be found among the hybrid teas, the hardier of the teas, and the China and hybrid classes.

We pass on to the planting of the Roses selected, but first let me add a word of caution. Do not purchase Roses by auction at sale-rooms. It is foolish. The craze of cheapness is at the bottom of it, no doubt; but Roses that have been dragged up, kept sometimes a week out of the soil, their roots damaged and open to and unprotected from all the four winds of heaven, how can they be expected to do well? But they are expected, and if they behave in a manner contrary to the expectations Rose-growing is given up. No; go to a good nurseryman—there are plenty of them, and the Rose is now grown in such quantities that it has found its fair market price. Get the best article, and you will get the best results.

A few words as to the planting. This should be done as early as possible in November. The distance between your plants will depend somewhat on the growth of the variety, but I am an advocate of close planting. When I look at a bed of Roses, I like to see Roses and not soil in between each plant. Eighteen inches between each plant is ample for dwarfs, and about two feet six inches to three feet for standards. I always mark the position of each Rose before I plant it.

During the process of planting keep all cold winds or sun away from the roots by means of straw or matting. The hole for the reception of the roots should not be less than twelve inches square, sometimes it should be more. I dip the roots in tepid water immediately before planting and, with my left hand holding the plant, separate the roots and spread them out evenly; cover them with some fine soil, taking care that the point of junction between the stock and the Rose is not more than an inch below the surface of the bed. Then cover with more soil and manure, again taking care none of the latter comes into contact with the roots; and tread down well. It is difficult to plant too firmly. A good mulch of rotten manure will follow, and your work is complete. So much for planting dwarfs; for standards the procedure is similar, except that they must be staked and the roots kept nearer the surface.

I believe in earthing up all dwarfs for winter protection. This in the case of beds must not be done with the soil of the beds, or else the roots will suffer. I use road sweepings, obtained at a cost of 1*s.* a load, with a gift to the carter thrown in.

In a paper of this character it is impossible to touch upon the question of pruning. It is important, no doubt—of far greater importance than is usually supposed. I have visions of standards trimmed up, like the privet, with shears!

One or two hints peculiar to the subject and I have done. In my own garden we are troubled with the soots and dirty deposits of the atmosphere, and I am sure it is a mistake to allow these to accumulate, especially in the growing season of the year; so every morning I go round my Rose trees with a sprayer and thoroughly spray the tops of every tree. A couple of pailfuls of water is sufficient for 250 Roses, so it is not so long a job or so tiresome as many might suppose. If once or twice a week in May some "Abol" or quassia-solution insecticide is added to the water, even before the green fly puts in an appearance, one is likely to be but little troubled with it; this is more effective if the water is warm—prevention is far better than cure. Fifteen minutes with the hoe is better than half an hour's watering—that is, such watering as a suburban gardener gives—a damping of the surface with water often direct from the main, hard and cold. The surface of the beds should be kept loose. A careful search for the maggot must follow. The carrying out of simple rules on the lines laid down in this paper will enable anyone to have Roses in London as good as any that come from the country, and what more can one say? I could write at length on the pleasure of Rose-growing, but to every one who grows Roses there is no flower better worth the growing, no flower better worth the picking, and no flower better worth the giving away, and no Roses are as beautiful as the ones you have grown yourself.

Alphabetical List of Roses found suitable for Garden Decoration near Large Towns.

Those marked with an asterisk are recommended as climbers for walls and arches.

*Aimée Vibert, N.
Anna Olivier, T.
Antoine Rivoire, H.T.
*Ards Rover, H.P.
Augustine Guinoisseau, H.T.
*Billiard et Barré, T.
Blanc Double de Coubert, R.
*Bouquet d'Or, T.
Briers Hybrid Sweet.
Capt. Hayward, H.P.
Caroline Testout, H.T.
Common Monthly, C.
*Crimson Rambler, C.P.
General Jacqueminot, H.P.
*Gloire de Dijon, T.
Gloire Lyonnaise, H.T.
Grace Darling, H.T.
Grüss an Teplitz, H.T.
Gustave Régis, H.T.
Hon. Ed. Gifford, T.
Killarney, H.T.
La France, H.T.
*Longworth Rambler, H.T.
Laurette Messimy, C.
*Macrantha, S.
Mad. Abel Châtenay, H.T.
*Mad. Alfred Carrière, H.N.
Mad. Cadeau Ramey, H.T.
Mad. Eugène Resal, C.
Mad. Hoste, T.
Mad. Jules Grolez, H.T.
Mad. Isaac Périère, B.
Maman Cochet, T.
Marquise Litta, H.T.
Marquise de Salisbury, H.T.
Mrs. John Laing, H.P.
Mrs. R. G. Sharman Crawford, H.P.
Perle d'Or, P.
Prince C. de Rohan, H.P.
Reine Olga de Wurtemburg, H.T.
Souvenir du Prés. Carnot, H.T.
Ulrich Brunner, H.P.
Visct. Folkestone, H.T.
*W. A. Richardson, N.
White Maman Cochet, T.

A

REPORT ON THE METEOROLOGICAL OBSERVATIONS MADE IN THE SOCIETY'S GARDENS AT CHISWICK IN 1902.

By Edward Mawley, Past-President R.Met.Soc.

There has been no change during the year in the position of any of the instruments, and the records have been taken regularly, as in the three previous years, by the observer, Mr. T. W. Turner, at 9 a.m. each day. After carefully checking the entries in the observation book and comparing all those which appeared in any way doubtful with similar observations made at three other meteorological stations in and near London, it was found necessary to alter only six of the entries. In eight cases the columns of figures had been incorrectly added up, and in four cases the means had been incorrectly calculated. In November I tested all the thermometers, and found them in good working order and reading correctly.

A Brief Monthly Summary of the Observations taken in the Society's Gardens at Chiswick in 1902.

January.—Very warm and very dry. Both the days and nights were, as a rule, about 4 degrees warmer than is seasonable. On the coldest night the thermometer on the grass showed 14 degrees of frost.

The rainfall was very light, being less than half the average quantity for the month.

Mean temperature of the air in shade	41°.6	
Highest ,, ,, ,, ...	53°.1	on the 10th
Lowest ,, ,, ,, ...	22°.2	,, 15th
Lowest ,, on the grass	18°.4	,, 15th

	At 1 ft. deep	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	41°.1	43°.0	45°.0
Highest ,, ,, ,, ...	45°.1	44°.8	45°.7
Lowest ,, ,, ,, ...	36°.4	41°.0	44°.0

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 85

Rain fell on 7 days to the total depth of ... ... 0·73 in.

(Equivalent to about 3½ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·20 in. on the 1st

February.—Very cold and very dry. Both the days and nights were, as a rule, about 4 degrees colder than is seasonable. On the coldest night the thermometer on the grass showed 22 degrees of frost.

The rainfall was very light, being more than half an inch below the average quantity for the month.

Mean temperature of the air in shade	35°.9	
Highest ,, ,, ,, ...	53°.6	on the 28th
Lowest ,, ,, ,, ...	14°.0	,, 16th
Lowest ,, on the grass	9°.9	,, 16th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	35°.9	38°.8	42°.5
Highest ,, ,, ,, ...	41°.9	41°.0	44°.3
Lowest ,, ,, ,, ...	33°.6	37°.3	41°.3

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 87

Rain fell on 11 days to the total depth of ... ... 0·92 in.

(Equivalent to about $4\frac{1}{2}$ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·29 in. on the 23rd

March.—Very warm and wet. Both the days and nights were, as a rule, about 3 degrees warmer than is seasonable. On the coldest night the thermometer on the grass showed 13 degrees of frost.

The rainfall was heavy, being nearly half an inch in excess of the average quantity for the month.

Mean temperature of the air in shade	44°.8	
Highest ,, ,, ,, ...	61°.5	on the 17th
Lowest ,, ,, ,, ...	28°.0	,, 7th
Lowest ,, on the grass	19°.4	,, 23rd

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	43°.3	43°.8	44°.1
Highest ,, ,, ,, ...	45°.9	45°.5	45°.2
Lowest ,, ,, ,, ...	39°.7	41°.8	42°.0

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 81

Rain fell on 12 days to the total depth of ... ... 1·79 in.

(Equivalent to about $8\frac{1}{2}$ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·51 in. on the 14th

April.—Seasonable in temperature and most exceptionally dry. Both the days and nights were, as a rule, of about average temperature. On the coldest night the thermometer on the grass showed 14 degrees of frost.

The rainfall was most exceptionally light, being only about one-third the average quantity for the month.

Mean temperature of the air in shade	47°.4	
Highest ,, ,, ,, ...	68°.0	on the 19th
Lowest ,, ,, ,, ...	29°.0	,, 7th
Lowest ,, on the grass	18°.4	,, 7th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	47°.3	47°.2	46°.5
Highest ,, ,, ,, ...	51°.8	50°.3	48°.7
Lowest ,, ,, ,, ...	42°.4	44°.3	45°.3

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 70

Rain fell on 11 days to the total depth of ... ... 0·49 in.

(Equivalent to about $2\frac{1}{2}$ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·08 in. on the 30th

May.—Very cold and wet. The days were, as a rule, about 4 degrees colder, and the nights about 2 degrees colder, than is seasonable. On the coldest night the thermometer on the grass showed 9 degrees of frost.

The rainfall was heavy, being nearly half an inch in excess of the average quantity for the month.

Mean temperature of the air in shade	49°.1		
Highest ,, ,, ,, ...	70°.0 on the 27th		
Lowest ,, ,, ,, ...	30°.0 ,, 14th		
Lowest ,, on the grass	22°.6 ,, 14th		
	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	50°.8	50°.2	49°.0
Highest ,, ,, ,, ...	58°.9	55°.3	51°.3
Lowest ,, ,, ,, ...	47°.3	48°.4	48°.4

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 70

Rain fell on as many as 23 days to the total depth of ... ... 2.35 in.

(Equivalent to about 11 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·45 in. on the 17th

June.—Seasonable in temperature and most exceptionally wet. The days were, as a rule, about 1 degree colder, and the nights about 1 degree warmer, than is seasonable. On the coldest night the thermometer on the grass showed 2 degrees of frost.

The rainfall was most exceptionally heavy, being more than double the average quantity for the month.

Mean temperature of the air in shade	58°.6		
Highest ,, ,, ,, ...	61°.0 on the 29th		
Lowest ,, ,, ,, ...	38°.2 ,, 10th		
Lowest ,, on the grass	29°.6 ,, 10th		
	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	58°.9	56°.8	53°.5
Highest ,, ,, ,, ...	64°.3	60°.4	55°.7
Lowest ,, ,, ,, ...	54°.5	54°.6	51°.5

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 69

Rain fell on 18 days to the total depth of ... ... 4·07 in.

(Equivalent to about 19 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 1·00 in. on the 13th

July.—Cold and very dry. The days were, as a rule, about 1 degree colder, and the nights about 2 degrees colder, than is seasonable. On the coldest night the thermometer on the grass fell to 34 degrees, or 2 degrees short of the freezing-point.

The rainfall was very light, being about three-quarters of an inch below the average quantity for the month.

Mean temperature of the air in shade	61°.2		
Highest ,, ,, ,, ...	84°.6 on the 14th		
Lowest ,, ,, ,, ...	41°.8 ,, 12th		
Lowest ,, on the grass	34°.5 ,, 3rd		
	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	61°.5	60°.2	57°.0
Highest ,, ,, ,, ...	65°.1	61°.8	57°.5
Lowest ,, ,, ,, ...	57°.9	58°.5	55°.9

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 67

Rain fell on 10 days to the total depth of ... ... 1·58 in.

(Equivalent to about 7½ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·52 in. on the 10th

August.—Cold and wet. The days were, as a rule, about 2 degrees colder, and the nights about 1 degree colder, than is seasonable. On the coldest night the thermometer on the grass fell to 36 degrees, or 4 degrees short of the freezing-point.

The rainfall was heavy, being more than half an inch in excess of the average quantity for the month.

Mean temperature of the air in shade	60°.3	
Highest ,, ,, ,, ...	78°.3	on the 29th
Lowest ,, ,, ,, ...	43°.2	,, 2nd
Lowest ,, on the grass	35°·7	,, 11th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	61°.3	60°.3	57°.9
Highest ,, ,, ,, ...	63°.5	61°.2	58°.4
Lowest ,, ,, ,, ...	58°.4	59°.1	57°.5

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 77

Rain fell on as many as 22 days to the total depth of ... ... 2·92 in.

(Equivalent to about 13½ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·86 in. on the 18th

September.—Seasonable in temperature and in rainfall. The days were, as a rule, of about average temperature, while the nights were about 1 degree colder than is seasonable. On the coldest night the thermometer on the grass showed 3 degrees of frost.

The rainfall was about seasonable, being less than a tenth of an inch in excess of the average quantity for the month.

Mean temperature of the air in shade	56°.8	
Highest ,, ,, ,, ...	76°.0	on the 4th
Lowest ,, ,, ,, ...	36°.3	,, 19th
Lowest ,, on the grass	29°.0	,, 1 th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	57°.8	58°.4	57°.6
Highest ,, ,, ,, ...	62°.4	61°.0	58°.4
Lowest ,, ,, ,, ...	53°.5	55°.6	56°.2

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 78

Rain fell on only 6 days to the total depth of ... ... 2·57 in.

(Equivalent to about 12 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 1·77 in. on the 11th

October.—Warm and very dry. The days were, as a rule, of about average temperature, while the nights were about 2 degrees warmer than is seasonable. On the coldest night the thermometer on the grass showed 8 degrees of frost.

The rainfall was very light, being not much more than half the average quantity for the month.

Mean temperature of the air in shade	50°.1	
Highest ,, ,, ,, ...	65°.2	on the 10th
Lowest ,, ,, ,, ...	33°.3	on the 19th and 31st
Lowest ,, on the grass	24°.4	on the 31st

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	51°.4	53°.1	54°.3
Highest ,, ,, ,, ...	54°.3	55°.3	56°.0
Lowest ,, ,, ,, ...	48°.0	51°.3	52°.8

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 84

Rain fell on 18 days to the total depth of ... ... 1·51 in.

(Equivalent to about 7 gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·36 in. on the 9th

November.—Warm and dry. The days were, as a rule, about 1 degree warmer, and the nights about 2 degrees warmer, than is seasonable. On the coldest night the thermometer on the grass showed 9 degrees of frost.

The rainfall was light, being about a quarter of an inch below the average quantity for the month.

Mean temperature of the air in shade	45°.2
Highest ,, ,, ,, ...	58°.7 on the 1st
Lowest ,, ,, ,, ...	29°.0 ,, 21st
Lowest ,, on the grass	23°.1 on the 13th and 17th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	45°.4	48°.2	50°.7
Highest ,, ,, ,, ...	50°.6	51°.0	52°.7
Lowest ,, ,, ,, ...	39°.2	44°.4	48°.5

Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 87

Rain fell on 15 days to the total depth of ... ... 1·82 in.

(Equivalent to about 8½ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·32 in. on the 28th

December.—Very warm and rather dry. The days were, as a rule, about 2 degrees warmer, and the nights about 4 degrees warmer, than is seasonable. On the coldest night the thermometer on the grass showed 17 degrees of frost.

The rainfall was rather light, being only about a tenth of an inch below the average quantity for the month.

Mean temperature of the air in shade	41°.5
Highest ,, ,, ,, ...	57°.2 on the 17th
Lowest ,, ,, ,, ...	25°.1 ,, 5th
Lowest ,, on the grass	15°.3 ,, 5th

	At 1 ft. deep.	At 2 ft. deep.	At 4 ft. deep.
Mean temperature of the soil at 9 a.m.	42°.0	44°.5	47°.0
Highest ,, ,, ,, ...	46°.2	47°.0	48°.7
Lowest ,, ,, ,, ...	36°.7	41°.5	46°.0

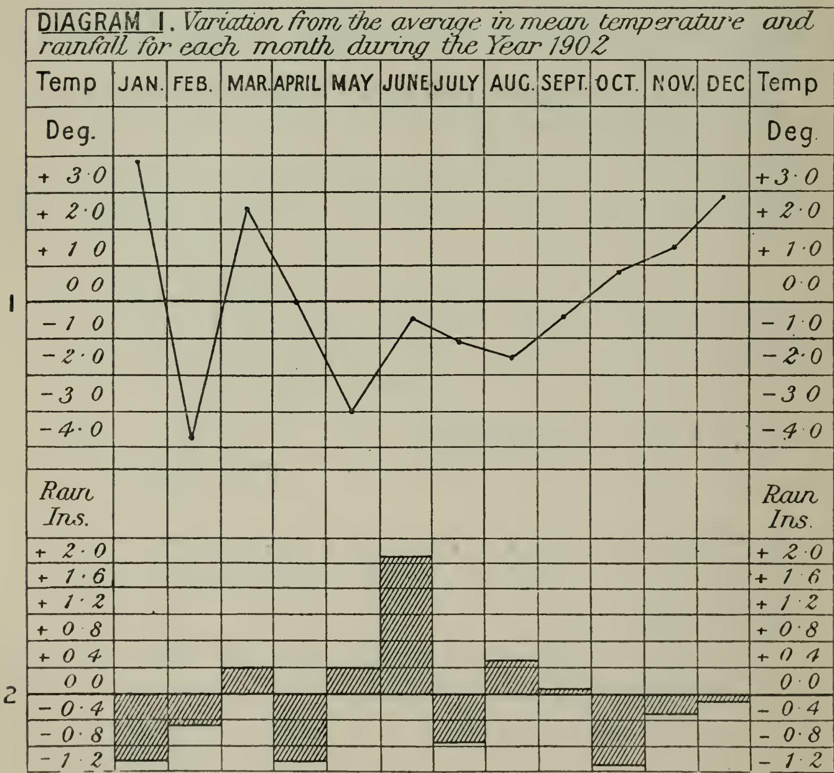
Mean relative humidity of the air at 9 a.m. (complete saturation being represented by 100) 85

Rain fell on 11 days to the total depth of ... ... 1·40 in.

(Equivalent to about 6½ gallons on each square yard of surface in the Gardens.)

Heaviest fall on any day ... ... 0·50 in. on the 17th

The Diagrams.—The averages with which the different mean monthly temperatures are compared in diagrams 1 and 2 are derived from the observations taken at Kew Observatory during the twenty-five years ending 1895. The actual averages for Kew have not been used, but the departures in mean temperature, &c., from the monthly means for 1902 at that Observatory have been applied to the Chiswick temperatures; and in this way very close approximations to the true monthly averages have been obtained. Mr. Glaisher's discussion of the Chiswick temperatures, 1826–69 (referred to in Vol. xxiii. page 391), was not available for this purpose, as it gives no maxima or minima temperatures. The rainfall averages used in diagram 1 are, however, those given by Mr. Glaisher for the forty-four years ending 1869 at Chiswick.



1. Average or seasonable Temperature. 2. Average or seasonable Rainfall.

Fig. 256.

Diagram 1.—This diagram (fig. 256) shows at a glance the general character of the weather of each month of the year as regards temperature and rainfall. For instance, it will be seen that between March and October, or during that part of the year when vegetable growth is most active, there did not occur a single unseasonably warm month; January and February were about equally exceptional as regards temperature, the former being as unseasonably warm as the latter was cold. Then as regards rainfall, it will be noticed that the only really wet month of the year was June, while January, February, April, and October were all unusually dry.

Diagram 2.—Here (fig. 257) the most noteworthy feature as affecting vegetation was the unusual coldness of the days in May, as compared

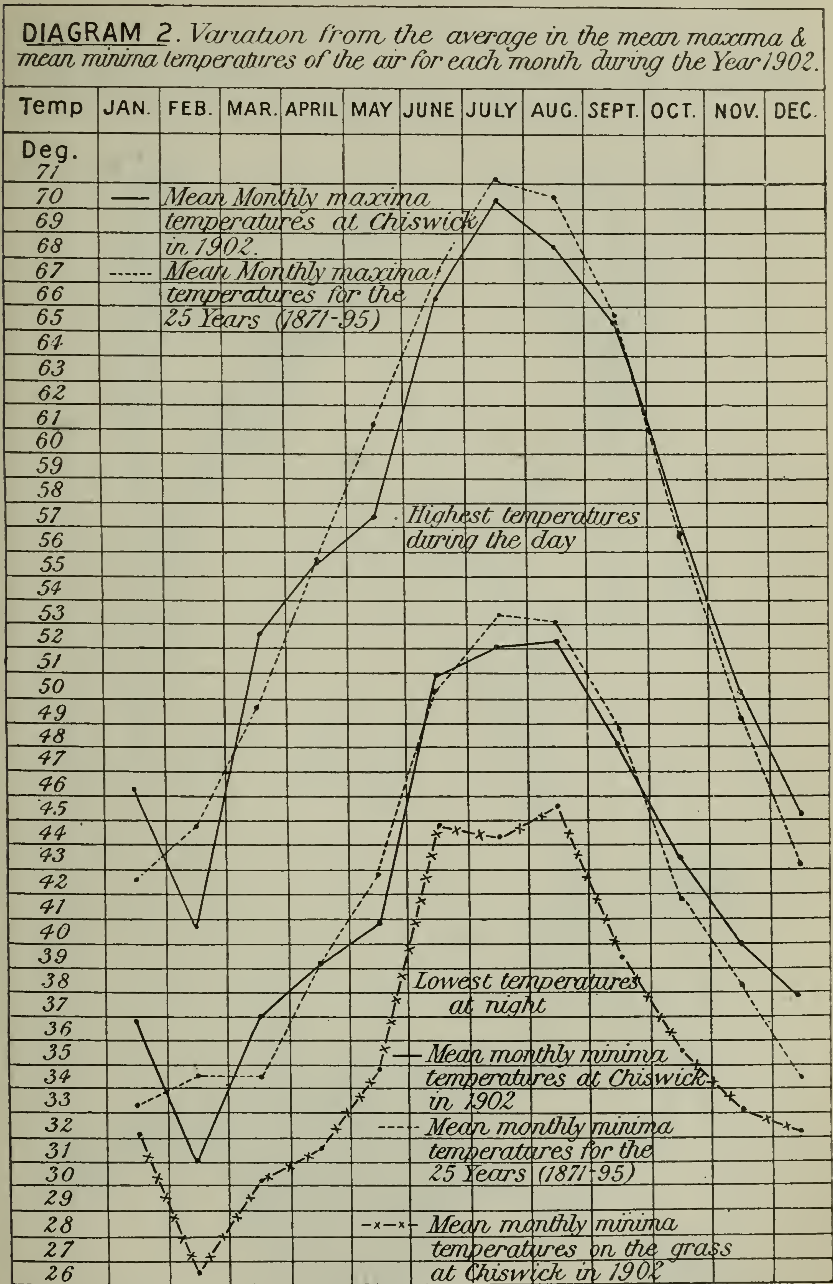


FIG. 257.

with the nights—which were, as a rule, only moderately cold. In January and February the departures from the average in temperature were the same during the daytime as at night. In December it was the high temperatures at night, rather than any unusual warmth during the daytime, which made this month such a very mild one.

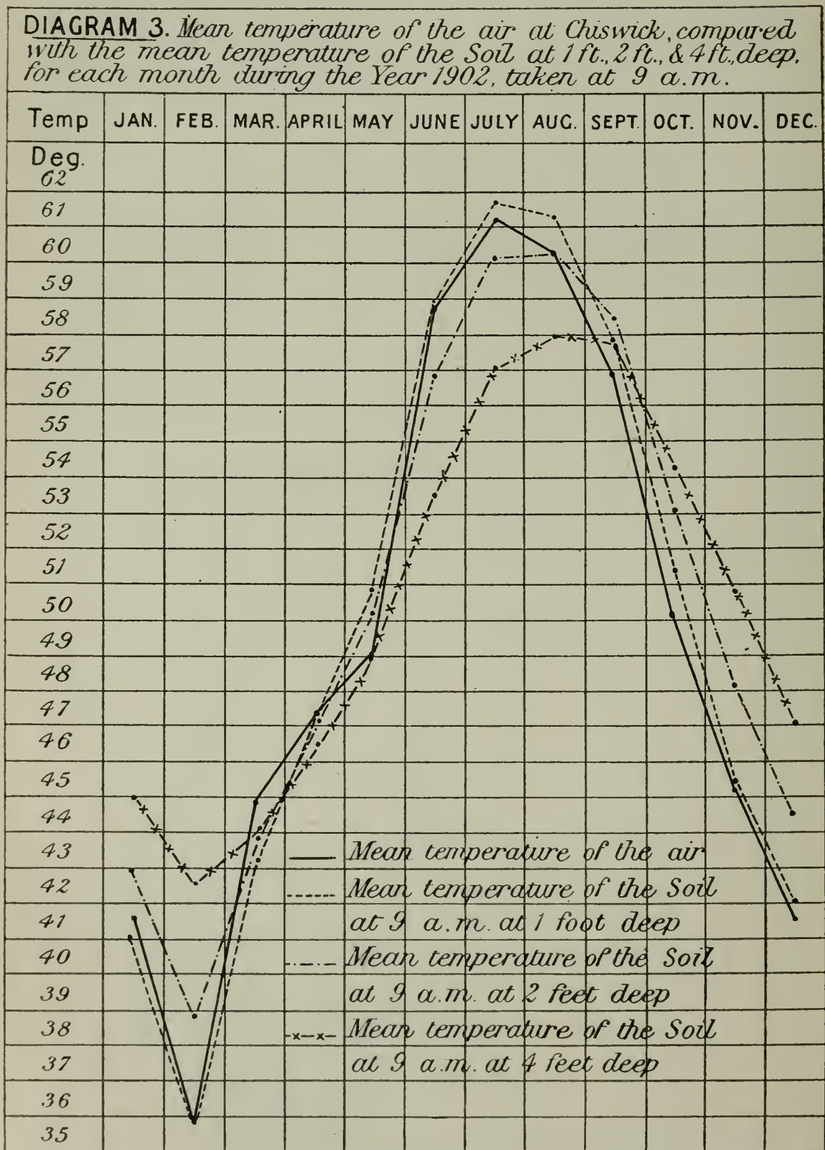
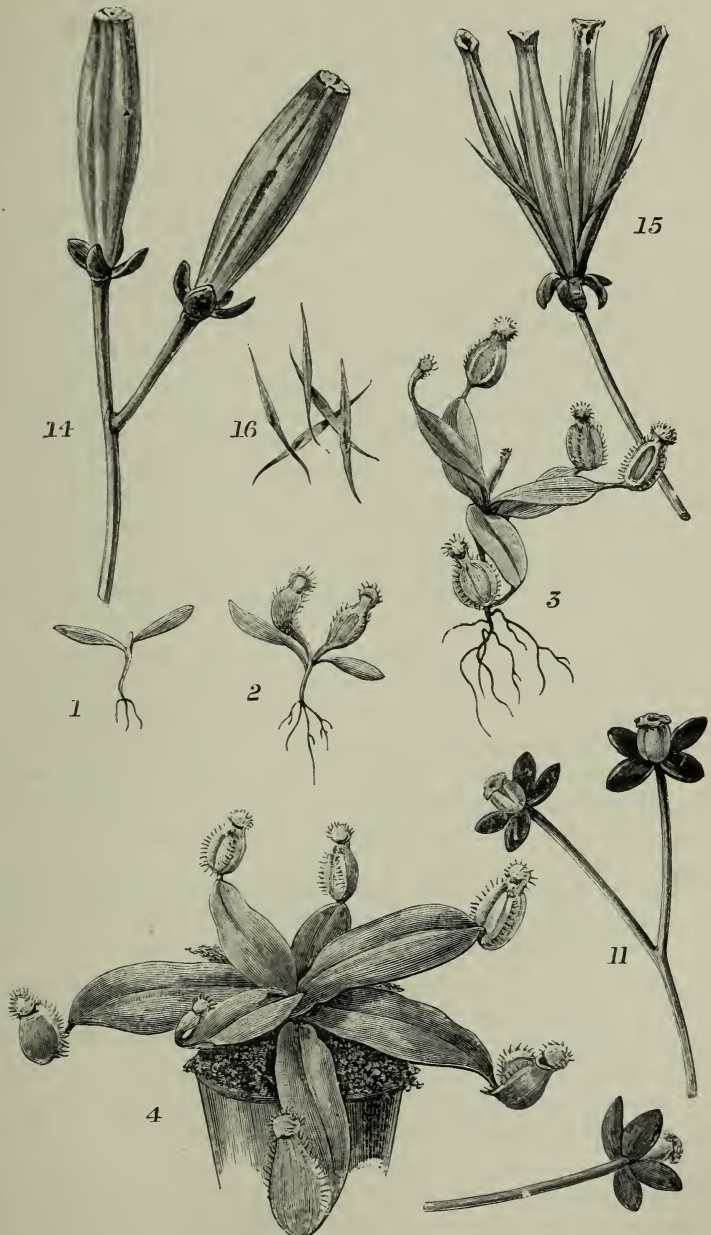


FIG. 258.

Diagram 3.—It will be noticed (fig. 258) that in the coldest month, February, the soil at four feet deep was, on an average, nearly 7 degrees warmer than the air; at two feet deep it was 3 degrees warmer than the air; but at one foot deep the soil and air were at the same temperature. In

May, the air temperature and that of the soil at four feet deep were the same, while at two feet and one foot deep the soil temperatures were, respectively, only 1 and 2 degrees warmer than the air. In the warmest month, July, the soil at four feet deep was 4 degrees colder than the air, but at two feet deep only 1 degree colder, and at one foot deep it was rather warmer than the air.



BOOKS RECEIVED.

"Nature Studies: Plant Life." By G. F. Scott-Elliot, M.A., B.Sc., &c. (Blackie, London.) 3*s.* 6*d.*

This book (which contains 340 pages, 43 illustrations, with a bibliography and index) is intended for all who take an intelligent interest in the world of plants, and especially for teachers and others engaged in giving nature study lessons. Technical terms are as far as possible avoided, but an attempt has been made to include as much of the more recent German work as bears upon the meaning of every detail in the structure of a plant. There is a short account of the Algæ and other Cryptogams, as well as a general history of the British flora and of the influence of man in modifying and altering the vegetation of Britain. The chapter on Woods explains how a wood is to be considered as an organism, with an assimilation system, absorption system, &c., composed of a whole series of plants, each of which has its own work to do for the good of the community. The book does not pretend to be a text-book of botany, but is designed to give suggestions by which a very great number of details are seen to fit into the general scheme of the plant's existence. Thus, in speaking of leaves, the author shows that to understand any leaf it is necessary to observe how it is protected against wind, how it competes with and perhaps overreaches other leaves, whether rain is absorbed, how it is mechanically supported, how it is protected in bud and against the attacks of insects and fungi. The examples are chiefly taken from very common and well-known plants.

There is a chapter on microbes, moulds, and yeasts, and a most interesting and detailed account is given of the work of bacteria in the soil. The chapter on defence gives many details regarding the animal and vegetable enemies of plants and the way in which they are guarded against. The book is too advanced to be placed in the hands of quite children, but every teacher of children will find it simply invaluable in preparing lessons and instructions on the plant life of nature.

"Report of the Secretary of Agriculture in relation to the Forests, Rivers, and Mountains of the Southern Appalachian Region." (Washington: Government Printing Office, 1902.)

The letter of transmittal by President Roosevelt clearly points out an intimate acquaintance with the forest conditions of the Southern Appalachian mountain region, and goes far in assuring us that the wholesale denudation of forest lands which has unfortunately been permitted in the past will now be carefully guarded against, and that steps to counteract some of the evils of wholesale and injudicious clearings are speedily to be taken in hand.

This elaborate work, with its seventy-eight nicely executed illustrations, may briefly be described as a complete history of the forests and forest conditions of this vast and valuable mountain region. Forest Preservation, Clearing and Agriculture, Evils of Lumbering, Dangers from Floods and Fire, and Aids to Natural Reproduction are all chapters of the greatest interest, though second only to the lucid description of the many and grave evils which have attended the injudicious removal of whole forests from these mountain regions.

Land erosions on the cleared slopes caused by wholesale cuttings are painfully evident, and an excellent illustration shows the steep lands that have been cleared, cultivated, abandoned, and ruined, all in a few years. The reports on geological formation, topography, and lists of trees and shrubs are all highly valuable, and reflect great credit on those to whom the management of these forest lands is entrusted. The work runs to over 200 pages, and, as before stated, the illustrations and maps very clearly convey what is included in the text.

"The Book of Pears and Plums." By Rev. E. Bartram, D.D. (Lane, London.) 2*s.* 6*d.*

A useful manual dealing with situation, soil, planting, stock, orchard trees, various forms of training, manures, varieties, pruning, insects, &c., and finally gives receipts for cooking. We commend the book in almost everything except its selection of varieties, and here we differ greatly from the author, *e.g.* if you can only plant three Pear trees he advises 'Fertility,' 'Pitmaston,' and Josephine.' We simply stare aghast at such a trio. Of course the selection of varieties is to some extent a matter of individual taste; but allowing as much as possible for that, we are still absolutely at a loss how to account for such a strange selection as this. We ask, where are 'Comice,' 'Beurré Hardy,' 'Louise Bonne,' 'Emile d'Heyst,' 'Beurré d'Anjou,' and 'Bon Chrétien'—of course for those who like its musky flavour?

"The Book of British Ferns." By Charles T. Druery, V.M.H., F.L.S., &c. (Newnes, London.) 3*s.* 6*d.*

A most thorough book, treating fully of all our native British Ferns and their innumerable varieties, and full of beautiful illustrations. The first part deals with the culture and propagation, the finding, planting, crossing, and hybridising of British Ferns in general. This is followed by detailed description of each genus and species and variety. So far the book may be said to be popularly written—as indeed it is—but the concluding part contains technical and scientific descriptions of the normal and various abnormal modes of reproduction which Ferns so curiously indulge in.

"The Book of Climbing Plants." By S. Arnott. (Lane, London.) 2*s.* 6*d.*

Shrubs which may conveniently be trained upon walls are also included, thus embracing such desirable subjects as *Magnolia*, *Azara*, *Ceanothus*, *Carpenteria*, *Choisya*, *Solanum jasminoides*, &c. It treats of climbing plants under Annuals, Hardy Deciduous, Hardy Evergreen, Under Glass, &c., and devotes separate chapters to the Clematis and the Rose. As a specimen of the good sense and judgment of the author we note with pleasure that he is not afraid to say out boldly, "The Ivy is undoubtedly the best and most useful of all hardy evergreen climbers." And so it is, and yet it is almost invariably despised and often torn down and rejected to make way for some far less beautiful and less hardy exotic plant. Were we planting to cover a house or walls with climbing plants, we should lay ourselves out to give up at least one-third of the wall space to Ivies, only using the flowering plants at intervals to give variety and to brighten up the whole. The only thing to care for is to see that the Ivy does not gradually usurp more than its fair share. Like many a spontaneously kind and generous disposition it requires occasional restraint and cutting back, and this it never minds.

"The Dahlia : its History and Cultivation." (Macmillan, London.) 1*s.*

A useful little manual of 120 pages suitable for any amateur who means to take up the growing of Dahlias as a speciality or hobby. The history and botany of the plant are first discoursed upon, then come chapters on its propagation and cultivation, followed by directions for exhibiting to the best advantage, and ending with selected lists for various purposes. May we enter a protest against the thin ragged things called Single Cactus Dahlias ? In our opinion they are undoubtedly a step in the wrong direction. As flowers of course they have some beauty—what flower has not ?—but as Dahlias their destination should be the rubbish heap, and not "my lady's garden."

"The Book of the Wild Garden." By S. W. Fitzherbert. (Lane, London.) 2*s.* 6*d.*

The author makes a much-needed point when he says that wild gardens do not mean gardens left to run into disorder. The wild garden properly understood should never give one the impression of untidiness, for Nature is never really untidy ; nor should it ever suggest an uncared-for garden or a garden gone to rack and ruin. It should consist in the natural growth of the particular soil and neighbourhood sparingly supplemented by the addition of a few of such native plants as are absent, or of hardy exotics which will add attractiveness to the view, and yet not look out of character with their surroundings. The great mistakes most frequently made with wild gardens are either on the one hand to imagine that there is an inherent beauty in a tangle of Briars, Brambles, and Nettles, or else to overdo the introduction of new plants, and so to swamp the natural growth and give the idea of at best but a mediocre garden much neglected. Whoever will follow the direction and advice of this excellent little manual will fall into neither of these errors.

"Gardening Year-book." (Collingridge, London.) 1*s.*

There is a great deal here for a shilling. First there is an almanack and short diary, then come directions for garden work under the headings of each month in the year. This is followed by a series of forms for entering memoranda of the dates of plants flowering, ripening, &c. ; and it concludes with short notes on various fruits and flowers, and how to treat and cultivate them, designed for amateurs, but suitable to many so-called gardeners also.

"The Book of the Strawberry." By Edwin Beckett. (Lane, London.) 2*s*. 6*d*.

Raspberries and Blackberries are also treated of. Full cultural directions are given both for outdoor growing and for forcing. The Alpines and the Perpetuals (as they are called) are also noticed. As regards the varieties to be grown we know of no fruit which varies so much on different soils; for example, 'Latest of All,' described as "one of the best late varieties," is, on our light soil, not only absolutely untrue to its name, but is in flavour positively nasty; and though we persevered with it for three seasons we had at last to entirely discard it, whereas we have tasted it excellent from heavy lands. Anyone wishing to grow Strawberries, and knowing nothing about them, should try various varieties one after another, only retaining such as suit the soil. 'Veitch's Perfection' is another example. It is absolutely perfect when you can get it, as we are told you can easily, on moderately heavy soils, but on a light sandy soil we had three long rows of it, and only gathered a dozen sizable fruits. Again, 'Countess,' which is on the light soil the finest-flavoured berry we have ever met with, is, we are told, in some soils comparatively worthless. We notice in the selection of varieties no mention is made of 'Queen of Denmark,' which, though perhaps small, is a thoroughly good doer and of excellent flavour, second only to 'Countess.' For private gardens 'Auguste Boisselot' should not be overlooked. It is too soft and tender to bear travelling, but where it can be gathered straight into the dessert-dish and taken at once into the house there is no berry more pleasant and refreshing to the palate. Strawberry growers will find great assistance from this work.

COMMONPLACE NOTES.

By the SECRETARY and SUPERINTENDENT.

BORDER FOR PEACH TREES.

FROM time to time we enter on these Notes—what to professional gardeners may seem very elementary questions—and we do so on the principle that what has been of use to one Fellow may very probably also be of use to others. Thus a Fellow writes inquiring for the names of "good early Peaches for forcing," and also for instruction "how to make a bed for them, the natural soil being boulder clay."

The best early Peaches for forcing are probably 'Amsden June,' 'Hales's Early,' 'Duchess of Cornwall,' and 'Condor.' Let no amateur be persuaded to have 'Alexander' or 'Waterloo' for forcing, although they are a week, possibly ten days, earlier than 'Hales's Early,' for they are difficult forcers, so inclined to throw their blossom buds before they open. It can be done by introducing them early and advancing the temperature very, very slowly and gradually; but it requires more care and skill and attention than any save quite a professional can give.

To make a bed or border take out all the soil to a depth of three feet, and at the bottom lay a good clean drain, with plenty of fall and a free outlet. This in such a soil is a *sine qua non*. Then lay in a depth of nine inches of coarse rough drainage, consisting of broken-up hard bricks or suchlike, and upon this place a layer of turf cut thick, with the grass downwards. Fill up with good fibrous loam, inclining rather to the heavy than to the light, such as the top spit of an old pasture, mixing a small barrowful of fine rubble or mortar or plaster rubbish with each cartload of loam. The loam should be comparatively dry when it is put in and should be trodden very firm, but *never tread wet soil.* No manure, either chemical or stable, should be used for two or three years at least.

EARLY FLOWERING BULBS ON BANKS.

In all gardens early flowers are most welcome, giving their bright shades of colour at a more or less dull season of the year; and there are many odd corners of the lawn and shrubbery, which are more or less neglected, which could be made one of the most attractive parts of the garden in early spring by planting Snowdrops, Crocuses, Scillas, Daffodils, &c. Again how well these bulbs thrive and blossom on sloping banks of grass, giving a long succession of flower, and brightening the appearance of the garden immensely! But although they answer so well on grassy slopes the most gorgeous effect we have ever seen was obtained by planting such bulbs amongst a groundwork of Ivy, where they had been established for years. And so contented were they with their position that the Crocus flowers almost hid the Ivy, and by the time Crocuses were over Daffodils were opening their buds. The Ivy must, of course, be kept cut close down every year, or it would get too dense and deep for the bulbs, and a light dressing of well-decayed manure or leaf soil should be given. This acts beneficially on both the bulbs and the Ivy, the latter making a beautiful mass of compact foliage immediately after the bulbs have done flowering, and is much more attractive all through the summer months than Ivy that is not cut so closely. However, whether the bulbs are planted on grassy slopes or amongst Ivy, anything like straight lines ought to be avoided; they look much better if all formality is absent, and simply growing naturally. The mixing of colour in Crocuses is a matter of taste, but our advice is to avoid "dotting," *i.e.* first planting one of one colour, and then one of another, and then of a third. Plant masses or clumps of one distinct colour, not, however, making the margins of each colour too rigidly defined, but letting them run into one another here and there, so as to produce a more natural effect. Some objection might be raised to the untidy look of grassy slopes if planted with bulbs. But as a rule the mowing of banks may be left some weeks later than the lawn without appearing untidy, and by that time the bulbs will have developed sufficiently to feel little or no ill-effect from the grass being cut.

Slow Growth.

It is very curious how slowly the appreciation of a privilege grows. In 1897 the Council arranged with Dr. Augustus Voelcker, M.A., one of the most distinguished horticultural and agricultural chemists of the day, a scheme by which Fellows of the Society could obtain advice at a considerable reduction in cost as to (1) the existing constituents of their soil; (2) what it would be advisable to add; (3) the quality of the chemical manures they purchase; and (4) what manures and in what quantity they should use. All this is set forth in the Society's "Book of Arrangements" at pages 26–33. In 1898 only one Fellow availed himself of this privilege; in 1899 eight did so; in 1900 eight again; in 1901 only six; in 1902 sixteen. It appears therefore as if Fellows were at last beginning to realise and appreciate one of the privileges attaching to their Fellowship.

Lawns.

Judging by the frequency of inquiry, the subject of the treatment of lawns is one of perennial difficulty. "How am I to treat a lawn very much impoverished by neglect? The soil is a light sand, and a few days' drought makes it terribly brown." We recommend treating the lawn three times in the year to a dressing of

1 oz. Nitrate of Soda 1 oz. Sulphate of Ammonia 2 oz. Bone Meal	} well mixed together

to every two square yards of lawn, the first dressing to be given in early April, the second in the middle of June, the third in the middle of August. Showery weather should be chosen for each application, and if it be not showery it must be watered in artificially. This will give the grass a fine deep colour, add to the thickness of the sward, and permanently enrich the soil.

If this should not succeed try

$$\left.\begin{array}{l}\text{1 oz. of Muriate of Potash}\\ \text{2 oz. of Superphosphate}\\ \text{1 oz. of Sulphate of Ammonia}\\ \quad\quad \textit{or}\text{ of Nitrate of Soda}\end{array}\right\}\text{ well mixed together}$$

and apply in the same way.

Trees and Shrubs for Damp Situations.

We are occasionally asked for the names of trees, shrubs, and plants for wet or damp situations, which are more or less an eyesore in the landscape. There is a great wealth of subjects that thrive exceedingly well in such positions, and instead of being unsightly the situation may be made one of the most beautiful parts of the grounds, or it may be made profitable by planting it with Alder (*Alnus glutinosa*), the wood of which is in good demand for clog-making and also, we believe, for gunpowder-making. A very ornamental tree for damp situations is the deciduous Cypress (*Taxodium distichum*), which retains its foliage until spring in wet positions. Again, all the Willows (*Salix*), both upright and pendulous varieties, are excellent for moist places. Elders (*Sambucus*) in variety, the Dogwoods (*Cornus*), Brambles (*Rubus*), Hydrangeas, and many other trees and shrubs succeed in moist positions. To these may be added Bamboos in great variety, which simply revel in such damp places, and are amongst the best plants that could be planted ; and what is not so well known as it should be is the fact that nearly all the varieties are perfectly hardy. Nor are they at all fastidious as to soil. Bog plants and aquatics are now so well known, and in such great variety, that these could be planted with good effect ; in fact, the choice is almost endless. To be able to properly enjoy all these plants it is advisable to have a raised walk through the place, which will always be dry under foot, with a rustic bridge over any very wet spot or stream.

New Vegetables.

It is said to be an Englishman's privilege to grumble, and one subject on which not a few of us exercise our birthright is in continual complaints that there are no new vegetables to eat ; and yet when something in this way is brought to our notice, if we do not happen to like it in the way it is first cooked and placed before us we put it on one side at once and say " worthless,'' or sometimes even " nasty,'' when the whole fault lies in the method of presentment and not in the vegetable itself.

Now we must confess to having had a deep-rooted insular prejudice against Yams and Sweet Potatos, but a few months ago, having been presented with a basket of each by Messrs. W. Pink & Sons, of Portsmouth, together with a few simple directions for cooking them, we decided to give them a fair trial, with the result that we have become enthusiastic as to the excellence of both Yams and Sweet Potatos *when they are properly prepared for table*, and we desire to share with others the pleasure we have experienced in the discovery. The one misfortune is that neither plant can be *successfully grown* in this country for table purposes; but as they both form one of the staple industries of our West Indian colonies every patriotic imperialist should rejoice to be able to help those long-suffering islands even in such a small thing as this.

Here is the account of the Yam (*Dioscorea Batatas*) and its varieties, given in the *Journal* of the Imperial Department of Agriculture for the West Indies:—

The "Yam," so familiar to all classes throughout the West Indies, is practically unknown in Great Britain. Beyond the comparatively small number of people who have visited the tropics, few have definite knowledge as to the nature of the plant or of the wholesome and palatable character of the food it provides.

Although grown throughout the tropics, it is in the West Indies that Yams are to be found at their best and in the greatest variety and abundance. During the time of the year they are in season they form a standard dish at the planter's table, in addition to being one of the staple foods of the estate labourer and, in fact, of all classes throughout the West Indies. The majority of visitors to the West Indies become, even in the course of a brief stay, very partial to the Yam.

For those who have not visited the tropics the general character of the Yam plant may perhaps be best described by saying that it closely resembles in habit the Black Bryony of English hedgerows. The plants are near relatives, and agree in their twining stems and shining heart-shaped leaves. Both, moreover, have an underground tuberous "root"; but whilst that of the Bryony is uneatable, the Yam "root" supplies man with one of the most wholesome vegetables the world affords.

The varieties of Yams are legion. Some are distinguished by the names of places whence they were first obtained, others by descriptive names, such as 'Horn Yam,' 'Snake Yam,' &c. Yams vary greatly in size and appearance. Usually they are covered by a deep brown skin, and their flesh is firm and of various shades of white, yellow, or in some few cases distinctly purple. Some are not more than 6 inches long and one pound or so in weight, whilst other varieties measure 3 or 4 feet in length, 6 or 9 inches in diameter, and weigh 30, 40, 50, or even 100 pounds.

Their cultivation is comparatively simple. The upper portion of a Yam, called the "Yam head," is put in the ground. It produces fresh leafy shoots, and the new Yams slowly form and mature beneath the ground. In Barbados the foliage is allowed to trail over the surface of the ground, whilst in Jamaica, Trinidad, &c. a stout stick is stuck in by each plant up which it climbs, so that a Yam patch somewhat resembles a miniature Hop field. The different varieties of Yams take varying periods to come to maturity. Some are quite ripe in five months, whilst others do not reach perfection for nine months or even a year.

The following hints, prepared by Mrs. J. R. Bovell, are published for cooking Yams and presenting them in an attractive form at table.

Roasted Yams.—Lay a Yam before the grates of the stove or in the oven, turning it occasionally until cooked. Scrape off the outer skin, cut into pieces or mash with butter, and serve hot.

[We have tried this without scraping off the skin, merely serving like baked Potatos, and they were very good, somewhat reminding one of shredded Cocoanut, only much softer in texture.—Ed.]

Baked Yams.—Pare a Yam, put it in the oven and bake until soft, take it out of the skin, mash with butter, put back into skin, cut in pieces, and serve hot.

Boiled Yams.—Pare a Yam, put it into boiling water, cook until tender; serve whole.

Yam Chips.—Pare and boil a Yam until tender, cut into chips, fry in boiling lard, and serve hot.

[We think these "chips" the most delicious thing of the kind we ever tasted—far better than any Potato-chips. We have sometimes boiled them as here directed and sometimes cut them into chips unboiled and cooked them entirely by the frying, and it is difficult to say which were the nicer.—Ed.]

Yam Rice.—Pare and boil a Yam until tender, press through a colander on to a hot dish, shake the colander lightly every few seconds, to cause the Yam to fall off in short grains like Rice; serve very hot.

[This is *excellent*—far superior to mashed Potatos.—Ed.]

[Sliced and fried Yam: We cut them into thin slices and fried them in boiling fat, and they were as crisp as glass and most delicious.—Ed.]

Yam Rissoles.—Pare, boil, and mash a Yam, add pepper and salt and, if liked, a little minced Parsley. Shape into rissoles, cover with egg and bread crumbs, and fry until a light brown.

Yam Border.—Pare, boil, and mash a fair-sized Yam, about two pounds in weight, add to it two tablespoonfuls butter, half a cup boiling milk, one tablespoonful salt, the yolks of two eggs well beaten; beat the mixture until very light. Butter a border mould, pack the Yam in it, and let it stand for eight minutes. Beat the whites of the eggs to a froth, add salt, turn out Yam, cover with the whites, and put in an oven to brown; take from oven and fill the centre with meat or fresh fish heated in a sauce.

Yam aux Choux.—One pound boiled Yam, one boiled cabbage, two tablespoonfuls cream, one ounce butter, with salt and pepper to taste.

Rub the Yam and Cabbage through a wire sieve, mix together with butter, cream, and seasoning; pile upon a dish and serve with fried croutons of bread around. Serve very hot.

Porcupine Yam.—Two pounds Yam, boil and mash with one egg and salt to taste; shape and roll in beaten egg and vermicelli; fry. Serve hot with parsley.

Yam Fritters.—Pare and boil half a pound of Yam until soft, beat ightly with a fork; beat the yolks of four and the whites of three eggs, add two tablespoonfuls of cream, two tablespoonfuls of wine, one dessert-spoonful of lemon-juice, and half a teaspoonful grated nutmeg. Beat all together until extremely light. Put plenty of lard into a frying-pan, drop a tablespoonful of the batter at a time into it, and fry the fritters a nice brown. Serve with wine sauce served separately, or only sprinkle powdered sugar over them.

Yam Pudding.—Half a pound Yam, two eggs, one lemon, two ounces butter, two ounces sugar. Pare and boil the Yam and rub it through a sieve while hot. Beat the butter and the Yam together and allow the whole to cool. Break the eggs and separate the yolks from the whites. Beat the yolks until light, add sugar, juice of lemon, the grated rind, and the Yam. Whisk the whites to a stiff froth and stir lightly in before baking. Put into a well-buttered dish and bake in a brisk oven for twenty minutes.

Yams en Brun.—Cut up one pound of Yam already boiled and fry a light brown, sprinkle thickly with chopped Parsley and Shallot or Mushroom, pepper, salt, and lime juice, and serve very hot.

The variety of Yam with which we made the above experiments was called the 'Lisbon Yam,' and came direct through Messrs. Pink from Barbados. It is of reasonable size, and is considered about the best for use in this country. The wholesale price is 15*s.* a barrel of about 120 lb., and the usual retail price is 2*d.* or 2½*d.* a lb. The "roots" are, in appearance, something like very fat Parsnips, with an external skin like that of a Potato.

The Sweet Potato, or Barbados Potato, as it is sometimes called (*Ipomœa Batatas*), belongs to the Convolvulus family, and is propagated from slips, cuttings, or pieces of the root, and in its leaves and purple flowers generally resembles our Convolvulus. They are said to have come originally from the East Indies, but are now cultivated extensively in all tropical and sub-tropical countries, but they will not bear an English winter. They thrive particularly well in all the West Indian colonies; but in the drier and well-drained islands, like Barbados, which has a porous coral soil, they are of a better quality than those grown in the heavy clay soils of British Guiana and Trinidad. In fact, so superior are the Potatos grown in Barbados to those grown in British Guiana and Trinidad that there is a considerable trade between the latter colonies and Barbados, amounting in 1900 to nearly £8,000.

They are rather difficult to keep after they are dug, and require to be stored in dry sand at a cool temperature. They are in season in this country from the end of September to the end of February, and are about the same price as Yams. They contain 32 per cent. of solid material, of which 16 parts are starch and 10 parts sugar. One must be prepared, therefore, for their being somewhat sweet; in fact, they remind one very closely of boiled or roasted Chestnuts, though they are a trifle sweeter, and have just a suspicion of a mixed flavour of rose and violet. They are highly nutritious, and form the staple food of the majority of the inhabitants of the West Indian Islands.

Here are some receipts for cooking them:—

Boiled.—Boil the Potatos in water *with their jackets on*, peel, and cut into slices before serving.

[Very good indeed. Like huge Chestnuts.—Ed.]

Roasted.—Lay them before the grates of the stove or in the oven, turning them occasionally until cooked. Scrape off the outer skin and cut into pieces or crush with butter and serve hot.

[Very floury and like sweet Chestnuts.—Ed.]

Broiled.—Potatos to be half boiled, the skin removed, and put into the oven, or before the fire, until done. They ought to be of a nice brown colour. Cut into pieces, serve hot.

Réchauffé of Cold Potatos.—Mash the Potatos until perfectly free from lumps, stir into every pound of Potato two tablespoonfuls flour, two ditto minced Onions, and 1 oz. butter; add sufficient milk to moisten them well, press the Potatos in a mould, turn out, and bake in a moderate oven until nicely brown.

Rissoles.—Boil and mash the Potatos, add pepper and salt, and, when liked, a little minced parsley. Shape the rissoles, cover them with egg and bread crumbs, and fry until a little brown.

Potato Pie.—One quart of Barbados Potatos boiled and mashed, three beaten eggs, three tablespoonfuls of sugar, one tablespoonful butter, half a nutmeg (grated), half a teaspoonful ground cinnamon, a little ground cloves, a little Lemon peel, and enough cream or milk to make the mixture of the constituency of batter. Make some rich pastry, line your dish with a part, pour in the mixture, and bake with a top crust.

We also tried them in the same way as the Yam Rice, and found it excellent, but of course sweet; but with saddle of mutton, for instance, we thought this an advantage. The "Rice" should not be put in the same plate as the mutton, at least not if there is any gravy, as the moisture turns it starchy. We also tried them as "chips," but did not succeed in this way.

It is most important, both with Yams and Sweet Potatos, that they should be served up *very hot.*

Too much Heat under Glass.

How very often in going through a range of glass houses we find some of them most uncomfortably hot, although the day may be dull, and comparatively cool outside! Is all this great heat necessary? is a question that might be asked with a good deal of reason; and our answer would, in many cases be, No, it is not; and not only is it unnecessary, but absolutely injurious to the plants. Strong fire heat on warm sunny days is very harmful in causing excessive evaporation, and is usually followed by red spider, thrips, or other insect pests, to say nothing of the waste of fuel. What is far better is to economise the fuel and to make full use of the sun by careful ventilation and atmospheric moisture. Nearly all plants under glass enjoy such conditions, making sturdy, healthy growth, free from insect or fungoid foes, and followed by fine flowers or fruit, as the case may be. Again, if a house is shut up early in the afternoon with a good sun heat and plenty of moisture the occupants of the house are perfectly happy, and it is astonishing how long the temperature remains at a high figure without any fire heat. While growing vines and stove plants like this treatment there are other things that should be kept as cool as possible during the summer months, such as Odontoglossums, Pelargoniums, and similar plants, all of which the experienced gardener thoroughly understands. It is the amateur and the inexperienced man who make such a grave mistake as to imagine that given plenty of heat anything may be grown well; and if it then does not seem quite satisfactory, why give it still more heat. Quite recently we saw a house full of Odontoglossums being completely ruined by a temperature that would have answered admirably for plants from the hottest part of the tropics; and even less valuable and better known plants are rendered useless by the same error.

Rabbits barking Trees.

A Fellow inquires how best to protect young trees from rabbits. The *best* way, no doubt, is to wire them round with small meshed wire at a distance of six or eight inches from the stem, taking care to let the wire go down at least six inches below the surface to prevent the rabbits burrowing under, and having it high enough to keep them from leaping over. Save, however, with a few specimen trees this is generally considered too expensive, and as a rule tar is used instead. But tar is not always satisfactory, as it sometimes itself kills the trees, particularly if applied *after* the rabbits have commenced to bark them. In any case Stockholm and not gas tar should be used, and a better plan than putting it on the young trees is to drive in a few stakes round the stem and smear them with the tar, as rabbits have a great dislike to their fur sticking to anything. We have found the following preparations very useful for the purpose : (1) Davidson's Composition, made by a Leith firm ; (2) a teaspoonful of the tincture of assafœtida in half a bucketful of liquid soil applied with a brush, perhaps twice during winter ; (3) a mixture of lime, water, and cow manure, pretty strong, is excellent ; so is any strong-smelling grease.

Gritty Pears.

"Why are my Pears, especially late varieties, so gritty now? They used not to be so," is the query more than one Fellow has put to us during the past year or two. It is said that the pruning and manuring and other treatment is just the same as in former days, and the poor quality of the fruit is put down to the roots being too far from the surface, tap-roots, the stock worn out, or some chemical constituent lacking in the soil. While admitting that one or more of these causes may in certain cases have such an injurious effect on the fruit, we believe that the principal cause is want of water, and if that necessary element could be supplied in copious quantities during the summer and autumn months those varieties of Pears that were esteemed for their high flavour and melting flesh, would again be as good as ever they were. Very few people realise what an enormous deficit there has been in the rainfall for a number of years past, and as a large proportion of the late varieties of Pears are grown on wall trees this shortage is greatly increased, as when the wind is in certain directions most of the rain falls on the opposite side of the wall to that on which the trees are planted. Again, bricks absorb a large quantity of moisture, and if the rainfall were normal it would still be very advisable to give the roots a good soaking of water occasionally to make up for any deficiency ; therefore how much more essential it is to water freely in such dry years as we have had recently! All wall trees are immensely benefited by a liberal watering occasionally during the hottest months of the year, but our experience is that no fruit is so much improved by it as those varieties of Pears that are slow in development, even that overrated variety, 'Beurré Diel,' will lose a great part of its grittiness if supplied with plenty of water while the fruit is swelling up to ripeness.

American Blight.

"How am I to get rid of the American Blight which is literally smothering some old Espalier Apples?" Many things will destroy the American Blight. Years ago we remember seeing an economical old gentleman saving up the oil which is left in emptied sardine tins and painting his trees all over with it; and this killed the blight, and so probably would any oil. At present we are using 4 oz. carbolic soft-soap and half a pint of paraffin to a gallon of nearly boiling water. It is well mixed and kept well stirred whilst in using, and is put on freely with a big brush. There is also a ready-made composition, which answers admirably, called "American Blight Destroyer."

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„ (3) "The Effects of Cross and Self Fertilisation in the Vegetable Kingdom."
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„ (3) "The Formation of Vegetable Mould through the Action of Worms."
„ (3) "The Origin of Species."
De Candolle, A. (3) "Origin of Cultivated Plants."
Duncan, F. Martin (4) "First Steps in Photo-Micrography."
Durand, T., and Jackson, B. Daydon (3) "Index Kewensis," suppl. i.
Earle, A. M. (3) "Old-Time Gardens."
Engler, A., and Drude, O. (3) "Die Vegetation der Erde," vol. vi.
"Flora of Tropical Africa" (8) viii., pt. 3, iv., pts 1 and 2.
Forsyth, W. (5) "A Treatise on the Culture and Management of Fruit Trees."
Foster-Milliar, Rev. A. (4) "The Book of the Rose," ed. 2.
Franchet, A., and Savatier, L. (6) "Enumeratio Plantarum in Japonia," 3 vols.
Granger, P. (3) "Les Fleurs du Midi."
Gravereaux, J. (4) "Les Roses cultivées à l'Haÿ en 1902."
Green, J. Reynolds (2) "A Manual of Botany," 2 vols.
, (3) "An Introduction to Vegetable Physiology."

Green, S. B. (2) "Forestry in Minnesota."
Grevillea (7) 26 pts.
Halácsy, E. de (3) "Floræ Græcæ," vol. ii., fasc. 1 and 2.
Hampel, W. (3) "Die moderne Teppichgärtnerei." Sechste Auflage.
Hayes, Rev. F. C. (2) "A Handy Book of Horticulture."
Hogg, R. (3) "The Apple and Pear as Vintage Fruits."
Hooker's (9) "Icones Plantarum," viii., pt. 2.
Hulme, F. E. (2) "Wild Fruits of the Country Side."
Hussey, Mrs. T. J. (3) "Illustrations of British Mycology," pts. 1–25, and 1 vol.
Jekyll, Miss G., and Mawley, E., (10) "Roses for English Gardens."
Johnston, G. (3) "The Natural History of the Eastern Borders: Botany."
Kew, Royal Gardens (8) "Hand-List of Trees and Shrubs," ed. 2.
Kirchner, Dr. O., and Boltshauser H. (3) "Atlas der Krankheiten und Beschädigungen unserer landwirtschaftlichen Kulturpflanzen," Serie 3–6.
Lowe, E. J. (3) "A Natural History of British Grasses."
,, (3) "Our Native Ferns," 2 vols.
Massee, G., (3) "A Text-book of Plant Diseases."
,, (2) "European Fungus Flora."
Meyer, F. W. (2) "The Best Hardy Perennials for producing an abundant Supply of Cut Flowers."
Miall, L. C. (2) "Round the Year: a Series of Short Nature Studies."
,, (2) "Injurious and Useful Insects."
Miller, P. (11) The second volume of the "Gardener's Dictionary," ed. 2.
,, (11) "The Gardener's Dictionary," ed. 4.
Miller, W. (12) "A Dictionary of English Names of Plants."
"Natural History Review" (3), 6 vols.
Newstead, R. (4) "Monograph of the *Coccidæ* of the British Isles," vol. i.
Percival, J. (3) "Agricultural Botany," ed. 2.
Planchon, G., and Collin, E. (3) "Les Drogues simples d'origine végétale."
Potter, M. C. (4) "An Elementary Text-book of Agricultural Botany," revised and enlarged edition.
Purchas, W. H., and Ley, A. (3) "A Flora of Herefordshire."
Purton, T. (3) "A Botanical Description of British Plants in the Midland Counties," 2 vols.
,, (3) "An Appendix to the Midland Flora," vol. 3, 2 pts.
Rogers, W. S. (2) "Villa Gardens: How to plan and how to plant them."
Schumann, K. (3) "Blühende Kakteen (Iconographia Cactacearum)," Lief. 6–8.
Seynes, J. de (3) "Recherches pour servir à l'Histoire naturelle des Végétaux inférieurs," 3 pts.
Thomas, H. H. (2) "The Book of the Apple."
Thompson's (3) "Gardener's Assistant," ed. W. Watson, div. vols. 1–6.
,, (2) ———, div. vols. 5–6.
Thumen, F. von (3) "Die Pilze des Weinstockes."
,, (3) "Die Pocken des Weinstockes."
,, (3) "Fungi Pomicoli."
Triggs, H. Inigo (3) "Formal Gardens in England and Scotland."
Urban, I. (3) "Symbolæ Antillanæ," vol. iii., fasc. 1 & 2.
Viviand-Morel, V. (4) "L'Art d'obtenir les Variétés nouvelles en Horticulture."
Vos, G. H. (2) "Easily grown Hardy Perennials."
Vries, Hugo de (3) "Die Mutationstheorie," Bd. ii., Lief. i.
Wallace, A. R. (2) "Travels on the Amazon and Rio Negro."
Ward, H. Marshall (3) "Disease in Plants."
Ward, N. B. (13) "On the Growth of Plants in closely Glazed Cases."
Warming, Dr. E. (14) "A Handbook of Systematic Botany," trans. and ed. by Prof. M. C. Potter.
Wythes, G. (2) "The Book of Vegetables."

DONORS OF SEEDS, PLANTS, &c., TO THE SOCIETY'S GARDENS AT CHISWICK DURING THE YEAR 1902.

ANDREWS, A., Campsea Ashe, Wickham Market. Black Currant Bushes. Planted in collection at Chiswick.

APPLEBY, H., Dorking. Seed Potatos. See p. 654.

ARMITAGE, Miss, Dadnor, Ross, Hereford. Michaelmas Daisy. See p. 661.

ATKINSON, J., Lazonby R.S.O., Cumberland. Seed Potatos. These will be reported upon next year.

ATLEE BURPEE, Messrs., Philadelphia. Vegetable and Flower Seeds. See pp. 657, 660.

AUSTIN, J., Broad Lane, Hampton. Tomato Seed. See p. 633.

BARR, Messrs., Covent Garden. Potatos and Tomato Seed. See pp. 633, 654.

BEACH, J. H., Hazels Gardens, Gravesend. Patent weed extractors. See p. 659.

BECKETT, E., Aldenham House Gardens, Elstree. Culinary Peas and Michaelmas Daisies. See pp. 204, 639.

BEDDOME, Col., F.L.S., Sispara, West Hill, Putney. Seeds of *Littonia modesta* and plants of *Tricyrtis hirta* and Swainsonias. See p. 664. The plants have been distributed to Fellows.

BLACKSTOCK, R., Thornton Hall, Stony Stratford, Bucks. Tomato Seed. See p. 633.

BODENHAM, J. R. D., Ivy Lodge, Acton Green. Unnamed bulbs from Central Africa. Will be reported upon next year.

BONAVIA, Dr., Richmond Road, Worthing. Two Oleanders. Being grown on at Chiswick.

BOUND, W. P., Gatton Park Gardens, Reigate. Seeds of *Barbarea vulgaris variegata*. Distributed as plants to Fellows.

BOURNE, W. R., 18 Hereford Square, South Kensington. Roots of Alligator Pear. Being grown on at Chiswick.

BRADLEY, F. M., Peterborough. Seed Potatos. See p. 654.

BRISTOW, T., Tonbridge, Kent. Seed Potatos. See p. 655.

BUNYARD, Messrs., Maidstone. Boskoop Currant Bushes. Planted in collection at Chiswick.

BURROUGHS, T., Ketton Cottage, Stamford. *Eremurus* Plants. Distributed to Fellows.

BURTON, T., Bexley Heath. Plant Frame. See p. 659.

CARTER, Messrs., High Holborn. Vegetable and Flower Seeds. See pp. 202, 204.

CROOK, J., Forde Abbey, Chard. Roots of *Gloriosa superba grandiflora*. Failed to grow.

CLEMENTI-SMITH, Rev. P., St. Andrews Rectory, Doctors Commons, E. C. Three Dracænas. For stock.

D'ALCON, O. W., Spalding. Seed Potatos. See p. 654.

DANIELS, Messrs., Norwich. Tomato Seed. See p. 633.

DEAN, A., Richmond Road, Kingston. Culinary Peas and Seed Potatos. See pp. 204, 655.

DEAN, R., Ranelagh Road, Ealing. Cabbage Lettuce Seeds. See p. 202.

DE LUZY Frères, Harold Street, Camberwell. Powder Distributing Bellows. See p. 659.

DICKSON, Messrs., Belfast. Culinary Peas. See p. 204.

DICKSONS, Messrs., Chester. Potatos and Tomato Seed. See pp. 633, 653.

DIRECTOR, Botanic Gardens, Kew. Collection of Seeds. Distributed as plants to Fellows.

DIRECTOR, Botanic Gardens, Jamaica. Seeds of *Ceropegia peltata*. Distributed as plants to Fellows.

DIRECTOR, Botanic Gardens, Melbourne. Collection of Seeds. Distributed as plants to Fellows.

DIRECTOR, Botanic Gardens, Vienna. Collection of Seeds. Distributed as plants to Fellows.

DOBBIE, Messrs., Rothesay. Michaelmas Daisies and Seed Potatos. See pp. 640, 654.

DOIG, Col., Rosemont, Woking. Lavender Cuttings. Being grown on at Chiswick.

DOIG, J., Rougham Gardens, Bury St. Edmunds. Chrysanthemums. Being grown on at Chiswick.

DYER, W. H., Frimley, Surrey. Tomato Seed. See p. 633.

Fenwick, M., Abbotswood, Stow-on-the-Wold. Two Phloxes. Planted in collection at Chiswick.
Fincham, H., Cranbrook, Kent. Seed Potatos. See p. 654.
Flowers, F. B., Duke Street, Ipswich. Birch Broom. See p. 659.
Forbes, J., Hawick. Phloxes and Flower Seeds. See pp. 649, 664.
Friday, R. W., Trigoni Hall, Largs, Ayrshire. Sweet Pea Seeds. Will be reported upon next year.
Gilbert, Messrs., Dyke, Bourne, Lincs. Anemones. Will be reported upon next year.
Gledstanes, F. G., Manor House, Gunnersbury. Crotons. For stock.
Goody, I., Belchamp St. Paul's, Clare, Suffolk. Vegetable and Flower Seeds. The last-named failed. See p. 658.
Green, R. W., Cornhill, Wisbech. Seed Potatos. See p. 654.
Grey, Miss, Nesham Place, Houghton-le-Spring, Durham. *Araucaria* Seed. Failed.
Harkett, Mr., Petersham. Carnations. See p. 661.
Henkel, F. H., Darmstadt, Germany. One Fuchsia. Will be reported upon next year.
Hollingworth, J., Woodseat, Uttoxeter, Staffs. Crotons. For stock.
Holmes, R., Tuckswood Farm, Norwich. Tomato Seed. See p. 633.
Hudson, Jas., V.M.H., Gunnersbury House, Acton. Apple tree scions and Water Lilies, &c. Being grown on at Chiswick.
Hughes, D., 35 Middle Lane, Denbigh. Vegetable Seeds.
Hughes, J., Wentworth Woodhouse, Rotherham. Seed Potatos. See p. 655.
Hughes Label Co., 34 Great Titchfield Street, W. Ivorine Label. See p. 659.
Kent & Brydon, Messrs., Darlington. Vegetable Seeds. See pp. 204.
Kime, T., Mareham-le-Fen, Boston. Seed Potatos. See p. 655.
King, Messrs., Broom, Biggleswade. Seed Potatos. See p. 654.
Lansdell, J., St. Wulstan's Crescent, Worcester. Tomato Seed. See p. 633.
Laxton, Messrs., Bedford. Culinary Peas and Tomato Seed. See pp. 204, 633.
Lee, F., Leigham Court Road, Streatham. Dracænas. For stock.
Lee, G., Clevedon. Seed of an unnamed *Phyllocactus*. Being grown on at Chiswick.
Lister, Messrs., Rothesay. Vegetable and Flower Seeds. See pp. 658, 664.
Lloyd, F. G., Langley House, Langley, Bucks. *Begonia* and *Episcia* cuttings. Distributed to Fellows.
Lorenz, C., Erfurt. Seeds of *Celosia Thompsoni magnifica*. See p. 661.
Lye, J., Easterton, Market Lavington. Tomato plants. See p. 633.
Lynch, R. I., Botanic Gardens, Cambridge. Collection of Flower Seeds. Distributed as plants to Fellows.
Masters, Dr., 41 Wellington Street, Covent Garden. Bean Seed. See p. 656.
McIver, D. G., Bridge of Weir, N.B. Fuchsia Cuttings. Received in poor condition.
Moore, W. L., Pilotpoint, Denton Co., Texas. Seeds of 'Elberta' Peach. Being grown on at Chiswick.
Nix, C. G., Tilgate, Crawley. Dracænas. For stock.
Nutting, Messrs., 106 Southwark Street, London. Culinary Peas. See p. 204.
Perry, A., Winchmore Hill. Saxifragas. Distributed to Fellows.
Peters, W., Givons, Leatherhead. Plants of Strawberry 'Givons Late Perfection.' Planted in collection at Chiswick.
Proudlock, R. I., Botanic Gardens, Ootacamund. Nineteen packets of Seeds. Distributed as plants to Fellows.
Reamsbottom, Messrs., Geashill, King's Co., Ireland. Anemones. Will be reported upon next year.
Rees, J., Llanover, Abergavenny. Begonias. For stock.
Robertson, J., Oldmeldrum, Aberdeenshire. A three-pronged tool for watering purposes. See p. 659.
Roemer, F., Quedlinburg, Germany. Cupid Sweet Pea Seeds. See p. 664.
Ross of Bladensburg, Lieut-Col., C.B., Rosstrevor House, Co. Down, Ireland. Seeds of *Callitris oblonga*. Being grown on at Chiswick.
Scammell, J. C., Wilton, Salisbury. Seed Potatos. See p. 653.
Schneider, G., 17 Ifield Road, Fulham. Vine Eyes. Being grown on at Chiswick.
Sharpe, Messrs., Sleaford. Seed Potatos. See p. 653.
Smith, J., Mentmore, Leighton Buzzard. Seed Potatos. See p. 654.
Stark, Messrs., Great Ryburgh, Norfolk. Plants of *Viola* 'Royal Sovereign.' Planted out in collection at Chiswick.
Street, Messrs., 164 Piccadilly, W. Cement 'Nonex.' See p. 659.
Steward, R., Danesfield Gardens, Walton-on-Thames. Culinary Peas. See p. 204.
Surrey Seed Co., Redhill. Pansy Seed. Being grown on at Chiswick.
Sutton, Messrs., Reading. Culinary Peas, and Tomato Seed. See pp. 204, 633.
Sydenham, R., Tenby Street, Birmingham. Collection of Sweet Peas. See p. 663.
Tayler, Mrs., Kansas. Unnamed Asters. See p. 661.

Thomas, O., 25 Waldeck Road, Ealing. Seed Potatos. See p. 654.
Towndrow, G. H., Malvern. Zonal Pelargonium 'Beauty.' See p. 664.
Valls, Messrs., 12 Colman Street, London. Valls 'Beetlecute.' See p. 659.
Vaughan, F. P., 38 Charlwood Street, Pimlico. Five packets of Seeds. Being grown on at Chiswick.
Veitch, Messrs. J., Chelsea. Vegetable and Flower Seeds. See pp. 204, 657, 660.
Veitch, Messrs. R., Exeter. Vegetable and Flower Seeds. See pp. 658, 660.
Wade, A., Colchester. Seeds of *Arctotis grandis*. See p. 660.
Wallace, W. E., Eaton Bray, Dunstable. Chrysanthemum 'Horace Martin.' See p. 661.
Ward, A., Godminton Gardens, Ashford, Kent. Tomato Seed. See p. 633.
Watkins & Simpson, Messrs., Tavistock St., Covent Garden. Vegetable and Flower Seeds and hybrid Lantanas. See pp. 204, 662.
Welstead, C., Dering Road, Croydon. Lettuce Plants. See p. 202.
Westropp, J. B., Holypost, Maidenhead. Fig and Grape-fruit plants. Being grown on at Chiswick. See p. 657.
Wilks, Rev. W., Shirley Vicarage, Croydon. Crinums and seedling *Incarvillea Delavayi*, &c. Distributed to Fellows.
Willmott, Miss, V.M.H., Great Warley, Essex. Michaelmas Daisies. See p. 639.
Wrench, Messrs., 39 King William Street, E.C. Vegetable Seeds. See p. 202.
Wythes, G., V.M.H., Syon Gardens, Brentford. Seed Potatos. See p. 655.

NOTES ON RECENT RESEARCH

AND

SHORT ABSTRACTS FROM CURRENT PERIODICAL LITERATURE, BRITISH AND FOREIGN,

AFFECTING

HORTICULTURE

AND

HORTICULTURAL AND BOTANICAL SCIENCE.

JUDGING by the number of appreciative letters received, the endeavour commenced in our last volume, to enlarge the usefulness of the Society's Journal, by giving an abstract of current Horticultural and Botanical periodical literature, has met with success. It has certainly entailed vastly more labour than was anticipated, and should therefore make the Fellows' thanks to all who have helped in the work all the more hearty.

That anything approaching perfection either in method or execution should have been achieved as yet is not to be expected, but the Editor desires to express his most grateful thanks to all who co-operate in this work for the very large measure of success already attained, and he ventures to express the hope that they will all strictly adhere to the general order and scheme of working, as the observance of an identical *order* can alone enable the Editor to continue to cope with the work. The order agreed on was as follows :—

1. To place first the name of the plant, disease, pest, &c., being noticed ; and in this, the prominent governing or index word should always have precedence.

2. To place next the name, when given, of the author of the original article.

3. Then, the abbreviated form of the name of the journal, &c., in which the original article appears, taking care to use the abbreviation which will be found on pp. 1102, 1103.

4. After this, a reference to the number, date, and page of the journal in question.

5. If an illustration be given, to note the fact next, as "fig.," "tab.," or "plate."

6. After these preliminary necessities for making reference to the original possible for the reader, the abstract or digest should follow, ending up with the initials of the contributor affixed at the close of each Abstract or Note.

Names of those who have kindly consented to help in this Work.

Boulger, Professor G. S., F.L.S., F.R.H.S.
Bowles, E. A., F.R.H.S.
Burbidge, F. W., M.A., V.M.H.
Chapman, H., F.R.H.S.
Chittenden, F. J., F.R.H.S.
Cook, E. T., F.R.H.S.
Cooke, M. C., M.A., LL.D., A.L.S., F.R.H.S., V.M.H.
Cox, H. G., F.R.H.S.
Dod, Rev. C. Wolley, M.A., F.R.H.S.
Druery, C. T., V.M.H., F.L.S., F.R.H.S.
Farmer, Professor J. B., M.A., F.R.H.S.
Goldring, W., F.R.H.S.
Groom, Professor Percy, M.A., D.Sc., F.L.S., F.R.H.S.
Hartog, Professor Marcus, D.Sc., M.A., F.L.S., F.R.H.S.
Hawes, E. F., F.R.H.S.
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Henslow, Rev. Professor Geo., M.A., F.L.S., F.R.H.S., V.M.H.
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Hooper, Cecil, M.R.A.C., F.R.H.S.
Houston, D., F.L.S., F.R.H.S.
Hurst, Captain C. C., F.L.S., F.R.H.S.
Kent, A. H., A.L.S., F.R.H.S.
Lynch, R. Irwin, A.L.S., F.R.H.S.
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Mawley, Ed., F.M.S., F.R.H.S.
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Paul, Geo., J.P., V.M.H., F.R.H.S.
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Reuthe, G., F.R.H.S.
Saunders, Geo. S., F.L.S., F.E.S., F.R.H.S.
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Shea, Charles E., F.R.H.S.
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Smith, William G., B.Sc., Ph.D., F.R.H.S.
Veitch, Harry J., F.L.S., F.Z.S., F.R.H.S.
Ward, Professor Marshall, Sc.D., F.R.S., F.R.H.S.
Webster, A. D., F.R.H.S.
Worsdell, W. C., F.R.H.S.

JOURNALS, BULLETINS, AND REPORTS

from which it is proposed to make Abstracts, with the abbreviations used for their titles.

Journals, &c.	Abbreviated title.
Acta Horti Petropolitani	Act. Hort. Pet.
Agricultural Gazette of New South Wales	Agr. Gaz. N.S.W.
Agricult. Journal, Cape of Good Hope	Agr. Jour. Cape G. H.
Agricultural News, Imperial Dep. West Indies	Agr. News Imp. Dep. W.
American Gardening	Amer. Gard.
Annales Agronomiques	Ann. Ag.
Annales de la Soc. d'Hort. et d'Hist. Naturelle de l'Hérault	Ann. Soc. Hé.
Annales de la Soc. Nantaise	Ann. Soc. Nant.
Annales des Sciences Naturelles	Ann. Sc. Nat.
Annales du Jard. Bot. de Buitenzorg	Ann. Jard. Bot. Buit.
Annals of Botany	Ann. Bot.
Beihefte zum Botanischen Centralblatt	Beih. Bot. Cent.
Boletim da Real Sociedade Nacional de Horticultura	Bol. R. Soc. Nac. Hort.
Boletim da Sociedade Broteriana	Bol. Soc. Brot.
Botanical Gazette	Bot. Gaz.
Botanical Magazine	Bot. Mag.
Botanische Zeitung	Bot. Zeit.
Bulletin de la Société Botanique de France	Bull. Soc. Bot. Fr.
Bulletin de la Soc. Hort. de Loiret	Bull. Soc. Hort. Loiret.
Bulletin de la Soc. Mycologique de France	Bull. Soc. Myc. Fr.
Bulletin Department of Agricult. Brisbane	Bull. Dep. Agr. Bris.
Bulletin Department of Agricult. Melbourne	Bull. Dep. Agr. Melb.
Bulletin of the Botanical Department, Jamaica	Bull. Bot. Dep. Jam.
Bulletin of Bot. Dep. Trinidad	Bull. Bot. Dep. Trin.
Bulletino della R. Società Toscana Orticultura	Bull. R. Soc. Tosc. Ort.
Canadian Reports, Guelph and Ontario Stations	Can. Rep. G. & O. Stat.
Centralblatt für Bacteriologie	Cent. f. Bact.
Chronique Orchidéenne	Chron. Orch.
Comptes Rendus	Comp. Rend.
Contributions from the Botanical Laboratory, University of Pennsylvania, Philadelphia.	Contr. Bot. Lab. Phil.
Department of Agriculture, Victoria	Dep. Agr. Vict.
Department of Agriculture Reports, New Zealand	Dep. Agr. N.Z.
Dictionnaire Iconographique des Orchidées	Dict. Icon. Orch.
Die Gartenwelt	Die Gart.
Engler's Botanische Jahrbücher	Eng. Bot. Jah.
Flora	Flora.
Gardeners' Chronicle	Gard. Chron.
Gardeners' Magazine	Gard. Mag.
Gartenflora	Gartenflora.
Journal de la Société Nationale d'Horticulture de France	Jour. Soc. Nat. Hort. Fr.
Journal Dep. Agricult. Victoria	Jour. Dep. Agr. Vict.
Journal Imperial Department Agriculture, West Indies	Jour. Imp. Dep. Agr. W.I.
Journal of Botany	Jour. Bot.
Journal of Horticulture	Jour. Hort.
Journal of the Board of Agriculture	Jour. Bd. Agr.
Journal of the Linnean Society	Jour. Linn. Soc.
Journal of the Royal Agricultural Society	Jour. R.A.S.
Journal S.E. Agricultural College, Wye	Jour. S.E. Agr. Coll.
Just Botanischer Jahresbericht	Just Bot. Jah.
Kaiserliche Gesundheitsamte	Kais. Ges.
Kew Bulletin	Kew Bull.
Lindenia	Lind.
Nature	Nature.
Naturwissenschaftliche Zeitschrift für Land- und Forstwirthschaft	Nat. Zeit. Land-Forst.
Notizblatt des Königl. Bot. Gart. und Museums zu Berlin	Not. König. Bot. Berlin.

Journals, &c.	Abbreviated title.
Orchid Review	Orch. Rev.
Proceedings of the American Pomological Society	Am. Pom. Soc.
Queensland Agricultural Journal	Qu. Agr. Journ.
Reports of the Missouri Botanical Garden	Rep. Miss. Bot. Gard.
Revue de l'Horticulture Belge	Rev. Hort. Belge.
Revue générale de Botanique	Rev. gén. Bot.
Revue Horticole	Rev. Hort.
The Garden	Garden.
Transactions Bot. Soc. Edinburgh	Trans. Bot. Soc. Edin.
Transactions of the British Mycological Soc.	Trans. Brit. Myc. Soc.
Transactions of the Massachusetts Hort. Soc.	Trans. Mass. Hort. Soc.
U.S.A. Department of Agriculture, Bulletins	U.S.A. Dep. Agr.*
U.S.A. Experimental Station Reports	U.S.A. Exp. Stn.†
U.S.A. Horticultural Societies' publications	U.S.A. Hort. Soc.†
U.S.A. State Boards of Agriculture and Horticulture	U.S.A. St. Bd.†
Wiener Illustrirte Garten-Zeitung	Wien. Ill. Gart.-Zeit.
Woburn Experiment Farm Report	Woburn.
Zeitschrift für Pflanzenkrankheiten	Zeit. f. Pflanz.

* The divisions in which the U.S.A. Government publish Bulletins will be added when necessary.
† The name of the Station or State will in each case be added in full or in its abbreviated form.

NOTES ON RECENT RESEARCH.

ALGÆ.

Algæ (Siphoneæ) (*Beih. Bot. Cent.* bd. xiii. ht. 1, pp. 115–148, pls. vi.–x.).—Herr A. Ernst (Zürich) gives a full description of a new genus *Dichotomosiphon tuberosus*, formerly known as *Vaucheria tuberosa*, Braun. The hyphæ show dichotomous branching, and characteristic constrictions; there is a very full account of the starch grains, chlorophyll bodies, and reserve substances. The oogonia are terminal. The antheridia are 2–4, and the oogonia solitary or in pairs. The latter are 290–315 μ along the long diameter, and 275–280 μ across. The plant when grown on wet soil often forms tubercular swellings from 0·5–5 m. long and 0·2–0·4 mm. broad. These are full of protoplasm, chlorophyll, and starch, and are of a dark green colour: new filaments are given off by these tubercles. The plates are exceeding well done.—*G. F. S.-E.*

LUMINOUS BACTERIA.

Bacteria, On Luminous.—Note by J. E. Barnard and Allan Macfadyen (*Ann. Bot.* vol. xvi., No. 64, p. 587). Abstract of paper read before Section K of the British Association, Belfast, 1902.—"These organisms are to be found mainly in sea-water and on dead marine animals. . . . About 25 varieties have been described, but it is probable that some of these are very closely related, if not identical. A hitherto undescribed form has been isolated from sea-water in the course of investigations made by one of us at Plymouth. . . . The luminosity of the sea is mainly due to higher forms of marine life and not to *Bacteria*, at any rate in northern latitudes. On the other hand, the phosphorescence of dead objects, such as fish, &c., is due to bacterial forms of life. . . . The luminosity appears to be a function of the living cell, and can be disturbed by any process which interferes with the vitality of the cell itself. The dead cell is non-luminous, while antiseptics which kill the cells inhibit at the same time their luminosity. . . . There is no evidence of a bacterial product as the source of light. The process appears to be the result of an active oxidation occurring within the cell. The light produced is confined to a small portion of the visible spectrum, and invisible radiations have not been detected. The light is produced without heat. No invisible radiations allied to the X-rays were detected. Photographs have been obtained by the aid of the light emitted by these organisms. . . . An exposure to the temperature of liquid air does not destroy the luminosity of the organisms. . . . The luminous Bacteria mechanically broken up . . . ceased to phosphoresce. The luminosity, therefore, is due to the vital processes of the cell, and essentially depends for its origin on the intact organisation of the cell. We have brought these results forward because this interesting group of organisms have not hitherto been studied in this country so far as we can trace."—*R. I. L.*

Temperature and Leaf Assimilation.

Carbon Dioxide Assimilation, The Effect of Temperature on. Note by Miss Gabrielle L. C. Matthaei (*Ann. Bot.* vol. xvi., No. 64, p. 591). Abstract of paper read before Section K of the British Association, Belfast, 1902. "This investigation differs from any which have preceded it on the same subject in the attention paid to uniformity in the environment of the leaves *before* the experiment. Recent work has shown that both the assimilation and the respiration of a leaf depend on its previous nutrition and temperature. For this reason a separate leaf was used for each temperature, care being taken to keep them for some time under exactly similar conditions. Leaves of the Cherry Laurel (*Prunus Laurocerasus*) were employed throughout. . . . The lowest temperature at which assimilation could be detected was $-6°$ C. This is the first well-established case of assimilation below 0° C. For temperatures between $-6°$ C. and 33° C. it was found that assimilation is affected in exactly the same way as is respiration. Provided the illumination is sufficient, the assimilation increases with the temperature. At any given temperature the leaf is only capable of a limited absolute amount of assimilation, and increase of illumination beyond the amount requisite for this maximal amount produces no further effect at all. A greater assimilation can only be obtained by increasing the temperature. Thus the fundamental condition regulating the assimilation is the temperature, the intensity of the light occupying a secondary position similar to that of the percentage of carbon dioxide. . . . For temperatures above 33° C. the result is complicated by the injurious effects of the temperature. The fatal temperature for Cherry Laurel leaves is in the region of 41°–45° C., but the specific resistance of the leaves is very variable. Death is shown by a rapid decrease in the respiration, but it may be several hours before this ceases entirely. Exposure to light has a most marked effect in increasing the resistance of leaves to the effect of high temperatures. Most interesting results were obtained from the prolonged exposure of leaves to high temperatures. It was found that respiration of a leaf in the dark falls off much more rapidly than that of a leaf in the light, and the former can in no case be taken as a measure of the latter. At first assimilation and respiration are equally and similarly affected by the temperature, but later the assimilation ceases while respiration is still active."—*R. I. L.*

Carbon Dioxide and Growth.

Carbon Dioxide, Effect of, on Plant-growth. By Paul Chapin (*Flora*, vol. xci. 1902, pp. 348–379, t. xxi., and one cut). This research was, unfortunately, completed before recent English publications, to which no reference is consequently made. (1) Experiments on Fungi.—(*a*) Germination of spores.—Spores of *Aspergillus niger* germinated in an atmosphere of as much as 90 per cent. of CO_2, but took five days. At 40–60 per cent. they germinated in three days but formed no sporangia, while at lower concentrations they did. Those of *Penicillium glaucum* showed similar relations, but formed spores at 40 per cent. CO_2, while those of *Mucor stolonifer* failed to germinate with over 50 per cent., and to form sporangia with over 10 per cent. In no case did exposure to pure CO_2 kill spores or mycelium. (2) Roots of Flowering Plants.—*Vicia sativa* and *Pisum sativum* showed an increased growth for small quantities of CO_2, but a decrease with above 2 per cent.; growth fell to a very small rate at 30 per cent., and the roots die in a few days. (3) Stems of Flowering Plants.—For this purpose seedlings of *Sinapis alba* and *Trifolium incarnatum*, raised in sawdust, were used. Up to 2 per cent. an increase in rapidity of growth was noted; decrease at higher strengths; ultimate death at 30 per cent. in seven days for *Sinapis*, at 20 per cent. in eight days for *Trifolium*. Barley showed an increase of growth of the green leaf up to 3 per cent., and all proportions up to 9 per cent. gave greater elongation than in the control experiment. Even 80 per cent. did not arrest growth completely, though death ensued after five days here, and after eight days in 60 per cent. Experiments in which, after 24–48 hours' treatment, air was applied, showed no evil after-effects with roots up to 25–40 per cent. CO_2, but stems showed them after 20 per cent. CO_2. The effect of CO_2 is only manifest after a certain interval.—*M. H.*

Carbon Dioxide: The Effect of varying amounts of this Gas on the Growth of Plants. By Jost (*Bot. Zeit.* No. 24, Dec. 16, 1902, pp. 370–371).—Remarks upon the results of experiments by H. T. Brown and F. Escombe (*Proc. R. S.* 1902, No. 70, pp. 397–413, 5 plates), which demonstrated that a considerable addition (up to 600 CO_2 in 10,000 instead of 2·8) to the normal amount of carbon dioxide resulted in a diminution of leaf area, accompanied by some distortion, a deeper green colour, and increased starch contents, while flowering was entirely suppressed. The reviewer considers these results to imply damage in lieu of adaptation, and points out that while the control plants obtained their carbon dioxide normally from the air, the others were supplied from vessels containing liquid carbonic acid, which might involve some disturbing element. It is noteworthy that the abnormal quantity of gas varied from 11·47 to 600 in 10,000 without affecting the extent of abnormal results.—*C. T. D.*

Oxygen and Chlorophyll.

Chlorophyll, Formation of, in rarefied air and in rarefied oxygen. By Jean Friedel (*Comp. Rend.* cxxxv. No. 23, p. 1063; 1903). M. Palladine has shown that when detached etiolated leaves are exposed to light, chlorophyll does not form unless the amount of aeration is very considerable. From this fact the conclusion was formed that, for plants to become green, it is necessary they should receive more oxygen than the amount required for respiration. Acting on this idea, Friedel studied the action of oxygen on entire plants placed under conditions where the pressure of the gas could be measured.

Lepidium sativum was used in the experiments. Two lots of seeds were sown and allowed to germinate in darkness. When sufficiently developed, the plants were exposed to light; one lot under normal atmospheric pressure; the second lot under half an atmosphere of pressure. The plants growing under normal conditions quickly became green, whereas these under a reduced pressure remained paler in colour, and several amongst them remained completely etiolated.

On February 21 three other lots were experimented upon; lot 1 under normal pressure; lot 2 half an atmosphere; and lot 3, one sixth of an atmosphere. On March 1, lots 1 and 2 were green, the latter the paler of the two, whereas lot 3 remained completely etiolated.

In a second series of experiments, oxygen alone was used, the pressure being about half an atmosphere. Under these conditions the plants became as green as those growing in the open air.

Experiments with *Phaseolus multiflorus* corroborated all the above results. These plants under a pressure of one sixth of an atmosphere of atmospheric air remained etiolated, whereas under an equal pressure of oxygen the green colour was equal to that of plants growing in the open.

A further experiment with plants hermetically sealed in a globe, furnished with an arrangement for absorbing the carbonic acid given off by the plants, enabled the author to formulate the following:

In rarefied air the formation of chlorophyll is much diminished. It is the insufficiency of oxygen, and not the accumulation of carbonic acid gas, that retards the formation of chlorophyll.—*G. M.*

Daphnine.

Daphnine, Localisation of, in Daphne Laureola. By M. W. Russell (*Rev. Gén. Bot.* t. xiv., 1902, p. 420).—The *Daphne Laureola* is known to possess poisonous properties, and the cortex of the stem, which is the officinal portion, contains the substance daphnine, though it is not certain whether it is to this body or to the resinous or oily secretion that the plant owes its utility. The daphnine is a glucoside, and can be detected by adding to tissues containing it a solution of iodide of potash. This gives rise to a rose colour passing through orange, carmine, and finally to reddish-brown. Various other tests are also given. The daphnine is shown to be localised in the bundles and in the epidermis as far as the leaf is concerned. In the stem the glucoside is localised in the epidermis, phelloderm, bast, parenchyma, and medullary rays. It occurs also in the root (sparingly) and in the flowers.—*J. B. F.*

Plankton Diatoms.

Diatoms of the Plankton, Statistics of Varieties in. By Schröter & Vogler (*Flora*, xci. 1902, pp. 380–383).—This is an abstract by P. Vogler of (1) a research published by him in the *Viertelj. Naturf. Ges. Zur.* vol. xlvi. 1901. Every month the width of 100 ribbons of *Fragillaria* were measured so as to give the length of the single frustules; (2) another by Schröter's pupil, Lozerau, on *Asterionella gracillima* and *Tabellaria fenestra.* The chief result is that in the Plankton Diatoms auxospore-formation occurs after long intervals of vegetative reproduction. During these the size of the individuals gradually diminishes. The conditions of auxospore-formation have still to be determined.—*M. H.*

DICTYOSTELIUM MUCOROIDES.

Dictyostelium mucoroides, The Physiology of. By George Potts, D.Sc. (*Flora*, vol. xci. 1902, pp. 281–347; 4 cuts).—This is an interesting member of the *Acrasieæ*, differing from the true Myxomycetes in its not possessing flagella at any stage, nor forming a true plasmodium, the amœbulæ simply multiplying by fission, and aggregating to form a fructification, the lower and central ones being sterilised as a stalk and central axis up which the others creep to form an oval assemblage, and then encyst as spores. It was found by cultures on agar-jelly containing various nutritive substances the amœbæ do not take in bacteria, but kill them and are nourished by absorption of the products. It grows better on a solid than a liquid substratum, preferably slightly alkaline rather than acid. In liquid the fructification is spherical, no stalk being formed as in air. Maize extract was found the most suitable nutritive substance. Incidentally a new bacterium was found, very suitable for feeding the *Dictyostelium*, and described as *Bacterium fimbriatum*, from the fringing outgrowths along the needle's path in gelatine cultures.—*M. H.*

ECOLOGY OF DELAWARE.

Ecology of Delaware Coast. By L. M. Snow (*Bot. Gaz.* xxxiv., p. 284, No. 4; with map and 10 photos).—The portion studied was between six and seven miles long and from one half to a mile wide along the Atlantic coast. After describing the topography, soil, and climatology, the author deals with plant formations as follows:—A. "Treeless open," consisting of the beach formations, dunes, and heath. B. Wooded region. The first place of vegetation is secured by the accumulation of sand and driftwood, &c. Here species of *Cakile*, *Salsola*, *Xanthium*, and *Atriplex* occur; on the next zone *Ammophila* establishes itself. Higher up *Panicum amarum*, *Cenchrus tribuloides*, &c. are added. The dunes are divided into four series. The outer consists of "Pine graveyards," *i.e.* the remains of the forest over which the dunes are now passing. The next lies behind the former as a general depression characterised by *Hudsonia tomentosa*. Swamps and meadows extend among these dunes. "Silver-lake" occurs in them, around which is *Scirpus americanus*, *Cyperus* sp., *Polygonum maritimum*, &c.; while more xerophytic forms appear on low elevations.

The heath region starts from the second series and extends back to the forest, containing a large number of species with few characteristic forms, such as *Baptisia tinctoria*, *Rubus* sp., *Juniperus virginiana*, *Pinus rigida*, &c. Lastly is the wooded region and forest formation, containing *Quercus digitata*, &c., and *Carya ovata*.—*G. H.*

EMBRYOLOGY.

Embryology of Cynomorium (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 194–202).—Professor Dr. O. H. Juel (Upsala) describes the morphology and development of the embryo of *Cynomorium coccineum*. The embryo-sac mother-cell divides into four daughter-cells. The micropyle becomes obliterated, though the pollen-tube enters in the micropylar region. Both the micropylar and chalazal regions of the embryo-sac are very rich in food material. The author did not find that the antipodal cells divide. There is a full account of the nuclear divisions observed, and a short description of the seed. There are five figures in the text.

G. F. S.-E.

Embryos of Dicotyledons, Observations on the Development of. By B. Schmid (*Bot. Zeit.* parts 10 and 11, pp. 207–230, Nov. 1, 1902; with 3 plates).—A record of observations on the varying development of the embryo, and especially on partial or entire abortion of one of the cotyledons on some plants, which, though undoubtedly belonging to dicotyledonous orders, consequently resemble monocotyledons in the primary stage.—*C. T. D.*

Causes of Leaf-fall in Ceylon.

Foliar Periodicity in Ceylon. Note by Herbert Wright, Peradeniya (*Ann. Bot.* vol. xvi., No. 64, p. 595). Abstract of paper read before Section K of the British Association, Belfast, 1902.—"The high temperature and humidity of the air in most parts of Ceylon allow almost continuous growth of the arborescent vegetation. There are, however, nearly two hundred species which become leafless at different times of the year. External and internal factors affect the phenomena of defoliation and foliar renewal. The climatic effect is obvious from the fact that the majority of our deciduous species become leafless during our hottest and driest months. The deciduous trees respond only to one hot dry period of three or four months, and not to the dry part of each monsoon. Some species undergo complete defoliation twice per year; these exhibit periodic increase in foliar activity several times per year, in addition to a complete annual renewal, and many introduced species show great variation during their phase of acclimatisation. In the northern districts, where the rains of the south-west monsoon are very feeble as compared with those at Peradeniya, the defoliation is considerably delayed. The climatic conditions in Ceylon are not equable enough to allow continued development along personal lines, and botanists desiring to study the personal equation in plant-life should select a more equable area. Internal forces are, however, obviously at work, as evidenced by the following facts:—

"(*a*) Species retain full possession of their foliage or put forth new leaves when the temperature and dryness of the air are at a maximum.

"(*b*) Some species drop their leaves and remain bare during our wet, cool months, when transpiration is at a minimum.

"(*c*) Plants of the same species, on the same plots, are deciduous at periods varying by many weeks and months.

"(*d*) The same species may undergo defoliation at approximately the same time of the year, though under the dissimilar climates of Peradeniya, Colombo, and Manaar.

"The irregularity of foliar periodicity is very pronounced. There is not a month when all the trees are in full leaf. The foliar periodicity of the evergreens is as complex as that of the deciduous trees . . . all being subject to individual variations. Foliar periodicity is the most potent factor in determining the number and significance of the rings of growth, but for the complete interpretation of these a further knowledge of the rate of cambial activity and the independent effect of a hot dry season is necessary. The rate of cambial activity is of special value in determining the varying significance of the xylem differentiations in slow-growing deciduous or quick-growing evergreen trees."—*R. I. L.*

Generative Process in Gall Worm.

Gall Worm, Internal Structure of the. By N. A. Cobb (*Agr. Gaz. N. S. W.* p. 1031; October 1902).—The article sets forth the examinations carried out on the structure and relationships of the worm causing disease. These proved that the males are possessed of a double internal sexual apparatus. The appearances are often somewhat deceiving, and it would be easy in some cases so to mistake them as to arrive at the conclusion that the internal sexual apparatus is single. As to the internal structure of the testicles little that is new or interesting was observed. The blind end in each organ is occupied by a special cell, and from thence the mother-cells of the spermatozoa extend onward in a single row, or approximately so, throughout the length of the testicle proper. The change by division to spermatozoa occurs near the proximal of the organ. In the seminal receptacle, formed by the junction of the hitherto separate branches of the apparatus, the spermatozoa are arranged in several rows, and the vessel is of such a size as to occupy the greater portion of the lumen of the body near the posterior extremity. The ejaculatory duct appeared to be quite short. Most of these details are carefully set forth in illustrations.—*H. G. C.*

Influence of Light on Germination.

Germination of Seeds and Light (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 164–172).—Professor E. Heinricher (Innsbruck) has carried on some very interesting experiments on this point. He finds that the seeds of the following plants *only* germinate in light: *Pitcairnia maidifolia*, (*Bromeliaceæ*) and *Drosera capensis*. Light favours the germination of seeds of *Mesembryanthemum obliquum* and *M. pinnatifidum*, also those of *Echinocactus Grossei*, of *Echinopsis Rohlandii*, and of two species of *Dyckia*. On the other hand, light appeared to hinder germination in the cases of *Æchmea cærulescens*, of *Acanthostachys strobilacea*, of *Stapelia variegata*, and of *Portulaca oleracea*; the difference appears to depend on the natural habitat of the plant, those of very sunny places or epiphytes being especially favoured by light.—*G. F. S.-E.*

Fungicide applied through Root-absorption.

Lettuce rendered immune against Mildew (*Comp. Rend.* cxxxv. No. 23, p. 1067, 1902).—M. E. Marchal has made some very interesting experiments on this subject. He points out the fact that the "downy mildews" or fungi belonging to the *Peronosporaceæ* are exceedingly sensitive to metallic poisons; thus the zoospores of the vine mildew, *Plasmopora viticola*, will not germinate in the presence of $\frac{2}{100000000}$ to $\frac{3}{100000000}$ of sulphate of copper. Under these conditions, it is asked, would it not be possible to introduce into the body of the plant small quantities of sulphate of copper or some other equally efficacious substance, and thus render the tissues refractory to the development of mildews?

Special experiments were conducted for the purpose of rendering Lettuce immune to the attacks of *Bremia lactucæ*, the Lettuce mildew. These experiments were made with two objects in view: the action of the salts experimented with on the vitality of the Lettuce, and on that of the parasite.

Sulphate of Copper.—Lettuce grown in a nutrient solution containing $\frac{6}{100000}$ to $\frac{7}{100000}$ of this salt showed variable results, depending on the rapidity of growth, temperature, hygrometric condition of the air, and amount of light. Sometimes growth was sensibly retarded, and it was found necessary to use not more than $\frac{4}{100000}$ to $\frac{5}{100000}$ to secure normal growth of the Lettuce.

Lettuce grown with $\frac{5}{100000}$ to $\frac{7}{100000}$ of sulphate of copper completely resisted infection. Sometimes the cotyledons were slightly attacked, but the leaves proper proved to be absolutely immune.

Lettuce treated with $\frac{3}{100000}$ to $\frac{4}{100000}$ of the same salt, showed a marked resistance to infection. This resistance totally disappeared when the amount of copper was reduced to $\frac{1}{100000}$.

Certain other salts, as sulphate of iron and sulphate of manganese, were also experimented with, but proved in every case inferior to sulphate of copper.

A series of experiments conducted for the purpose of determining the effect of nutritive salts, as influencing a predisposition to disease or otherwise showed that nitrates and phosphates favoured the attacks of the *Bremia*, whereas potassium salts enabled the Lettuce to resist such attacks to a marked degree.

As a result of these experiments, it is considered that by means of absorbing certain fungicides through the root, more especially sulphate of copper, Lettuce can be rendered immune against the mildew known as *Bremia lactucæ*.

Unfortunately, there are difficulties yet to be overcome before these processes can be practically applied on a large scale; the most serious of which consists in the comparatively narrow margin between the amount of sulphate of copper required to secure immunity from the mildew, and that amount which the Lettuce can bear without injury.

Notwithstanding these present difficulties, the author considered that further experiments may lead to a successful issue, and that not only Lettuce but also other plants may be rendered immune against their respective mildews through the absorption of mineral salts by the roots.

G. M.

Effect of Manganese.

Manganese Compounds, Action on Plants of. By O. Loew, K. Aso, and S. Sawa (*Flora*, vol. xci. 1902, pp. 265–273; 1 fig.).—Manganese is known to be an important constituent of plants, often exceeding iron. Thus the ash of Birch-leaves gave 14·47 per cent. Mn_3O_4, and only 1·43 per cent. Fe_2O_3; that of needles and bark of

Pinus Abies 35·53 per cent. and 41·23 per cent. respectively (equal to 1·08 per cent. and 0·66 per cent. of the total dry constituents). The metal has been found in the ashes of oxydases, and also in a nucleo-proteid extracted from Tea-leaves. Experiments made to prove the action showed that 0·25 per cent. solutions of manganous sulphate were poisonous to seedling Peas. On placing Barley seedlings in 0·01 per cent., after seven days they were yellow and had formed no water roots; in nine days some leaves began to flag. The extract showed that they were exceptionally rich in oxydase and peroxydase. This confirms Bertrand's discovery that the presence of Mn increases the power of oxydases. Other experiments were made with normal mineral solutions to which were added $MnSO_4$, $FeSO_4$ with a trace of iron, and the two salts respectively, 0·02 per cent. of either being the strength. It was found that growth was favoured, especially at first, by Mn; it is suggested that the oxydases destroy products of metabolism which hinder growth. The restriction of growth (elongation) in the light may indeed be the effect of such hindering substances.—*M. H.*

Crotalaria anagyroides.

Nectaries, Extrafloral, and Water-secreting Calyx (*Beih. Bot. Cent.* bd. xiii. ht. 1, pp. 112–114).—Herr Fritz Noack gives a short account of the honey-secreting stipules of *Crotalaria anagyroides* which are visited by soldier-ants that keep off leaf-cutting ants and also large animals. There is also an account of the water-secreting hairs in the calyx of *Datura suaveolens*.—*G. F. S.-E.*

Structure of Young Algæ.

Œdogonium, The Structure and Development of the Young Plants in. By F. E. Fritsch, B.Sc., Ph.D. (*Ann. Bot.* vol. xvi., No. 63, p. 467, with three figures in the text).—The *Œdogonia* are green Algæ of simple articulated filaments with cells marked with transverse striæ at one extremity, and some may be found in the tubs or waters of any garden. The intention of the paper is thus explained: "Although the young plants of *Œdogonium* have not infrequently been figured in various species, not many observations on their structure or mode of development have been published. I propose therefore, in the present paper, to discuss the structure of the young plants in five species of *Œdogonium*, obtained from different parts of the Royal Gardens at Kew." Referring to *Œd. cardiacum* the author writes: "There is only a slight constriction at the point at which the colourless root-end goes over into the chlorophyll-containing part of the plant; at this point, coinciding almost with the former position of the cilia, I very frequently saw a ring of brown matter extending right round the cell. I found considerable numbers of young plants of *Œd. cardiacum* with this type of base floating on the surface of the water, and most of them exhibited a striking peculiarity. I found that each of these was in intimate connection with an air-bubble of variable size. The connection was not alone a mere cohesion, but a closer examination showed that the otherwise spherical air-bubble was drawn out to a distinct point of attachment, coinciding usually with the ring of brown matter mentioned above. It would thus appear as though there were some connection between the presence of the air-bubble and this brown matter, for the two nearly always occurred side by side. The curious shape of the bubble suggests its having been formed on the plant itself, which was by this agency enabled to float on the surface of the water. All my attempts to elucidate this point have as yet proved unsuccessful, as the bubbles break up soon after the plant is removed from its floating position. The substance forming the brown ring is undoubtedly ferric oxide, or some ferric salt. The same is very commonly found, forming a coating on the basal disc of this and other species of *Œdogonium.* It is often present in considerable quantity in places where young plants of this genus are attached to other filamentous Algæ. If treated with a solution of potassium ferrocyanide, to which a trace of hydrochloric acid has been added, this brown substance is dissolved, and in its place a precipitate of Prussian blue is formed." In his summary, the author remarks that "certain types of root-ends are characteristic for certain species of *Œdogonium;* thus the attaching-disc and rhizoid for *Œd. calcareum, capillare*, and *stagnale*, the rhizoid alone for the species from the river Severn, and the attaching-disc and sack-shaped basal end for *Œd. cardiacum.*" This paper is of much interest in connection with the entertaining study of Fresh-water Algæ.—*R. I. L.*

Anthracnose in Orchids.

Orchid Anthracnose. By M. C. Cooke (*Trans. Br. Myc. Soc.* 1902). Under this name is described an Orchid disease which appeared before the Scientific Committee (see Journ. xxvi. pp. cxxxix and cxli). The species has been called *Glœosporium Bidgoodi*, with the following description :—

Pustules rather large, covered by the blackened cuticle, at length ruptured for the escape of the conidia. The stroma upon which the conidia are produced is also blackened, but the conidiophores become hyaline above, bearing the narrowly elliptic conidia (18–20 × 4 μ) which have two nuclei. No direct evidence that eventually they become uniseptate. On leaves of *Odontoglossum.* It has been known for six or seven years, but not described. Leaves were submitted to Mr. Bidgood in 1901, who declared it to be a species of *Glœosporium* but not described, and now it is associated with his name. The conidia of *Glœosporium Vanillæ* are 14–16 × 6–7 μ. Those of *G. cinctum* are 10–15 × $2\frac{1}{2}$–3 μ. Those of *G. Oncidii* are 14–17 × $4\frac{1}{2}$–6 μ. Those of *G. Orchidearum* are 20–25 × 5–7 μ; and those of *G. affine* are 14–20 × 4–6 μ: but other features have to be taken into account as well as the dimensions of the conidia.—*M. C. C.*

Growth of Ovules in the Rosaceæ.

Ovule and Seed, Development of, in Rosaceæ. By F. Péchoutre (*Ann. Sc. Nat.* (*Bot.*) xvi. pp. 1–158, 166 figs.; 1902.)—The ovules of about thirty species of *Rosaceæ*, representing important genera, are described from the first appearance of the ovule onwards to the mature seed. After an introduction explaining the problems involved, and an historical review of previous work, the greater part of the paper is occupied by the details of the selected types. The figures are good and numerous, and in themselves indicate the stages of development; thus, a series of 21 figures is devoted to the Pear, 17 to *Cerasus Juliana*, 11 to Agrimony, and 10 to *Spiræa Filipendula*. A summary of the more important results is as follows: (1) Form of ovule-rudiment, and development of nucellus. In *Pyreæ* the papilla is symmetrical for a time, and the two integuments are distinct in origin. In the other groups the ovular papilla becomes more and more asymmetrical, the nucellus papilla is displaced to one side, and the two integuments arise from adjacent cells. (2) The integuments of the ovule and seed. Contrary to the opinion of Baillon that all indigenous *Rosaceæ* (except *Pyreæ* and *Amygdaleæ*) have only one integument to the ovule, the author finds that almost all show a double integument. In *Geum*, *Fragaria*, *Potentilla*, and *Alchemilla*, while the origin of two integuments is discernible, the inner becomes suppressed, and the ovule is monochlamydeous. As a rule, the inner integument arises from four epidermal cells, the outer from one sub-epidermal cell. Their further growth depends on that of the nucellus papilla. In *Pyreæ* both integuments are distinct from chalaza to micropyle. Where the papilla soon becomes asymmetrical, the two integuments become more or less fused and can only be distinguished near the micropyle, or not at all. With the early curvature of the papilla, there is a corresponding suppression of one or both integuments on the side next the funicle. The development of the seed-coats is variable in the groups, both as to differentiation and cell-wall changes. (3) Evolution of the nucellus. This arises very constantly from several sub-epidermal cells. After the first stages of growth, there are considerable variations in the different groups. (4) Evolution of the embryo-sac and its contents. This is described in each case, but the details of fertilisation are not given. The growth of the embryo and its relation to the endosperm are discussed at length. The development of the seed is slow in comparison with its size, and seeds may be found apparently full-grown, yet with only a tiny immature embryo.—*W. G. S.*

Ovules as a Basis of Classification.

Ovules considered as Bases of Classification. By G. Senn (*Bot. Zeit.* No. 20, pp. 305–310, Oct. 16, 1902).—A review of a monograph by Van Tieghem (*Ann. des Sci. Nat. Bot.*, *sér.* 8, vol. 14, p. 213) on a natural system of classification based on the primary reproductive processes. A general outline of the resulting nomenclature is given, and although the reviewer doubts the general practical applicability of the system, he inclines to the belief that the development and conformation of the ovum, as embracing the organs most protected from external influences, might well be worthy of more consideration as a systematic basis than it has hitherto been held to be.—*C. T. D.*

Growth of Unfertilised Seed.

Parthenogenesis in Thalictrum purpurascens. By M. Koernicke (*Bot. Zeit.* No. 22, p. 343, Nov. 16, 1902).—Note on contribution by

J. B. Overton (Hull Bot. Lab. xxxv., *Bot. Gaz.* 1902, No. 33, pp. 363–375, 2 plates) on the production of plants from non-fertilised seed, the ovum developing precisely as if impregnated. *Antennaria alpina* and species of *Alchemilla* are cited as other parthenogenetic examples.

C. T. D.

Plankton in the Thames.

Phytoplankton of the Thames, Preliminary Report on. Algological Note. By F. E. Fritsch (*Ann. Bot.* vol. xvi., No. 63, p. 576).—The free-swimming or floating plant-life of rivers has been very little studied, and, as far as the author is aware, no paper on this subject has ever been published in this country. This note, therefore, is of considerable interest, and especially as it deals with an important river like the Thames. It is worth note that marine species reach to about Kew, while fresh-water species are there dying off. "The quantity of plankton-organisms decreases steadily as we approach the river's mouth. Plankton-hauls from the Thames at Kew showed that many of the Desmids and Pediastrums are either dead or in a dying state, and many of the Diatoms merely consist of the empty frustules. . . . Even at Kew a few truly marine species (e.g. *Coscinodiscus radiatus*, *Surirella ovata*, *Rhaphoneis Rhombus*) were found, and had my observations extended over a greater length of time, more would probably have been discovered. I do not think that many of the fresh-water forms found on the upper reaches of the river will be met with much further down than Kew." The collecting was done between Kew and Cookham on six separate days during a period of little more than a month, and the examinations were apparently made in the Jodrell Laboratory at Kew, whence the note is dated. A table of fifty-six species of *Chlorophyceæ*, *Conjugatæ*, *Bacillariales*, *Schizophyceæ*, and *Flagellatæ* is given, showing the distribution and relative number of the species found.—*R. I. L.*

Ovule Development.

Piperaceæ, Development of. By D. S. Johnson (*Bot. Gaz.* xxxiv. p. 321, No. 5; plates ix.–x.)—The author discusses the following structures of *Piper* sp.; (i.) The ovule, seed, and fruit; (ii.) The development and germination of the seed of *Heckeria*; (iii.) Germination of the seeds of *Peperomia* and *Heckeria*; (iv.) Summary and conclusions. A peculiarity resides in the fact that the embryo-sac of *Peperomia* contains 16 free nuclei derived from the megaspore nucleus; and that 8 are fused to form the endosperm nucleus, 7 others are persistent near the wall of the sac, and one near the egg in the position of a synergid. The ripe seed has a very small endosperm, chiefly aleurone, but has an abundant perisperm of starch.—*G. H.*

Plant-Breeding.

Plant-Breeding: Recent Work in New Jersey (*U.S.A. Exp. Stn. New Jersey, Report* 1901).—Dr. B. D. Halstead gives some results of experiments in plant-breeding carried out during last year.

Lima Beans.—Crosses were obtained in the previous year between two varieties of Lima Beans, 'Henderson' and 'Burpee.' From the seeds of these plants 472 plants were raised which varied considerably in vegetation, but all except seven adhered to the dwarf type. These seven were of the tall type, and six of them climbed the poles with which they were provided vigorously. The type of fruit among the dwarf hybrids varied little, and was unlike that of either of the parents. The following table gives a comparison between the hybrids and their parents.

—	No. of plants	No. of ripe pods.	No. of green pods filled.	No. of green pods empty	Av. no. of pods per plant.
'Burpee' .	369	449	1,056	620	6
'Henderson' . .	700	3,550	340	350	6
Hybrids . . .	472	10,236	2,241	402	27

The hybrids were thus much earlier in reaching maturity than either of their parents, and yielded much higher. The seeds of the hybrids were nearer the 'Burpee' type in size than the 'Henderson,' and the quality, while not so rich as the 'Burpee,' was higher than the 'Henderson.'

The pole beans mentioned above gave an average yield of 166 pods per plant, two of them producing 404 pods and 292 pods respectively.

Figures are given of the seeds.

Tomatos.—The results obtained from 37 plants raised from the seed of a red-fruited hybrid between 'Golden Cross' and 'Dwarf Champion' are interesting. The hybrid bore 83 fruits, all below average size and nearly free from seeds, while the plant itself was unusually large and vigorous, having a mottled green foliage. Of the progeny, 5 bore no fruit, 20 bore red fruits, 8 yellow, the remainder not stated. The habit of growth varied considerably, some being bushy, others very rank-growing; in one case the foliage was potato-like. The number of fruits per plant varied from 0 to 406, 6 plants each producing over 100 fruits, and 10 below 10; 5 plants produced ripe fruit during the second week in August, others were much later and failed to mature the majority of the fruits produced.

Cucumbers.—A list of variations obtained by growing seeds from the fruit of a cross between 'White Spine' and 'White Pearl' is given, and the variations figured. The colour of the fruit varied from white to deep green, the size and shape were very variable, while in some cases the fruits were very spiny and in others quite smooth. The type which was fairly uniform in the previous year had, as is the general rule with crossed plants, been broken up in the second generation.

Egg Plants.—By crossing 'New York Improved Spineless' with 'Long People' a variety has been obtained which is a great gain upon either of its parents, if it maintains itself in years to come. The fruit of the cross has a shape something like that of a pear of the 'Louise Bonne' type, a dark purple colour similar to that of 'Long Purple,' a quality superior to that of its ancestors "the small slices, when properly prepared, suggesting strongly the oyster without its disagreeable features to those whose defective digestion is insufficient for the bivalve." The plants are much more vigorous than their parents, and produce fruits a month or six weeks earlier.

Sweet Corn with Red Grains.—Pink grains from ears having over ten rows of grains in the cob were selected for seed. The number of grains of each colour for five average ears was as follows :

	Uncoloured.	Black.	Red.
	69	21	342
	35	140	205
	43	115	322
	215	110	179
	82	21	257
Average	90	81	261
Average for 1900	172	121	92

Thus, by selecting pink grains as seed, the number of red grains in the cobs was very largely increased at the expense of the uncoloured and black grains.

There was a much greater range of variation in the ears this season than last, and nearly all of them were more than eight-rowed, in this respect showing that the 'Black Mexican' type is largely lost. The number of rows of grains in the cobs was counted for 100 ears where the seed-ears varied in the number of rows.

No. of rows in the ears from which seed was taken.	Produce.			
	8-rowed cobs.	10-rowed cobs.	Over 10-rowed cobs.	Average.
8-rowed ears . .	26	36	21	28
10 ,, ,, . .	46	25	44	38
12 ,, ,, . .	27	37	31	32
14 ,, ,, . .	1	2	4	2
Total . . .	100	100	100	100

The 'Egyptian' type, which has no fully established number of rows in the cob over eight, seems to have had a preponderance of influence over the 'Mexican' type, which is an eight-rowed variety, in the production of the number of rows in the ear.

Other experiments were carried out with white and black seeds taken from ears having more than ten rows. The colour of the seeds again showed the preponderating influence of the mother in this direction.

—	White.	Pink.	Black.	Total.
Ear from white seed .	330	33	93	456
,, ,, black ,, .	178	49	193	420

A count of the rows of seed in the best ears throughout the plot gave the following :

—	White Seed.	Black Seed.
No. of 8-rowed ears . . .	15	15
,, 10- ,, ,, . . .	42	41
,, 12- ,, ,, . . .	58	74
,, 14- ,, ,, . . .	4	6

Salsify Hybrids.—The hybrid plants *Tragopogon pratensis* × *T. porrifolius* reported on in U.S.A. Exp. Stn. Rep., New Jersey 1900, produced seed sparingly. There are two types in the crossed plants raised from these seeds as regards the colour of the inflorescence, (1) with both ray- and disc-florets coloured alike, darker red, red violet, and (2) those with ray-florets dark, while disc-florets are yellow. There are no intermediates. In the crosses the violet has diminished, while the red has greatly increased, and the yellow is scarcely in evidence in one of the types.

Other Experiments in Hybridising.—*Martynia louisiana*, Mill. was crossed with *M. lutea*; an acceptable pickle may be thus produced. An attempt was made to cross *Tecoma radicans* with *Martynia*, but unsuccessfully, as was an attempt to cross *Linum grandiflorum* with *L. usitatissimum*, L. In the latter case several full-sized seed-vessels were produced, but they contained no seed.—*F. J. C.*

Evils of Premature Pollination.

Pollination, Injurious Effects of Premature. By Ch. P. Hartley (*U.S.A. Dep. Agr. Bur. Pl. Ind., Bull.* No. 22, with 4 plates of photos; 1902).—The object of the paper is to show that "a premature pollination is destructive to the flowers of some plants, preventing them from forming seeds. With Tobacco the growth of the pollen-tubes into ovaries before the ovules are mature enough for fertilisation results in an injury which causes the flowers to pale."

Numerous experiments are described in detail, giving as the extreme difference 20 flowers pollinated two days before opening; no seed-pods set.

20 flowers, do. ½ day; 19 seed-pods were set, or 95 per cent.

"Dividing the six series of experiments into two groups, namely those pollinated more than one day before opening, and those pollinated one day or less than one day before opening, they show that the former set 4 per cent. of seed-pods which contained no germinative seeds, while the latter set 86 per cent. of seed-pods which contained germinative seeds."

A microscopic examination showed the pollen-tubes within the ovary, but none can penetrate the micropyle in the immature ovule, and "in just what way the flower has been destroyed has not been determined."

Experiments with *Datura Tatula* showed similar results to those with Tobacco. Other experiments were tried with flowers of Cotton-plant and Oranges, but with less decisive results. With the Orange, "it was demonstrated that fruits containing good well-developed seeds will result from flowers pollinated nine days before they could naturally have received pollen."—*G. H.*

Pollen in Conifers.

Pollen-sac Dehiscence in certain Conifers. By K. Goebel (*Flora*, vol. xci. 1902, pp. 236–255; 13 figs.).—The mode of dehiscence is in direct relation to the position of the pollen-sacs at anthesis, so as to facilitate the ready escape of the dusty pollen. Where the sacs are vertical or down-turned, the split is longitudinal (*Pinus*, *Picea*). Where the male cones are down-turned the slit is oblique, and expands below into a spout (*Larix*, *Abies*). In *Taxus* the epidermis which forms the exothecium of the sac is detached along all its circumference, the walls of the verticil of sacs of an anther rolling back as they shrink, like the segments of a closing umbrella. *Gingko* differs from all other Conifers and Cycads, and resembles Angiosperms in possessing a sub-epidermal "endothecium" of hygroscopic reticulate cells in its anther-wall. The twin pollen-sacs are parallel at first, and open by facing slits on the inner side of each. As each sac dries it shrinks from the other and passes through a right angle, so that the gaping slits now face directly downwards.—*M. H.*

Polycotyledony.

Polycotyledony, Morphological Note on. By Sir W. T. Thiselton-Dyer, K.C.M.G., C.I.E., F.R.S., Director Royal Gardens, Kew (*Ann. Bot.* vol. xvi., No. 63, p. 553, with plates xxiv. and xxv., and figure in text).—This is one of a vauable series of notes (No. viii.) contributed from the unrivalled resources at Kew. The author writes: "It is the object of these notes as much to suggest problems as to solve them. In the present case, I propose to tell a story of which I do not quite see to the bottom. . . . My friend, Professor Bayley Balfour, in a very suggestive address which he delivered from the chair of Section K at the Glasgow meeting of the British Association, gave a theory of the Dicotyledonous Embryo, the main points of which I will quote: 'We ought, I think, to look upon the embryo as a protocorm of embryonic tissue adapted to a seed life. . . . Confining ourselves to the general case, the axial portion of the protocorm of the Dicotyledon, the hypocotyl, bears a pair of lateral outgrowths, the cotyledons, and terminates in the plumular bud and in the primary root respectively. The cotyledons are its suctorial organs, and the hypocotyl does the work of rupturing the seed, and placing the plumular bud and root by a rapid elongation which commonly brings the plumular bud above ground, protected, it may be, by the cotyledons. These latter may then become the first assimilating organs, unlike or like to the epicotylar leaves.' This, though a guarded statement, appears to imply that the cotyledons are more or less organs *sui generis*, and not homologous with ordinary or epicotylar leaves. It brought to my recollection some observations which I made some years ago, and which it now seems worth while to put on record. It is well known that the Sycamore (*Acer Pseudo-Platanus*) reproduces itself spontaneously from seed with great readiness. . . . A notable portion of the seedlings of this tree (at Kew) came up with three cotyledons. The circumstance is not, however, unusual, and similar cases are discussed in Duchartre's classical 'Mémoire sur les Embryons qui ont été décrits comme Polycotyle' in the *Annales des Sciences Naturelles* (3e sér., x., pp. 210–211)." Duchartre is quoted at some length, but let us take only his opinion. "'Je me borne à figurer ici deux de ces germinations, choisies entre beaucoup d'autres; dont l'une présente un cotylédon bifide, tandis que l'autre en montre un profondément biparti. . . . Si l'on observe que la fente qui les sépare descend un peu moins profondément que celle qui existe entre les deux vrais cotylédons; si, de plus, on fait attention à la situation des deux petites feuilles primordiales déjà développées, qui alternent avec le cotylédon biparti comme avec celui qui est resté entier, on ne pourra conserver le moindre doute sur le phénomène de division qui a valu à cette germination son apparente polycotylédonie.' 'Nothing, apparently, could be clearer than this explanation, but unfortunately it does not meet the facts as they presented themselves at Kew. In pl. xxiv., fig. 2, I have figured a seedling with three perfectly distinct and normal cotyledons and three equally normal young leaves developed from the plumule. . . . Pl. xxv., fig. 4, shows the result at the end of the second year. It will be seen that I obtained a young Sycamore with ternary instead of opposite leaves, and I was in hopes that I had secured a new seminal variation which would be constant. These hopes were, however, frustrated." In pl. xxiv., fig. 1, the author illustrates a case similar to those which Duchartre studied and also another, which apparently he did not meet with, having three cotyledons followed by a pair of opposite leaves, one of which is bipartite. "In the former case, according to Duchartre's view, the embryo started with a pair of cotyledons, one of which subsequently branched." Having referred to Masters (*Vegetable Teratology*, p. 370), who thinks with Duchartre that "some of these cases may be accounted for by chorisis or by a cleavage of the original cotyledons," the author writes :—

"I arrive, however, at the conclusion that the simplest explanation is that in all the cases now described the embryo is provided with three instead of two primordial lateral outgrowths, and that these either develop completely into three normal cotyledons, or that two of them sooner or later coalesce into one which is more or less deeply bifid. If this explanation is true of cotyledons, it must equally apply to the similar phenomena exhibited by the epicotylar leaves. . . . I confess that all the evidence seems to me to point to the fact that cotyledons, whether suctorial store organs or foliaceous, must still be regarded as foliar organs. Lord Avebury (*Seedlings*, vol. i., pp. 9, 10) cites the opinion of Klebs who observes, that 'on the whole the forms of cotyledons are much simpler than those of leaves, and. . . . that while in some cases perhaps, like the first leaves, they retain the form which characterised the species in bygone ages, we may rather, as a more generally applicable explanation, apply to them the suggestion of Goebel with reference to stipules, and regard them as simplified by arrest.' Lord Avebury adds that another suggestion has been that cotyledons are 'a survival of the universal foliage of deciduous trees in olden geological days, ere time had differentiated them into their present varied forms.' That cotyledons preserve a more ancient and primitive type of foliage is in accordance with the general facts of embryology. The cotyledons have their own battle to fight, but it is not that of the adult plant, and adaptations suitable for the more strenuous struggle would be superfluous in the simpler conflict. This consideration is strengthened by the case produced in fig. 30, of a young seedling of *Libocedrus macrolepis*. In this, after a time, there is a complete change in the form and disposition of the foliar organs. The primitive leaves, which are not very different from the cotyledons with which they are serially continuous, no doubt represent a generalised and unmodified type of foliage."—*R. I. L.*

Experiments on Potato-tubers.

Potato-tubers, Experimental Morphology upon. By H. Vöchling (*Bot. Zeit.* 60, pls. 3–4). Rev. in *Bot. Gaz.* xxxiv. p. 242, No. 3, by B. E. Livingstone.—The French variety "Marjolin" was used. Grown in darkness at 6–7° C. [25–26° F.] few roots but numerous new shoots are developed. The latter take the form of tubers, but without the small leaves usually grown in darkness. At 25–27° C. [77–80° F.] roots and shoots are produced. As the temperature below this optimum is decreased, more tubers and fewer leaf-bearing shoots are produced; and in the neighbourhood of the minimum for growth all the shoots are tuberous. The temperature seems to be directly effective in this response. The shoots change their response to the gravity stimulus; being negatively geotropic at the higher temperature, they become positively so at the lower. At the higher, a culture with little water produces only tubers. When water is added to the soil leafy shoots are developed. In cultures with dry air above the soil, the leaf-bearing shoots creep along the surface of the substratum, being hydrotropic. With a partial pressure of oxygen, the roots fail to be provided with the usual hairs.—*G. H.*

Protective Provisions of Young Leaves.

Protection of Young Leaves and Cotyledons (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 173–193).—Professor Dr. A. Hansgirg (Prag) continues his well-known researches on leaf protection (*Phyllobiologie*).

These young leaves are more adaptable, and endure repeated changes of temperature &c. better, than the mature forms. The hypocotyl and cotyledon stalk show characteristic curvatures which are independent of light, gravity, &c. Examples and descriptions are given of: 1. *Aspidium* type (circinate). 2. *Convallaria* type (convolute), often protected by a horny conical point on the tip of the leaf; *Caltha*, *Ficus*, &c. 3. Palm type (plicate). 4. *Peltiphyllum* type (*Soldanella*, &c.), with the tip of the leaf pointing downwards, and the midrib bent or curved so as to break through the earth. 5. *Aralia* type, similar to the above, but with a curve of the petiole. 6. *Hydrophyllum* type, similar, but with special knobs or swellings on the young leaflets which shield the lower ones. 7. *Podophyllum* type; the stiff upright point of the petiole breaks through the earth, the lamina is folded back against the petiole. 8. *Asarum* type, folded along the midrib and breaking through the earth by their apices. 9. *Prunus* type; the two leaf-halves folded against one another. 10. *Asclepias* type, also folded along the midrib but covering one another (*Buxus*, *Deutzia*, *Digitalis*, *Lychnis*, &c.); this is very common. 11. *Rhododendron* type (revolute). 12. *Daphne* type (involute). Reference must be made to the original for transitional forms and the very wide series of examples cited.—*G. F. S.-E.*

The Sensory Zone of Roots.

Roots, The Sensory Zone of. By Frederick C. Newcombe, University of Michigan. With a figure in the text. (*Ann. Bot.* vol. xvi., No. 63, p. 429).—Darwin wrote in "The Movements of Plants": "We believe that there is no structure in plants more wonderful, so far as its functions are concerned, than the tip of the radicle" ; and he also said it acts like the brain of one of the lower animals. Since the publication of these noteworthy remarks in 1880, various marvellous experiments have been performed, especially by Mr. Francis Darwin, the results of which do but strengthen and emphasise their truth. No less than nine tropisms or responses, due to as many distinct stimuli, are incidentally alluded to in this paper, but the author deals only with his work on *rheotropism*, the response due to a current of water. The author writes: 'In a recent paper* evidence was offered to show that the stimulus giving the response known as rheotropism is perceived by the apical millimetre of *Zea Mays*, L., and of *Raphanus sativus*, L. There was evidence to show also that, in the root of the latter plant, the stimulus was perceived throughout the elongating zone, and still more posteriorly, to a distance even 15 mm. back of the apex, this being at least 10 mm. beyond the limit of the elongating zone. This discovery was of such interest that it seemed advisable to extend the research to other plants, to ascertain whether the phenomena observed in *Raphanus* might be found to be general. The results obtained in such an investigation are reported in the present paper." The author describes his experiments with several species, and in his summary and conclusion says: "As far as we know, there is no reason in the nature of the case why the sensitiveness of roots to stimuli should be confined to the region capable of elongation. A grass stem receives and responds to the gravitation stimulus when under ordinary conditions its growth has ceased; the cotyledon of *Panicum* is sensitive to light after growth has ceased; and the leaves of *Mimosa* and of numerous other plants continue to receive and respond to stimuli long after growth has ended. The region of roots shown in the foregoing pages to be sensitive to stimuli. though no longer capable of elongation, may still grow in diameter. And it may be said here that the assumption of the limitation of sensitiveness of roots for certain stimuli to certain regions is not in all cases justified. Czapek appears to have tenable ground for limiting the perception of gravitation to the root apex. But that moisture stimulates only the apex cannot be maintained until the elongating zone and the back part of it are tested in the neutralisation of gravitation. So also with thermotropism, aerotropism, and the like; for aught we know, the stimuli for these responses may be received beyond as well as in the elongating zone. . . . Of course there is pressure against the roots by the stream of water. But thigmotropism (response to touch of rough surface) has not been, and probably cannot be, demonstrated in ordinary roots by ordinary means. If rheotropism is not thigmotropism, we do not know what the nature of the stimulus is; but until thigmotropism has been demonstrated in roots, no claim can be made for the identity of these two responses."—*R. I. L.*

* Newcombe, "The Rheotropism of Roots," *Bot. Gaz.* xxxiii., 1902, p. 117.

The Nile Sadd, or Sudd.

Sadd, The, of the Upper Nile: its Botany compared with that of similiar obstructions in Bengal and American waters. By C. W. Hope (*Ann. Bot.* vol. xvi. p. 496).—This interesting article opens with the following paragraph of the introduction :—" The Cataracts of the Nile are well-known obstacles to navigation between its mouth and the Soudan, but they are beginning to yield to the attacks of modern engineers, who are throwing dams across the river, and providing side-channels through which navigation will be carried on by means of locks. The cataracts are caused by barriers of granite rock which cross the bed of the river. But it is not so well known that an almost more serious obstruction to navigation is caused by the accumulation of a few species of plants floating in the Bahr-al-Jebel, or Mountain Nile, beginning about 435 miles south of Khartum, and extending thence southwards for about 250 miles; and that this accumulation also seriously reduces the flow of water northwards to the Lower Soudan and Egypt. The great Equatorial Lakes store the rainfall of vast catchment basins, and so regulate its off-flow northwards by means of the Mountain Nile ; but this function is greatly neutralised by the vegetable accumulation which begins 715 miles northward, in a comparatively flat country, and which reduces the velocity of the current, and also causes the water to spill right and left over the country and go to waste in shallow lakes and lagoons, where it is subject to evaporation to a serious extent." Seriously contributing to this " Sadd " is the common Papyrus. " Macgregor, in the *Illustrated London News*, April 24, 1869, describing the Papyrus on the waters of Merom, Syria, said :—'On this (morass) is a vast floating forest of *Papyrus* and cane, perfectly dark inside. I could never penetrate more than 3 feet. Many of the stalks of the *Papyrus* are as thick as my arm. The water percolates below and through the spongy mass, and there loses at least half its volume by absorption and evaporation. This impassable barrier is about a mile wide.' The other main factor in the composition of Sadd is, according to Sir William Garstin, the 'um-soof' reed. That is the Arab name of the plant: the botanical name is, according to Dr. Georg Schweinfurth (the author of *Beitrag zur Flora Aethiopiens*, Berlin, 1867, and other works on the botany of the Nile region), *Vossia procera*, a grass belonging to the *Rottboelliecæ*." Another of the "Sadd" plants is "Ambatch" (*Herminiera elaphroxylon*), belonging to the *Leguminosæ*, of which Dr. Schweinfurth writes in his book of travel *The Heart of Africa*: " It plays so prominent a part in the waters of the Upper Nile that it might fairly be designated the most remarkable of the aquatic plants. . . . The 'Ambatch' is distinguished by the almost unexampled lightness of its wood, if the fungus-like substance of the stem deserves such a name at all. It shoots up to fifteen or twenty feet in height, and at its base generally attains a thickness of about six inches. The weight of this fungus-wood is so insignificant that it really suggests comparison to a feather; only by taking it into his hands could anyone believe that it were possible for one man to lift on his shoulders a raft made large enough to carry eight people on the water." Mentioned among the smaller plants of the Sadd are *Pistia Stratiotes*, *Utricularia*, *Azolla*, *Ceratopteris*, and *Aldrovanda*, the latter a tiny plant allied to *Drosera*, which catches small aquatic animals by means of its bilobed leaves, after the manner of *Dionæa*. In Bengal 'Ambatch' is represented by the closely allied *Æschynomene aspera*, *Azolla nilotica* is represented by *A. pinnata*, and of the identical plants are *Vossia procera* and *Pistia* &c. In America the Sadd is of entirely different composition. The 'Water Hyacinth' (*Eichhornia speciosa*) is the main factor in the block of the St. John's River. It was originally introduced from tropical South America.—*R. I. L.*

Decrease of Helpful Parasites.

Scale Insects, Limitations of Parasites in the Destruction of. By Walter W. Froggatt, F.L.S., Government Entomologist (*Agr. Gaz. N. S. W.* pp. 1087–93 ; November 1902).—An article on the question of destroying noxious insects by other means than the mechanical processes of spraying, fumigating, or poisoning, such as the introduction of parasitic insects that destroy the injurious ones. It is pointed out that the Eastern entomologists, including Dr. L. O. Howard, chief of the Entomological Division of the U. S. Department of Agriculture, and the majority of the trained men, declare that while predatory and parasitic insects are most valuable as destroyers of noxious insects, they cannot, unless in exceptional cases, check their ravages, unless the farmer or orchardist also lends a hand.

The other school of entomologists, among whom those from California are the most prominent, claim without any reservation that every noxious insect has a parasite which destroys it, and if we can find the native country of any particular insect, we shall there find the parasite that keeps it in check; these would stop all mechanical methods and leave everything to the introduced or native parasites.

The latter method certainly appeals to the orchardist who does not intend to do anything towards keeping down pests, but lets his more energetic neighbours worry at those he breeds in his neglected orchard and which are sufficient to damage all the surrounding trees. He would sit on his fence and wait for the parasites to clean his trees, for if he were to interfere he would damage the insects working on his behalf.

There is just enough truth in this theory to make it plausible to the ordinary individual who has not gone further into the matter, that every insect has its parasite, internal or otherwise. That parasite will also have its particular foe to keep up the balance of power that we know exists in all branches of the animal kingdom. In a wild country, where man has not interfered with the surroundings, the struggle for existence works out its own end, and the hardy plant or animal best adapted to the situation survives.

Everything is changed, however, when man appears with axe and plough, clearing off the forest flora to make room for crops and trees, succulent and delicate in comparison with the original vegetation they replace, through long years of cultivation under artificial conditions. The supply of food is increased perhaps a thousandfold, and insects that were restricted on account of a limited food supply also multiply in proportion.

Such a case in point occurred when the eastern emigrants, pushing out west, planted Potatos in the home of the then unknown Colorado beetle (afterwards only too well known as the "Potato bug"). This beetle fed upon the wild Sand Burr (*Solanum rostratum*), a plant belonging to the same natural order of plants as the cultivated Potato, so that when it found such a luxuriant growth of more suitable food, it deserted its old host plant, and, multiplying in millions, spread through the Potato-fields of the whole of the United States, and is still one of their greatest pests.

If every insect's parasite were as effective under all conditions as is claimed by the one section, surely the "Potato bug," with its soft-bodied larvæ, would have been kept in check by its natural enemies.

This is an admirable illustration of the case where the parasite, if any, did not increase in proportion to its host.

Many other instances might be quoted to show how insect pests in their native land remain and become increasingly formidable enemies with the spread of cultivation. The Chinch bug and the Hessian fly, common in America, levy an incredible toll on the wheat-fields of the States, and though the latter has a number of well-known parasites, and the actual home of both pests is well known, they both have to be combated with mechanical methods, sowing catch crops, or the doubtful spreading of fungus germs.

Reference is also made to the great increase in the scale insects, aphis and grubs which attack the trees of our orchards, special note being made of red scale, San José scale, black or brown olive scale, white louse and mussel scale. In bringing a most interesting article on insect life to a conclusion the writer points out that he is quite in unison with other economic entomologists who have carefully studied the question of the relative value of predatory or internal parasites from all points, in agreeing that, while they do their part in acting as a check on the spread of the countless millions of injurious insects, and minimising the damage caused, it is only under exceptional circumstances, and in isolated cases, that they have done more. Just as the noxious insects appear in immense numbers one year, and not in the following one, so is the supply of the parasites variable (even when known to exist); and naturally, though they might do very good work one year, the next will find them wanting.—*H. G. C.*

Seeds and Temperature.

Seeds, Resistance of, to High Temperatures. Note by Henry H. Dixon, Trinity College, Dublin (*Ann. Bot.* vol. xvi., No. 64, p. 590). Abstract of paper read before Section K of the British Association, Belfast, 1902.—"Various experimenters have investigated the limits of temperature which spores of the lower plants and animals can withstand. The results they have obtained show that these spores, if dry, can germinate after exposure to the lowest temperatures obtainable, while the upper limit for similarly dried spores lies between 100° C. (212° F.) and 130° C. (266° F.). For seeds of the higher plants also, it has been more recently shown that the lowest temperatures available are without harmful effects. This note contains an account of some experiments on the maximum temperatures which seeds can withstand, and after which they will retain their germinative power." The author gives a list of twenty-two species, in ten natural orders, showing the highest temperature under which the seeds survived and afterwards grew, the duration of exposure being at least one hour. *Medicago sativa* survived the highest temperature of all, viz. 121° C., but another leguminous plant, *Trigonella Fœnum-græcum*, grew at the lowest temperature of all that survived, viz. 90° C. Seeds of *Lagenaria vulgaris* and *Heracleum giganteum* were unable to grow after exposure to that temperature. *Convolvulus tricolor* comes next to *Medicago sativa* in power of resistance. "The seeds of any one species show considerable individual differences in their power of resisting high temperatures. . . . The time needed for germination is increased by exposure to temperatures near the maximum. . . . Long exposure to a comparatively low temperature may prove more fatal than a short exposure to a high temperature. Thus, seeds which will germinate successfully after one hour's exposure to 110°–120° C. (230°–248° F.) will not germinate after twelve days' exposure to a temperature of 95°–97° C. (203°–206·6° F.)."—*R. I. L.*

Anatomy of Selaginella.

Selaginella, Contributions towards a Knowledge of the Anatomy of the Genus. By R. J. Harvey-Gibson, M.A., F.L.S., Professor of Botany in University College, Liverpool. Part IV. The Root (*Ann. Bot.* vol xvi. No. 63, p. 449, with plates xx. and xxi.).—In this paper the root of *Selaginella* is extensively treated, and is valuable for study and reference on that account. It is most obviously interesting, perhaps, from the views expressed by the author of the nature of the "rhizophore." "Nägeli and Leitgeb's researches lay the foundation of our knowledge of the anatomy of roots, and as their observations and conclusions have been called in question by more recent investigators, it may be advisable to summarise their results at somewhat greater length. Their observations were apparently made on four species, viz. *S. Kraussiana*, *S. Mertensii*, *S. cuspidata*, and *S. lævigata*. They commence by calling in question the accuracy of applying the term 'root' to the organs arising at the branchings of the stem, and point out that a root-cap is absent from the apices of such organs. They further express their belief that these bodies are in reality cauline in their homology, giving them the name of 'rhizophores' (*Wurzelträger*). Despite the fact that several authorities have brought forward evidence and arguments against this view, the name is still commonly employed in text-books, &c., to designate the unbranched aerial portion of the root in such species as possess such organs. In the present paper the 'rhizophore' is designated as the 'aerial part of the root,' and that portion which is embedded in the soil as the 'subterranean part.'" In addition to the absence of a root-cap, Nägeli and Leitgeb point out that the "rhizophore," as they term it, is occasionally transformed into a leafy branch, and that it arises exogenously, whilst the true roots are developed from it later endogenously. This view is combated by Van Teighem and Russow, and the latter says that the so-called rhizophores and roots agree in anatomical structure. Van Teighem observes that neither in regard to exogenous origin nor absence of root-cap is *Selaginella* exceptional. "Anatomically it will be seen from the present paper that the aerial and subterranean parts of the root exhibit practically identical features . . . there does not seem any stronger reason for distinguishing the aerial part of the root by a special name and ascribing to it stem-characteristics than there exists for differentiating the aerial part of the root of a *Pandanus* or a *Rhizophora* from that which is subterranean and sub-aquatic. The view held by some authors that the aerial part of the root is of cauline value . . . is not supported by sufficient morphological, anatomical, or developmental evidence." Fellows who cultivate the procumbent species of *Selaginella* may readily observe the curious point that in some of them, particularly in *S. Kraussiana* and *S. Galeottei* for instance, the "rhizophore" or "aerial part of the root" clearly originates on the upper side of the stem and always at a joint.—*R. I. L.*

Reproductive Organs of Selaginella.

Selaginella, Studies on the Gametophyte of. By D. H. Campbell, Professor of Botany in the Stanford University, California, U.S.A. (*Ann. Bot.* vol. xvi., No. 63, p. 419; with plate xix).—While the gametophyte or prothallus of Ferns is well understood by most horticulturists, little or nothing is known to them of the corresponding structures of that most interesting and familar genus *Selaginella*; indeed a knowledge of it to botanists is only now, apparently, being brought correspondingly up to date. There are, no doubt, important practical points to become acquainted with, for we do not yet raise Selaginellas as we are accustomed to raise Ferns. "Several years ago the writer undertook the study of the development of the female gametophyte in *Selaginella Kraussiana*, and the results were published in brief form.* Before their publication a paper by Heinsen appeared, and since then four other contributions have been made by Arnoldi, Bruchmann, Fitting, and Lyon. . . . The most recent paper is by Miss Lyon. This is a somewhat extended study of the development of two native species, *S. apus* and *S. rupestris*. The most interesting point recorded by Miss Lyon is the retention of the macrospore within the sporangium until after the fertilisation of the archegonia." The earlier stages in the development of the male and female gametophytes alone are dealt with in this paper, of the former only, apparently, as concerns Miss Lyon's work, to which it otherwise largely refers. The author explains that the later stages of the gametophyte, the structure and development of the archegonium, have been sufficiently described and figured by him before. The figures of the plate all refer to the common *Selaginella Kraussiana*.—*R. I. L.*

Composition of Starch.

Starch Grains, The Structure of. By H. Kraemer (*Bot. Gaz.* xxxiv., p. 341, No. 5; pl. xi. and text figs.).—The author gives a short account of the previous views of the structure and chemical composition

* *Structure and Development of the Mosses and Ferns*, 1895, pp. 485–504.

of starch grains. He then points out that they can be distinguished from one another by eleven particulars which tend to show that starch is made up of several substances in varying proportions, but definitely arranged. A reserve grain formed by protoplasm out of sugar contains from the "hile" outwards: (*a*) a colloidal substance with cellulose; (*b*) granulose in addition; (*c*) the peripheral layer is elastic, probably consisting of an anhydride of cellulose; (*d*) sometimes dextrine, or maltose, dextrose, &c., are present, probably the results of alterations.

Illustrations are given showing the successive effects of reagents, as chromic acid, upon starch grains, revealing the colloidal and crystalloidal substances arranged in separate lamellæ, that is at the point of origin of growth, and in the alternate lamellæ the colloidal substance preponderates associated with the crystalloid cellulose; whereas in the other layers the crystalloidal substance, consisting for the most part of granulose, occurs in greater proportion.—*G. H.*

Stem Formation.

Stem, The Formation of the Outer Layer (*Berindung*) **by the Leaf-base.** By L. J. Čelakovský (*Flora*, vol. xc. 1902, pp. 433–465; 11 woodcuts).—In *Chara* it is very evident that the outer layers of the stem are formed by the base of the leaf; and Hofmeister showed that in *Equisetum*, *Selaginella*, and the immense majority of leafy plants, this rule holds good. His conclusions have been recently attacked by Tobler; and Čelakovský has maintained and extended Hofmeister's views. There are no unutilised bare intervals between the youngest leaves whose bases at first cover the whole surface of the stem; and as it is impossible for imaginary non-existent organs, such as "lines of separation" between adjacent leaves, to enlarge into existent ones, internodes, where present, must be formed from those regions of the leaf-base that grow longitudinally and tangentially more than they do radially.—*M. H.*

Fructification of Stereum hirsutum.

Stereum hirsutum, The varying Symmetry of the Fructification of. By H. Goebel (*Flora*, vol. xc. 1902, pp. 471–476; 2 cuts).—Herbert Spencer notes that the form of the pileus of *Agaricus noli tangere* may be a radial or eccentric and bilateral structure, according as it is isolated or one of a cluster, and that *Lentiscus flabelliformis*, growing on trees, turns up its trunk to bring the cap horizontal, and that this is also of the bilateral type, the side next the trunk being least developed. Goebel finds *Stereum* on a fallen Alder develop a radial pileus on either the upper or under surface, but an eccentric on the flanks of the tree; these lateral ones have the hymenium turned towards the ground, while the radial ones have it turned towards the substratum. The results may be due to the effect of unilateral illumination favouring the growth of the side more remote from the trunk.—*M. H.*

Effects of Low Temperature.

Suspension of Life at Low Temperatures, On the.—Note by Allan Macfadyen and Sydney Rowland (*Ann. Bot.* vol. xvi., No. 64,

p. 589). Abstract of paper read before Section K of the British Association, Belfast, 1902.—"Our first experiments were made with organisms possessing varying degrees of resistance, the extremes in this respect being represented by the sensitive *Spirillum* of cholera asiatica and the resistent spores of *Bacillus anthracis*. Ten organisms altogether were used and cooled down to −190° C., in the first instance for twenty hours and eventually for seven days. These exposures did not produce any appreciable impairment in the vitality of the organisms, either as regards their growth or their characteristic physiological properties, such as pigment and gas production, pathogenicity, &c. Amongst the organisms tested were photogenic Bacteria, and these likewise preserved their normal luminous properties; and we were able, through the kindness of Professor Dewar, to apply a still severer test, namely an exposure to the temperature of liquid hydrogen (about −252° C.), a temperature which is as far removed from that of liquid air as is that of liquid air from the average summer temperature. Ten hours' exposure to this temperature had no appreciable effect upon the vitality of the micro-organisms tested." The influence of prolonged exposure to the temperature of liquid air was then tried. "The organisms employed were the *Bacillus typhosus*, *B. coli communis*, *Staphylococcus pyogenes aureus*, and a *Saccharomyces*. . . . Samples were taken and tested at intervals for a total period of six months. In no instance could any impairment of the vitality of the organisms be detected. The ordinary manifestations of life cease at zero, but at −190° C. we have every reason to suppose that intracellular metabolism must also cease, as a result of the withdrawal of two of its cardinal physical conditions, heat and moisture. It is difficult to form a conception of living matter under this new condition, which is neither life nor death, or to select a term which will accurately describe it. It is a new and hitherto unobtained state of living matter—a veritable condition of *suspended animation*."—*R. I. L.*

Thuja.

Thuja, A Morphological Study of. By W. J. G. Land (*Bot. Gaz.* xxxiv. p. 249, No. 4, pls. i.–viii).—The development of the pollen-grain and tube, of the archegonium and the ventral nucleus, is described. This is followed by fertilisation, and the formation of the pro-embryo.—*G. H.*

On the Ascent of Sap.

Transpiration Stream, The Rise of the.—By E. B. Copeland (*Bot. Gaz.* xxxiv. p. 161, No. 3; and p. 260, No. 4).—This is an historical and critical discussion, and in part experimental. The author considers the various views held, from Dutrochet's in 1837 to the present day, adding at the close a very long bibliography. He is more especially concerned with Dixon and Joly's theory of cohesion, which he finds insufficient, observing: "Ten years ago Böhm alone imagined that capillarity could play the leading *rôle* in the ascent of sap. It had been tried and found wanting. Then it was named cohesion, and sprang at once into popular favour." The chief hindrance to the theory is the presence of bubbles when the tension is low and the transpiration active.

As to the actual cause the author says: "Of the various theories, we have found no other to have so much in its favour as that which says the ultimate cause of the upward movement of water in the wood to replace the loss by transpiration is the pressure of the atmosphere against the water absorbed by the roots. The kernel of the whole question is, Why is this atmospheric pressure (said to push water up only 10 m) exhausted so slowly by the ascent of the tree that, whatever height is reached, and however rapidly and forcibly water may be drawn from the wood, some pressure always remains? Of two physiological factors—removal of water by transpiration and the pressure of the atmosphere—we know that in the entire absence of either the water does not rise." He concludes with the words: "Much further than this we cannot go."

G. H.

On the Origin of Tubers.

Tuberisation, Studies on. By M. Nöel Bernard (*Rev. Gén. Bot.* t. xiv., 1902; with plates and figures in the text).—The author endeavours to show that the tubers so characteristic of many plants, *e.g.* Potatos, Orchids, &c., owe their origin to a reaction on the part of the plant to a fungus, apparently belonging or related to *Fusarium*. The fungus is found in the roots, and M. Bernard finds that the time of tuberisation bears a relation to the period at which infection in the soil takes place.

Many instances are known of the reactions of plants to other organisms, as the result of which definite structural features become apparent, as for example in the case of the production of galls. It may, however, be doubted whether botanists will be prepared to accept the author's conclusions in the absence of full experimental evidence based on rigid methods of cultivation of the affected plants when the fungus is excluded from them as well as when it is present. The alleged time relation between tuberisation and infection may only be a circumstance of a correlative character, and may not in any way indicate a causal connection such as M. Bernard supposes.—*J. B. F.*

Classification of Uredinæ.

Uredinæ on Umbelliferæ, Classification of, by Lindroth. By C. B. Plowright (*Gard. Chron.* No. 825, p. 282; Oct. 18, 1902).—The writer has extracted from Lindroth's work on these fungi a list of the British species, seventeen in number, and says the above-mentioned work "consists of a classification and description of all the known species, some eighty-eight in number, of Uredines which attack umbelliferous plants." The *Pucciniæ*, which are by far the most numerous, are divided into four groups: (1) those with reticulate teleutospores; (2) with verrucose; (3) with smooth; (4) with well-developed teleutospores, thickened above, on coloured persistent stems; and (5) a group which includes four exotic *Lepto-pucciniæ*.—*G. S. S.*

Nature of Stem Formation.

Vascular System of the Stem, the Nature of, in certain Dicotyledonous Orders. Note by W. C. Worsdell (*Ann. Bot.* vol. xvi., No. 64, p. 599). Abstract of paper read before Section K of the British Association, Belfast, 1902.—This note is of interest in the presence of older views, and in the relations shown to exist between Dicotyledons and Monocotyledons, usually regarded as fundamentally different. The author writes: "The object of the present thesis is to show, from anatomical data, that no hard-and-fast line exists between the two classes of Dicotyledons and Monocotyledons. The hollow vascular cylinder of the stem of a great number of dicotyledonous orders, if not of all, has been derived from a system of scattered bundles, such as is characteristic of the stem of almost all Monocotyledons. The flowering-stem and peduncle, as being those parts of the caulome which have undergone least modification owing to the necessities of adaptation to external conditions, exhibit, as a rule, most clearly the primitive structure which in the vegetative parts has become obscured. The axial organs of the seedling, owing to their limited diameter and the small number of leaf-traces concerned in the building-up of the vascular system, cannot as a rule possibly exhibit the primitive scattered arrangement of the bundles. As the stem increased in height and became more woody, and the leaves smaller and more numerous, the scattered arrangement of bundles in the stem . . . gradually became modified into that of a hollow cylinder, which was necessary both to support the bending-strains from a tall stem, and to facilitate the continuous centrifugal addition of new conducting-tissues by means of a secondary meristem. As far as the investigation has gone, the primitive scattered arrangement of bundles can be traced in the stem of about thirty dicotyledonous orders, viz. . . . and no doubt many more will reveal it." The author then gives a number of other characters very frequently accompanying the above feature in dicotyledonous stems. Among them he instances the rudimentary character of many bundles, representing those members of the vanishing scattered system which are not destined to form part of the functional cylinder, and also the trimerous character of some or all of the floral whorls. He mentions that several orders exhibit 5-merous single perianth whorls, which Čelakovský has shown is derived from two trimerous whorls by conversion of the lowest perianth-member into a bract. "In some Monocotyledons, the scattered bundles have become very peripheral, and even reduced to a single series or row of bundles. In some cases amongst Dicotyledons where the scattered arrangement has vanished from the stem, it can still be found in the less modified foliage-leaf, especially where the petiole is cylindric in contour or possesses a considerable diameter." In view of the facts given, the author cannot, he says, agree with those writers who maintain that the vascular structure of the seedling stem of Dicotyledons generally proves to be primitively tubular in character.—*R. I. L.*

Stem Formation.

Vascular Tissue of Plants, The Evolution of. By W. C. Worsdell (*Bot. Gaz.* xxxiv. p. 217, No. 3; with seven figures in text).—The author regards the most primitive form of stem-structure to have been a *solid stele* or *protostele* consisting of a central mass of wood or xylem, surrounded by a zone of phloëm. This is illustrated in the apparently most primitive forms of Ferns.

The next stage is for the xylem to be filled with pith in the middle. This is the *tubular stele.*

The *solenostele* follows, in which a zone of phloëm occurs in the interior of the xylem as well as outside it.

Now follows the solution of these three concentric rings into separate steles, forming the *diastelic* or *polystelic* condition. From this we trace the origin of the fibro-vascular bundles of Gymnosperms and Dicotyledons. This is brought about by the arrest of the centripetal growth. Having been a *mesarch*, *i.e.* growing both ways, the bundle becomes *endarch*, or only grows centrifugally.—*G. H.*

Yeast Proteolysis.

Yeast Enzymes Proteolytic (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 235–264).—Professor Dr. Th. Bokorny records many experiments showing that yeast can produce both peptic and tryptic enzymes. Under certain conditions only peptones and propeptones are formed, but badly nourished "Hunger" yeasts produce Tyrosin, Leucin, and Hexonbases. Both animal and vegetable albumen can be proteolysed by yeast. The experiments were conducted with "Flesh fodder meal" (Liebig's), Pease meal, Soja Bean meal, and Rape seed. From 10 % to 40 % dry or fresh yeast was used, with 0·5 to 1 % phosphoric acid, at temperatures from 35°–40° (in one case 20°). The time permitted was generally 24 hours, though in some cases 2 hours and in others 120 hours. The amount of the albuminous material proteolysed was in one case 20 %, but in others much less (from 1·5 to 2·8 % in most cases). The yeast proteolysis is also compared with that produced by animal pepsin and trypsin, and with acid proteolysis. A critical account is given of various researches with regard to variations in the amount of enzyme produced. Protein material appears to assist the formation of enzymes. The paper is of great importance for students of yeast, and of fermentation generally.

G. F. S.-E.

ABSTRACTS

FROM CURRENT HORTICULTURAL PERIODICALS.

Acacias, Greenhouse. By W. Dallimore (*Garden*, No. 1623, p. 445; 27/12/1902).—Many of the Acacias suitable for greenhouse culture are excellent indoor flowering plants, for they are easily grown, require little fire heat, and flower profusely either planted out in borders or when growing in pots. Upwards of 400 species are known, and of these about one fourth are in cultivation at Kew. A descriptive list of the most useful species is given.—*E. T. C.*

African Flora XXIV. By A. Engler (*Engl. Bot. Jahrb.* xxxiii. 1902, pp. 1–208; 18/11/1902).—Includes the following papers: "The Plankton (*Chlorophyceæ* and *Cyanophyceæ*) of Lake Nyasa and other lakes in the African Interior," by W. Schmidle. "East African Fungi II.," by P. Hennings, with description of new forms. "African Grasses III.," by R. Pilger, containing a discussion of the relation between the section *Ptychophyllum* of the genus *Panicum* and its relation to the genus *Setaria*. The author regards *Setaria* as forming with *Ptychophyllum* a section of *Panicum*. He also describes new species of *Panicum* and allied genera. "African Orchids VII.," by F. Kränzlin; descriptions of a number of new species in various genera. "African *Dichapetalaceæ* II.," by A. Engler and W. Ruhland; descriptions of a number of new species of *Dichapetalum*. "African *Lentibulariaceæ*," by F. Kamienski; notes on distribution and description of new species. "African *Moraceæ* II.," by A. Engler; description of new species. "African *Urticaceæ*," by A. Engler; description of new species in various genera. "African *Violaceæ*," by A. Engler, including notes on the systematic subdivision of *Rinorea*, and description of new species. "African *Passifloraceæ*," by H. Harms; description of a new genus *Schlechterina*, and new species of *Tryphostemma* and *Adenia*. "African *Leguminosæ*," by H. Harms; description of new species. "African *Acanthaceæ* VI.," by G. Lindau; description of new species. "African *Dilleniaceæ*," by E. Gilg; a revision of the African species of *Tetracera*.—*A. B. R.*

Alkaline lands of Colorado. (*U.S.A. Exp. Stn. California, Bull.* 140, *and supplement*, 2/1902).—These papers give an account of the composition of the soil in this part of the States. The soluble salts vary from 8,480 to 170,880 lbs. per acre, the average being 46,000 lbs. per acre, *i.e.* $1\frac{1}{7}$ per cent. Of this about $\frac{3}{8}$ is common salt and $\frac{3}{7}$ Glauber salt. To prevent the rise of alkali in the soil frequent and deep cultivation is necessary. A list of twenty-two plants native in the region is given and a long list of possible crops, together with tables and letterpress showing the maximum amount of sodium sulphate (Glauber salt), sodium carbonate, sodium chloride (common salt), and total alkali various trees and plants will tolerate, are inserted. A very suggestive paper for those having to deal with land impregnated with alkali.—*F. J. C.*

Almonds, Spanish. By David G. Fairchild (*U.S.A. Dep. Agr. Bur. Pl. Ind. Bull.* 26, 1902 ; 7 plates).—A description of the various sorts of Almond imported from Spain into England and America, with a statement of all the arguments in favour of an attempt to grow them in California. Soil and climate are both apparently very much the same among the foot-hills of California and in the parts about Malaga and Alicante, and in the other regions along the Spanish coast where the Sweet Almond of commerce is almost exclusively grown.

The only reason why American confectioners have hitherto preferred the imported Almond is that so far the best sorts have not been planted in California except experimentally.

The trade names of these best varieties are apparently not known to the growers in Spain, but were given by the English buyers, who formerly monopolised almost the whole supply available for export. The most esteemed sort is the so-called Jordan Almond, the long slim white one with which we are familiar at dessert, and which is grown in the neighbourhood of Malaga. Next to this in value comes the Valencia Almond, a short heart-shaped nut with a flat broad kernel and less delicate flesh, which grows about Alicante. "Mollar" is the local name for a soft-shelled variety, or more probably any soft-shelled variety, grown also about Alicante, largely for home consumption.

It still remains to be conclusively proved that the parts of California otherwise suitable to Almond-growing are free enough from late frosts for the cultivation of these choice sorts; but as the State is able already to produce $2\frac{1}{2}$ million lbs. a year of Almonds, only slightly inferior to the best imported ones, the experiment seems at all events worth trying.

The bulletin concludes with plates showing Jordan and Valencia Almonds in every possible position, a view of a fruiting branch affected with the gummosis to which the trees are liable, and a well-reproduced series of most pictorial photographs illustrating the home of the Almond in Spain, its manner of growth, and some of the processes of its cultivation.—*M. L. H.*

Alpine Regions, Geographical Distribution of Plants in. By Paul Taccard (*Flora*, vol. xc. 1902, pp. 349–377).—This is a largely statistical article. The most important conclusion is that the repartition of species in the different districts is largely conditioned by the existing ecological conditions. The more uniform the conditions in a district, the greater the falling off in numbers, and this is again greater for species than for genera, so that in the most uniformly conditioned districts each genus may be represented by a single species. This recalls the character of island floras.—*M. H.*

Amelanchier oxyodon n.sp. By E. Koehne (*Gartenflora*, 15/11/1902, p. 609, fig. 126).—A brief botanical description of a new species from North-West America.—*J. P.*

Ants in relation to Plants. By Hibernia (*Gard. Mag.* No. 2532, p. 285, 10/5/1902).—An interesting note in which the writer endeavours to show how destructive ants are to garden plants and their fruits, notwithstanding the statements made by other observers, who contend that ants are useful in destroying insect pests such as mealy bug, which infests so many plants under glass-house culture. "Hibernia" even asserts that ants provide and encourage mealy bug in order to provide themselves with food, while waiting for luscious Peaches and other fruits to ripen. It is not common knowledge that ants are capable of providing a stock of mealy bug on plants for convenient consumption, and the assertion is of sufficient importance to encourage investigation.

Whether ants "poison" soil about the roots of plants by leavening it with formic acid is also a subject of interest. The writer of this abstract is inclined to the truth of this assertion, as cases have come under his notice where *Clematis* and other plants have been killed when the roots have been growing in ant-infested soil.—*W. G.*

Ants, White. By C. L Marlatt (*U.S.A. Dept. Agric. Div. Entom., Bull.* 50, 6 1902; 4 figs.).—An account of the interesting life-history and social economy of the white ant of America (*Termes flavipes*, Koll.) which does great damage to houses, furniture, books, and sometimes trees and herbaceous plants. The insect, which is a member of the order *Neuroptera*, has been imported into Europe, where it is now rather widely distributed. Remedies are suggested, such as the removal of all decaying stumps (the normal habitat of the insect), complete dryness of the buildings, &c., and in cases of bad attack, when prompt measures are necessary, fumigation with hydrocyanic acid.—*F. J. C.*

Apple, Black Spot of the, together with Spraying for Fungus Diseases. By D. McAlpine (*Bull. Dep. Agr. Vict.* No. 3, 1902; plates i–xi., pp. 1–29).—The fungus here dealt with is *Fusicladium dendriticum*. Its effect upon the fruit is the most noticeable feature of the disease to the fruit-grower, yet, as a rule, the fungus first appears on the leaves and may attack the young shoots as well. The result often is that the leaf is completely destroyed by the fungus and the tree is deprived of the necessary nourishment obtained by means of the leaves. The extent of the damage varies, in the first place, according to the varieties: some are practically immune, while others are very susceptible; and, secondly, to certain climatic conditions favourable to the disease. The three most useful preparations recommended for this pest are the Bordeaux and Copper-soda mixtures, and the simple solution of copper sulphate. The first-named has, so far, given the most satisfactory results. It is a compound of bluestone and lime. "There are strictly no defined proportions in which these constituents should be mixed, though it is known that the lower the proportion of lime present, provided the mixture is not acid, the more satisfactory are the results." The methods of preparing the Bordeaux mixture are carefully detailed.—*R. N.*

Apple, Peasgood's 'Gold Reinette.' By W. Nollenberg (*Die Gart.* p. 61, 8/11/1902, with illustration).—Of the many sorts of Apples introduced to Germany from Great Britain as excellent new sorts, the greater number are useless, but this is one of the very best, adapted for the German climate and a first-class cropper, keeping well till the end of

January. The fruit is most attractively coloured, and has a splendid taste.—*G. R.*

Apples and Pears, The best (*Garden*, No. 1613, p. 260, 18/10/02). So great is the interest taken in fruit growing that a select list of the best varieties of Apples and Pears for gardens and orchards, arranged in the order of ripening, may be useful. Selections are given for all the year round.—*E. T. C.*

Apples, Origin of favourite sorts. By Alger Petts (*Gard. Mag.* No. 2545, p. 511; 9/8/1902).—An interesting account of the origin of such Apples as 'Ribston Orange,' 'Cox's Orange Pippin,' 'Blenheim Orange,' 'Mannington's Pearmain,' 'Emperor Alexander,' or 'Peasgood's Nonsuch,' and the newer sorts that have been derived from those well-known Apples. The history of the origin of popular fruits and flowers is always interesting, and this very readable account gives much information on the subject. *W. G.*

Apples, Storage of. By Alger Petts (*Gard. Mag.* No. 2553, p. 653; 4/10/1902).—An important subject to most gardeners, but one that is perhaps less understood than most others in connection with gardening. So rarely does one find in private gardens, new or old, an Apple storage room constructed on rational principles, that one feels that either the matter of Apple preservation is little understood or that it is not considered worthy of serious consideration.

This article deals with the subject from a scientific and practical standpoint, and is worth reading by those who are interested in the matter. The storage of fine fruit is as important as its production, but properly constructed Apple stores are seldom seen in private gardens in this country.—*W. G.*

Apples, The Twelve Best. By G. Gordon (*Gard. Mag.* No. 2552, p. 630; 27/9/1902).—The compiler of this selection must have felt a great responsibility before he attempted to make a choice from the hundreds of good varieties. Even a limited selection is seldom seen narrowed to twelve. It may be well to give the names given in this list. They are 'Bismarck,' 'Blenheim Pippin,' 'Bramley's Seedling,' 'Cox's Orange Pippin, 'Ecklinville Seedling,' 'King of the Pippins,' 'Lane's Prince Albert,' 'Lord Grosvenor,' 'Newton Wonder,' 'Ribston Pippin,' 'Worcester Pearmain,' 'Warner's King.' All these are admirably illustrated life size. Many a good sort is necessarily excluded from the select dozen.—*W. G.*

Apricot, The. By A. P. H. (*Garden*, No. 1621, p. 417; 13/6/1902).—A glass-covered wall or a house effects a great improvement in the size and quality of the Apricot. Fair success may be obtained by growing the Apricot in pots as an orchard-house tree, but great care is necessary, especially when the trees are in bloom. This practical article tells how to grow the Apricot under glass, and gives the best varieties.—*E. T. C.*

Araucaria imbricata. By F. W. Meyer (*Die Gart.* p. 79, 15/11/1902, with illustration).—The author describes an *Araucaria* growing in the garden at Pencarrow, Bodmin, bearing male flowers and female cones on the same tree, which is apparently most unusual.—*G. R.*

Aristotelia racemosa. By Sir J. D. Hooker (*Bot. Mag.* 7868).—Nat. ord. *Tiliaceæ*, tribe *Elæocarpeæ*. Native of New Zealand. It is a common shrub, being the first to appear after the forests have been cleared. The flowers are in panicles, 3–5 ins. long, $\frac{1}{4}$ in. diam. The petals are 3–5-lobed and rose-red.—*G. H.*

Azalea pontica. By P. Hariot (*Le Jard.* March 20, 1902, p. 81).—Statistics of the flowering of this shrub at Moulins, in Central France, show that the date of commencement ranges from April 5 to May 7. Besides the honey bee, which extracts the poisonous honey of their flowers, they are especially visited by drones, and the large Cabbage white butterfly.—*C. W. D.*

Banana-leaf Blight. By F. S. Earle (*Journ. N. Y. Bot. Gard.* vol. iv. Jan. 1903).—A serious Banana disease has been observed in one locality, in the island of Jamaica. It causes the browning of the vascular bundles in the veins and midrib of the leaves. This is soon followed by the blackening of the entire leaf-blade, and eventually by the decay of the leaf and petiole. The terminal bud is not attacked, but continues to push out fresh leaves. These soon become infected in turn, so that usually not more than three or four of the younger leaves are free from the disease. Infected plants are much stunted in growth, and do not bear fruit. If so destructive a disease should by any chance become widely scattered, the results would be truly disastrous. Apparently it is due to a bacterial parasite. Cultures were obtained, and it is hoped to study the disease further.—*M. C. C.*

Barberries, The. By W. J. Bean (*Garden*, No. 1628, p. 71; 31/1/1903).—Probably between sixty and seventy species of Barberry are now known to botanists. Some of the species are so much alike that in gardens the genus may be quite adequately represented by growing about half of them. This and succeeding articles give the most useful species from a garden point of view, with notes about their culture.—*E. T. C.*

Barleria lancifolia and B. damarensis. By Spencer Moore (*Journ. Bot.* 480, pp. 407–8; 12/1902)—Redescription of two of T. Anderson's types from tropical Africa, now in the herbarium of Trinity College, Dublin.—*G. S. B.*

Barleria taitensis. By Spencer Moore (*Journ. Bot.* 478, p. 343; 10/1902).—Description of a new species, collected by Mr. Kässner at the Makindo River, British East Africa, from specimens in the Natural History Museum.—*G. S. B.*

Bauhinia acuminata. By Sir J. D. Hooker (*Bot. Mag.* tab. 7866). Nat. ord. *Leguminoseæ*, tribe *Bauhinieæ*. Native of tropical Asia. It is a shrub or small tree, 8–10 ft. high. Leaves bifid nearly to the middle, glabrous above, but downy beneath. Flowers solitary or few in a short raceme, $2\frac{1}{2}$ ins. broad, pure white. Though long grown at Kew, it flowered for the first time in 1901.—*G. H.*

Begonia 'Bavaria.' By B. Trenker (*Die Gart.* pp. 115 and 116, 6/12/1902). With illustration. A charming bedding *Begonia* of the tuberous class, comparatively new, and but little known in Great Britain. The plant is dwarf, bushy and compact, with light green slightly glaucous foliage, exceedingly free flowering, bearing uninterruptedly from June till late autumn a mass of rosy-carmine flowers.—*G. R.*

Birch-trees proof against Lightning. P. Hariot (*Le Jard.* Sept. 20, 1902, p. 273).—It is said in America that in a thunderstorm the Indians make for the nearest Birch-tree, and consider themselves secure beneath it. The writer recommends that the subject should be fully investigated, and the particular kind of Birch-tree specified.—*C. W. D.*

Bramble, The White-stemmed. By W. Dallimore (*Garden*, No. 1619, p. 379; 29/11/1902).—For horticultural purposes the hardy Brambles may be divided into three groups: first, those grown for their fruits; secondly, those valuable for their flowers; and, thirdly, those having coloured stems. In the latter group are some ten or twelve species, the White-stemmed Bramble (*Rubus biflorus*) being possibly the best known.—*E. T. C.*

Brassica, Seed-coats of certain species of the Genus. By A. J. Pieters and Vera K. Charles (*U.S.A. Dep. Agr. Div. Bot., Bull.* No. 29; 1901; 1 pl. and 6 figs. in text).—The object of this paper is thus stated:—"Heretofore it has been considered impossible to distinguish certain high-priced seeds of the group from some of the almost valueless ones. . . . The present investigation has resulted in the discovery of a method by which some may be distinguished." This is done by making microscopic sections of the seed-coat, when the different layers of cells are seen to vary considerably in each species; their differences are shown in the figures given in the text.—*G. H.*

Brasso-Cattleya Chamberlainiæ (*Orch. Rev.* p. 326, Nov. 1902).—The coloured characteristics and general particulars of this hybrid, derived from intercrossing *Lælia* (*Brassavola*) *Digbyana* and *Cattleya quadricolor*, are given.—*H. J. C.*

Bulbs, Open Air and Under Glass. (*Gard. Mag.* No. 2550; 13/9/1902).—What is called the Bulb Number of this Journal contains much information upon Bulbs, hardy and tender, from Snowdrops to Hippeastrums, and numerous illustrations accompany the various articles on particular classes of Bulbs.—*W. G.*

Carnation Disease in America. By A. M. Herr (*Le Jard.*).—The Carnation, which is a great favourite in the United States, is there exposed to a cryptogamic and microbic disease of the stem which seems to be analogous to, if not identical with, that which prevails on the Mediterranean coast. At least its cause is identical. Professor Wood, of Baltimore, has proved to the Carnation-growers that the disease is especially prevalent on soil which has been manured with dung or with decomposed turf, a common method in America. There, as here, chemical manures only should be used by the Carnation-grower, and bone powder (phosphate of lime) is strongly recommended.

Catasetum ochraceum. By R. A. Rolfe (*Orch. Rev.* p. 327, Nov. 1902).—Interesting particulars of this peculiar Orchid and its history are recorded.—*H. J. C.*

Catasetum quadridens, ♂ × ♀. By Sir J. D. Hooker (*Bot. Mag.* tab. 7864).—Nat. ord. *Orchideæ*, tribe *Vandeæ*. Native of ? The nearest affinity, according to Mr. Rolfe, is *C. cornutum* of Demerara. It is monœcious. The flowers are 2 ins. long, the sepals being pale green, with large dark red-purple blotches. The petals resemble them, but the lip is golden yellow speckled with dark purple, and having the margins fimbriate-dentate.—*G. H.*

Catalpa bignonioides, and allied Forms. By C. K. Schneider (*Die Gart.* p. 88, 22/11/1902, splendidly illustrated).—The specimen of our illustration grows at Vienna in the Rathhaus Park. *C. ovata* (syn. *C. Kaempferi*), *C. Bungei*, and *C. speciosa* are also mentioned, but the above is no doubt the best of all, and is much more used on the Continent than here. Unfortunately, the species is doubtfully hardy, excepting in the southern and western countries of the Continent.—*G. R.*

Catalpa, The hardy (*U.S.A. Agr. Exp. Stn. Kansas, Bull.* No. 108; April 1902).—There are two species of *Catalpa* in the United States—*C. bignonioides*, indigenous in the South-East, and *C. speciosa*, first distinguished as specifically distinct by Warder in 1855, inhabiting the Central West.

From a purely economic point of view the Catalpas are of great value, the annual consumption for railway tree timber alone being considerable, while as post and pole timber the durable quality renders it specially valuable; indeed it has been said that the *Catalpa* possesses more and greater advantages than any other indigenous tree.

The *Catalpa* plantations at the Agricultural College are said to have given encouraging results, even on very poor thin soils, the trees being adapted for posts in from seven to ten years, and in twenty years are useful for lumber and cabinet work. Under the head of "Commercial *Catalpa* Plantations" much interesting information is given as to the area and formation of plantations in the Forlington district, and where success has certainly crowned the efforts to establish breadths of this most useful forest tree. Appended are a series of illustrations of the *Catalpa* tree, experimental plantations, sections of the timber, with fruiting branches of the two species, all beautifully executed. Those showing fencing posts which had been in the ground for twelve and fifteen years, and yet, practically speaking, free from decay, are of particular interest, and form an excellent object-lesson.—*A. D. W.*

Cattleya Brymeriana Rchb. f. (*Gartenflora*, 1/2/1902, p. 617, pl. 1505).—A coloured plate of this *Cattleya* (which Reichenbach assumed to be a natural hybrid between *C. superba* and *C. Eldorado*), from a photograph obtained in Brazil.—*J. P.*

Cattleya Magneana. By Ch. Maron (*Le Jard.*).—This splendid novelty is one of the most beautiful of the species: it was produced by crossing a superior variety of *Cattleya guttata Leopoldi* with *C. Massaiana*, one of the best of the *Hardyana* group. The height of the plant when in bloom is about 20 inches, and of the pseudo-bulbs 10 inches. The leaves are about 8 in. × $2\frac{1}{4}$ in. They are thick, tough, and of a beautiful dark green colour. The floral stem has four branches, and consequently five flowers. These when fully open are of a remarkable size; indeed, the largest known diameter is $3\frac{3}{4}$ inches. The sepals are firm and cohesive, the upper one being remarkably erect, and they are of a plain ruby colour. The side petals are very wide and firm, with wavy edges and of an intense dark ruby colour. The lip, perfectly formed, very large, well opened, and with large curves, is of an intense ruby colour, which is deeper round the curves. The bottom of the orifice as well as its under side has a fawn-tinted shade. The rostellum, which is situated in front of the orifice of the labellum, is very large, and looks like a decorated Almond.

The plant requires no special care in cultivation. It should be kept in a good temperate house with the other Cattleyas.

Cattleya × 'Memoria Bleui' (L. Linden in *Lind.* xvi. t. 764; 1/4/1902).—A new hybrid between *C. Acklandiæ* and *C. granulosa*.
C. C. H.

Cedar Pencils. By P. Hariot (*Le Jard.* Oct. 5, 1902, p. 289). Pencils "made in Germany" excel all over the world. It seems that Messrs. Faber, the great German makers, have planted a grove of *Juniperus virginiana* (the Red Cedar) in Germany which gives them an advantage over importers of the wood. This writer asks, Why not in England? But it has perhaps been proved a failure. Indeed it is said that the most approved kind for pencils, *J. bermudiana*, is too tender to thrive in England.—*C. W. D.*

Celery. By C. A. Keffer (*University of Tennessee Record*, January 1903, p. 58).—In Tennessee, where it is apt to suffer from drought, Celery requires very heavy manuring and careful cultivation, under which conditions it is ready for use in about ten weeks from planting.

No advantage is gained by adding lime or acid-phosphate to the stable manure used.—*C. H. C.*

Cherry Disease, A New. By Paul Noël (*Le Jard.*).—M. Corboz, of Ancleins, has discovered a curious new Cherry disease, which is caused by a parasitic fungus, *Gnomonia erythrostoma.* From the beginning of summer the leaves begin turning yellow in places, then the stems turn brown, and before autumn the leaves gradually dry up, rolling up from the edges and turning towards the ground. These prematurely dead leaves do not fall with the others at the end of autumn; they remain on the tree during the whole of the winter and the following spring. At this season they are covered with little black spots, which are easily seen by the unaided eye. These are the fructifications of the *Gnomonia erythrostoma.* M. Corboz says the disease may be easily subdued by a very simple method, which is indicated by the progress of the disease itself. Indeed, since it is propagated from one year to another through the infection of the young leaves by those of the preceding year which remain on the trees, all that is required is to pick off these diseased leaves during the winter and burn them on the spot.

This parasite either destroys the fruit altogether or leaves it quite deformed, with only one side of the pulp developed, and therefore useless. M. Corboz has observed that this disease is especially prevalent in wet seasons in low-lying and sheltered orchards, where the trees are planted too close together, and the branches are too low. On the other hand, this disease rarely appears on isolated Cherry trees situated in the open.

Cherry Orchards of Sollie Pont in the Var. Anon. (*Le Jard.* July 20, 1902, p. 214).—An account of these is given. The kind chiefly cultivated is a small black variety called the 'Spanish Cherry.' Of these in the season, about the end of May, about thirty tons a day are sent off by railway to the North.—*C. W. D.*

Chimaphila maculata. By F. W. Burbidge (*Gard. Chron.* No. 827, p. 318, fig. 106; Nov. 1, 1902).—A little North American plant described as "A delightful little sub-shrubby *Pyrola*, not often seen, but a delightful plant for the bog-garden. Like most of the Ericaceous plants, it hates lime. In general appearance the plant looks like a *Pyrola* trying to become an *Arbutus*; the greyish leaves, crimson-red scapes, and drooping white flowers are very beautiful."—*G. S. S.*

Chinch Bug. By H. Garman, (*U.S.A. Exp. Stn. Kentucky, Rep.* 1898; 10 figs).—This insect (*Blissus leucopterus*) does great damage to wheat in parts of America. Its appearance and habits are described, and full notes on the fungal diseases which attack it are given. The fungus *Sporotrichum globuliferum* is cultivated and chinch bugs are infected with it; this results in a great diminution of their numbers. Notes on the bibliography of the insect are appended.—*F. J. C.*

Chondrobollea × Frœbeliana. By R. A. Rolfe (*Orch. Rev.* p. 347, Nov. 1902).—Interesting facts in connection with this distinct natural hybrid, supposed to have its origin through the intercrossing of *Bollea cœlestis* and *Chondrorhyncha Chestertoni.*—*H. J. C.*

Chrysanthemums, Early, The Best. By C. H. Curtis (*Gard. Mag.* No. 2558, p. 728; 8/11/1902).—In this number (devoted chiefly to the Chrysanthemum) the writer gives a descriptive list of the best twenty-five early-flowering varieties. The list has evidently been carefully compiled, and will be useful from which to make a selection of these beautiful autumn flowers, so valuable in the open air in September and October.
W. G.

Chrysanthemums, Grafted. By Albert Maumené (*Le Jard.* Nov. 20, 1902, p. 345).—Illustration of Chrysanthemums grafted several colours on the same bush, with notes on the practice.—*C. W. D.*

Cineraria Hamiltoni. By Spencer Moore (*Journ. Bot.* 479, p. 382; 11/1902).—Description of a new species, from specimens at the British

Museum, collected by Captain Barrett-Hamilton near Vredefort Road, Orange River Colony.—*G. S. B.*

Cirrhopetalum Hookeri. By Sir J. D. Hooker (*Bot. Mag.* tab. 7869).—Nat. ord. *Orchideæ*, tribe *Epidendreæ*. Native of Western Himalaya. It grows epiphytically on *Rhododendron arboreum*. The umbel of 6–10 flowers is borne on a slender peduncle. The flowers are 1 in. long, ochroleucous.—*G. H.*

Citrus Aurantium, Monstrosity in. By M. H. Focken (*Rev. Gén. Bot.* t. xiv., 1902, p. 97; with 3 figs.).—The author describes a common malformation in the orange in which the fruit shows an aperture at its summit leading down to a cavity within the fruit. This is completely filled by a second diminutive orange of normal structure.—*J. B. F.*

Clematis. By G. Gordon (*Gard. Mag.* No. 2565, p. 867; 27/12/1902). An account of the more popular species of *Clematis* grown in gardens, with a descriptive list of the best varieties. Illustrations are given of Clematises on walls, bowers, and trellises.—*W. G.*

Clematis coccinea Hybrids (*Rev. Hort.* No. 23, Dec. 1, 1902, p. 543).—*C. coccinea* appears to be prepotent in most, if not all, cases, and the second generation is so far barren that no plant, raised from apparently good seed, has lived more than a year. M. Morel, of Lyons, however, who is pursuing this branch of hybridisation, does not despair of establishing a fertile race.—*C. T. D.*

Clematis tangutica. By F. Morel (*Rev. Hort.* No. 22, Nov. 16, 1902, pp. 528–9).—Coloured plate representing a very pretty Clematis, of a warm yellow, flowers well expanded, $2\frac{1}{2}$ inches across. M. Morel considers it a distinct species, and not a form of *C. orientalis*, as the latter flowers in the autumn, while *C. tangutica* does so in the spring. Perfectly hardy and very free-flowering. By the description it appears to be a very desirable plant, both *per se* and for hybridisation purposes.
C. T. D.

Clerodendrons, C. Balfouri and C. splendens.—By Ed. André (*Rev. Hort.*, No. 21, Nov. 1, 1902, pp. 504–5).—Coloured plate, showing both varieties. Natives of Africa, torrid zone; stove-climbers. Culture easy with plenty of warmth and light, with open peaty compost. *C. Balfouri* is very beautiful, large lax panicles of flowers with conspicuous pure white, bract-like calyxes, whence protrude four brilliant scarlet corollas. *C. splendens* has a quite inconspicuous green calyx and self-coloured scarlet flowers.—*C. T. D.*

Clianthus Dampieri, The Culture of. By W. Dallimore (*Garden*, No. 1615, p. 307; 1/11/1902).—Many attempts are made to grow this beautiful plant, yet well-flowered specimens are seldom seen. The difficulty is to get it to grow freely during the first few months of its life. To overcome this, grafting has been resorted to with success. The stock used is the common Bladder Senna (*Colutea arborescens*).—*E. T. C.*

Climbing Plants, New Observations on Torsion-movements in. By Wilhelm Voss (*Bot. Zeit.* part 12, pp. 231–52, Dec. 31, 1902; with 2 plates and 5 woodcuts).—A series of interesting observations on the phenomena of torsional growth in numerous climbing plants, with diagrammatic records of same, as affected by different lighting, &c.

C. T. D.

Climbers Native in Wyoming. By A. Nelson (*U.S.A. Exp. Stn. Wyoming, Bull.* 50, *Mch.* 1902; 11 plates).—This bulletin pleads for the use of climbing plants on houses, and suggests the following climbers; American Ivy (*Parthenocissus quinquefolia*, Planch.); Western Clematis (*Clematis ligusticifolia*, Nutt.); *Vitis vulpina*, L.; Hop (*Humulus Lupulus*, L.); Balsam Apple (*Micrampelis lobata*, Greene). Directions are given as to their recognition and best methods of cultivation.—*F. J. C.*

Clover Anthracnose. (*Zeit. f. Pflanz.* xii. pp. 281–284, 1 fig.; 1902).—Linhart gives observations showing the wide distribution of this disease in Germany and Bohemia; he recommends steeping of seeds with copper sulphate as for smut on corn. Malkoff describes the appearance of Clover Anthracnose at Göttingen. He also describes and figures another Clover-leaf spot (*Macrosporium sarcinæforme*, Cav.).

W. G. S.

Cockroaches. By C. L. Marlett (*U.S.A. Dept. Agric., Div. of Entom., Circ.* 57; 5 figs.).—The species of cockroach more commonly met with in America are here described, viz.: The American "roach" (*Periplaneta americana*); the Australian "roach" (*P. Australasiæ*); the common "roach," the English pest (*P. orientalis*); and the German cockroach (*Ectobia germanica*), the most commonly distributed domestic species in the Eastern States, where it makes itself particularly disagreeable by gnawing books, injuring food products, &c. The life-histories are briefly described, and fumigating with hydrocyanic-acid gas where possible is recommended. Other remedies are the liberal use of pyrethrum powder, fumigation with carbon bisulphide for twenty-four hours, or with the fumes of burning pyrethrum powder or by trapping.—*F. J. C.*

Cockroach, Nepenthes useful to destroy. (*Bull. Bot. Dep. Trin.* No. 36, p. 489; October 1902).—*Nepenthes* have been found of great service to grow among Orchids in the W. Indies, as the pitchers trap and digest numbers of *Blatta americana*, which is there very destructive to Orchids.—*E. A. B.*

Cocoa-nut Bud Disease. By F. S. Earle (*Journ. N. Y. Bot. Gard.* vol. iv. Jan. 1903).—Outbreaks of a serious disease of Cocoa-nut trees have occurred in Jamaica at various times. Some years ago this made its appearance in the neighbourhood of Montego Bay. At present numerous cases of it exist widely scattered over the western end of the island. One of the first symptoms of the disease is the dropping of the immature nuts. The leaves droop a little, and soon become yellow. The young flower-buds, still enveloped in the spathe, rot, and finally the central leaf-bud rots, and the entire top falls away. The head of the tree was in all cases invaded by what seems to be a bacterial rot. The study of the disease is still in progress. From the present imperfect knowledge of this disease it is impossible to suggest a remedy. The necessity for the destruction of the contagion by the prompt cutting and burning of all infected trees is shown by the marked tendency of the disease to spread from each centre of infection.—*M. C. C.*

Cocoa-nut Wasting Disease. By F. S. Earle (*Journ. N. Y. Bot. Gard.* vol. iv. Jan. 1903).—This disease is prevalent in the eastern part of the island of Jamaica. The nuts fall, a few at a time. The lower leaves droop and fall prematurely, while the new leaves that are produced become successively smaller and less vigorous. At length the tree dies, but the course of the disease is always slow, and affected trees may live for months, or perhaps years. In the trees examined, a white scale insect was always found at the base of the petioles, and on the fruiting peduncles. In all the cases examined there was also a slow rotting of the sheathing bases of the petioles, and of the fruiting sheaths. The scale insects were also found on some trees which did not show recognisable symptoms of the disease. Further investigations are in progress with the scale insects and cultures from the diseased tissues.—*M. C. C.*

Cold, Artificial, in Horticulture. By A. Raddi (*Bull. R. Soc. Tosc. Ort.* 12, p. 363, December 1902).—The best type of a "cold greenhouse" consists of a perfectly isolated medium, kept in complete darkness, at a temperature of about 6° C., the floor of which is covered with very fine dry sand, in which are placed the more delicate bulbs and also roots. When one requires the bulbs or plants to flower, they are removed from the cold house, care being taken that the change is not too sudden. The influence of the warmth rapidly stimulates their dormant vitality: Lilies, *e.g.*, which, when grown in the usual way, require six weeks for flowering, develop very quickly when their flowering is artificially retarded. There appears to be no limit to this artificial retardation of the development of the plants and the flowers.—*W. C. W.*

Cold Spring of 1902. Ed. (*Le Jard.* May 20, 1902, pp. 147 and 170).—The cold rains and frosts of April have caused more damage in France to hardy plants than has been suffered for many years.—*C. W. D.*

Cold Storage of Apples (*U.S.A. Exp. Stn. New Hampshire*; *Bull.* 93; 10/1902).—Cold storage retarded decay, and when removed from cold storage decomposition proceeded faster than in autumn or winter. The rapidity of decay was inversely proportional to the height of the temperature to which the fruit was subjected.

The best results were obtained by wrapping the apples, this being especially true when the apples are to be kept for a considerable time, *e.g.* until June.

The decay of the apples is due chiefly to the influence of certain moulds; black rot (*Sphæropsis malorum*,), bitter rot (*Glœosporium fructigenum*), soft rot (*Penicillium glaucum*).

Other changes, those known as "after-ripening" (see Kulisch in *Bied. Centr. Agriculturchem.* 22, 625), in addition to those due to decay, occur, principally the change of starch into sugar and the change of cane sugar to invert sugar. These changes proceed rapidly soon after the apple is removed from the tree, so that the fruit should be placed in cold storage as soon as possible.—*F. J. C.*

Coloured Leaves of Polygonum (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 203 210).—Dr. Anton J. M. Garjeanne gives an account of the coloured abnormal leaves of various species of *Polygonum* near Amsterdam (seven figures in the text.)—*G. F. S.-E.*

Cornus alba L. By G. Ugolini (*Bull. R. Soc. Tosc. Ort.* 11, p. 343, November 1902).—The name *Cornus* is derived from the horny character of the wood of the old shoot. The present species is one of the most beautiful, on account of the blood-red colour of the shoots and branches exhibited on the fall of the leaves. The specific name is derived from the colour of its timber, but corresponds also with the white, somewhat pleasant-tasting, berry. The plants form a cheerful and almost brilliant feature amid the pale dull monotony of a winter landscape.

Other species, almost all North American, have been adopted for planting in large shrubberies: *C. cærulea*, with azure, primrose fruit; *C. florida*, with very large foliage, and a small yellowish flower, surrounded by a kind of rosy-white involucre affecting the appearance of a large corolla; *C. canadensis* with herbaceous stem 10–15 cm. in height, whose flowerets are furnished with a similar involucre to that of the preceding species; *C. paniculata*, whose clustered reddish fruits adorn the plant until springtime. All the Dogwoods are hardy and almost all soils suit them, save the excessively sandy or calcareous kinds. They are easily propagated both by cuttings and by seed.—*W. C. W.*

Corydalis thalictrifolia, and other Species. By A. Henry (*Gard. Chron.* No. 825, p. 288, fig. 91; and Supplement, Oct. 18, 1902). This charming rock plant has lately been introduced into cultivation by Messrs. Jas. Veitch & Sons. It is a native of Ichang, in Central China. "Kept in a greenhouse, it remains in flower through the winter months; placed in the open, as at Kew Gardens, it flowers all the summer." A full description of the plant is given, from which it appears that the flowers are of a yellow colour and from $\frac{3}{4}$ to 1 inch in length, and are borne in racemes. Short descriptions are given of three other species from the same neighbourhood.—*G. S. S.*

Cranberry Insects. By Dr. J. Smith (*U.S.A. Exp. Stn. New Jersey, Rep.* 1901, pp. 511–526).—An account is given of the method of investigation adopted in determining the life-history of the Cranberry Katydid (*Scudderia texensis*). The insect lays eggs in the leaves of plants growing in Cranberry bogs, preferably in those of species of *Panicum*, during the month of September. Burning over the area surrounding the bogs is recommended as a means of getting rid of the pest, and a "cyclone burner" is described.—*F. J. C.*

Crinum natans. By Sir J. D. Hooker (*Bot. Mag.* tab. 7862).—Nat. ord. *Amaryllideæ*, tribe *Amarylleæ*. Native of Guinea. This is the only species with submerged leaves, closely allied to *C. purpurascens* of the same region and amphibious. The leaves are 4–5 ft. long, $1\frac{1}{2}$ to 2 ins. broad, and waved. The flowers are umbellate, with the perianth-tube 6 ins. long, lobes of the limb narrow and white.—*G. H.*

Crinum, Hybridisation of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* 10, p. 300, October 1902).—Description of six hybrids, viz.: *C. Grillianum* (*C. longifolium* (*capense*) × *C. lineare*) ; *C. Lawsonianum* (*C. longifolium album* × *C. variabile*) ; *C. Malbranchii* (*C. Moorei* × *C. jemense*) ; *C. D'Anconæ* (*C. jemense* × *C. Moorei*) ; *C. roseum* (*C. jemense* × *C. Moorei*) ; *C. maximum* (*C. Schmidtii* × *C. jemense*).
W. C. W.

Crocuses, Autumn-flowering. By E. Jenkins (*Garden*, No. 1616, p. 324 ; 8/11/1902).—Starting in early autumn, these maintain a supply of flowers almost throughout the winter months ; perhaps a better display could be had in October than at any other time. Quite at home and delightful in any position, no plants are more easily grown ; they delight in a sandy soil, and are cheap enough to be grown in masses. This article closes with a description of the best species.—*E. T. C.*

Crocus Scharojani. By J. Hoog (*Gard. Chron.* No. 827, p. 321, fig. 107 ; Nov. 1, 1902).—"This bright orange-yellow autumn-blooming Crocus" is the only one of its group with bright yellow flowers, which gives it a peculiar value for horticultural purposes. It was said to be a native of the Caucasus, but the mountain in which it was supposed to grow was recently searched in vain ; it was, however, at last found on some mountains in the same district growing in short grass in open places in the full sun.—*G. S. S.*

Crops, British, of 1902. Anon. (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 332–337).—The statement comprises the figures for all the crops for which estimates of yield were collected, viz.:—Cereals, Beans, Peas, Potatos, Turnips and Swedes, Mangolds, Hops, and Hay. The returns for the Potato crops are given below :—

"Following upon a year in which the produce was about half a ton per acre above the average, the estimates show that in 1902 the Potato crop in Great Britain was nearly half a ton less than the mean. Here, however, Scotland has an advantage, the yield per acre beyond the Border being about half a ton better than the average ; while in England it was two thirds of a ton, and in Wales three-fourths of a ton, less than the decennial mean."

Potatos	Estimated Total Produce		Estimated Yield per acre		Average of the ten years 1892–1901
	1902	1901	1902	1901	
	Tons	Tons	Tons	Tons	Tons
England . . .	2,225,569	2,627,647	5·39	6·33	6·02
Wales . . .	155,508	182,122	4·95	5·70	5·72
Scotland . . .	813,111	861,481	6·27	6·62	5·67
Great Britain . .	3,194,188	3,671,250	5·57	6·36	5·92

R. N.

Crowea angustifolia. By Sir J. D. Hooker (*Bot. Mag.* tab. 7870). Nat. ord. *Rutaceæ*, tribe *Boronieæ*. Native of West Australia. It is a slender glabrous shrub, with narrow linear leaves. Flowers axillary, 1 in. diam., white or rose-coloured.—*G. H.*

Cucumbers and Tomatos, Root-knot Disease in. Anon. (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, p. 360, pl. v.).—This root-disease is effected by the Root-knot Eelworm (*Heterodera radicicola*). The remedies given are carbolic acid, one part to twenty parts of water. Thoroughly saturate the soil three times at intervals of a fortnight. "A second remedy is mixing the soil intimately with gas-lime.

"In either instance the soil so treated must remain for at least six weeks before it can be used.

"When soil in a house is infected, it is safest to remove the whole and treat it outside; the interior of the house should then be thoroughly washed with carbolic acid one part, water eight parts."

Copies of this article may be obtained free of charge from the Board of Agriculture, 4 Whitehall Place, London, S.W.—*R. N.*

Cyclamen europæum. By C. Wolley-Dod (*Garden*, No. 1613, p. 264, 18/10/02).—Nearly every week in autumn I see mistakes made in the flower notes of gardeners, who wrongly call the hardy autumn Cyclamen *C. europæum*. I only know one hardy autumn Cyclamen, and its right name is *C. neapolitanum*, Tenore. *C. neapolitanum*, native of South Italy and Sicily, begins to flower in ordinary seasons about the last week in August. *C. europæum*, Linnæus, is a native of South-Eastern France and Switzerland. In spite of repeated importations from Aix-les-Bains, where it abounds, I have never been able to make it thrive.—*E. T. C.*

Cymbidium × Mantinii (*Orch. Rev.* p. 361, fig. 37, Dec. 1902).—Historical and other particulars are included with the illustration of this hybrid, derived from the intercrossing of *C. Mastersii* and *C. giganteum*. *H. J. C.*

Cymbidium Simonsianum. By Sir J. D. Hooker (*Bot. Mag.* tab. 7863).—Nat. ord. *Orchideæ*, tribe *Vandeæ*. Native of Sikkim and Assam. Its nearest ally is *C. longifolium*, Don. The leaves are narrowly linear, 2–3 ft. long. Raceme pendulous, 10–20 fld.; flowers 2 ins. broad. Sepals and petals greyish white, with a blood-red central streak.—*G. H.*

Cypripedium × auriferum (L. Linden in *Lind.* xvii. t. 771; 1/6/1902).—A hybrid of doubtful parentage, raised, it is said, from the same capsule as *C.* × *Beeckmani*, but totally different.—*C. C. H.*

Cypripedium × Glonerianum (L. Linden in *Lind.* xvi. t. 753; 25/11/1901).—A new hybrid between *C. Victoria-Mariæ* and *C.* × *Leeanum*, raised by Messrs. Linden of Moortebeek, interesting as the first hybrid from *C. Victoria-Mariæ*.—*C. C. H.*

Cypripedium × Stepmaniæ (L. Linden in *Lind.* xvi. t. 765; 1/4/1902).—One of the numerous forms of the hybrid between *C.* × *Leeanum* and *C. villosum*, raised by M. Stepman.—*C. C. H.*

Cypripedium × Syrinx (Cogniaux in *Dict. Icon. Orch.* Cyp. x. t. 55; December 1902).—A new hybrid out of *C. tonsum* by *C.* × *Youngianum*, raised by Mr. Reginald Young of Sefton Park, Liverpool, and first flowered in May 1902.—*C. C. H.*

Desert Botanical Laboratory of the Carnegie Institution. (*Jour. N. Y. Bot. Gard.* vol. iv. Jan. 1903).—The Board of Directors of the Carnegie Institution (U.S.A.) has made an appropriation of 8000 dollars for the establishment and maintenance of a desert botanical laboratory for the year 1902–3. This has been established for the purpose of making a thorough investigation of the physiological and morphological features of plants under the unusual conditions to be found in desert regions, with particular reference to the relations of the characteristic vegetation to water, light, temperature, and other special factors. A resident investigator, to be placed in immediate charge of the laboratory, will begin a series of researches upon certain more important problems outlined by the Board, and facilities will be provided by the aid of which a few other investigators from any part of the world may carry on work upon any problem connected with desert plants.—*M. C. C.*

Digitalis, Abnormal Flowers of. By M. H. Focken (*Rev. Gén. Bot.* t. xiv., 1902, p. 517; with 3 figs.).—Cases of monstrous flowers of *Digitalis* are described in which, as often happens in the case of inflorescences of dorsiventral flowers, the terminal flower assumes a more or less radial type of organisation. In the first example the flower possessed 10 sepals, 10 petals, of which 6 are better developed than the remaining 4. The stamens are 8 in number, 4 being large and 4 small. The ovary retains its normal dimerous character.

In a second inflorescence, the increase in number in the members of the three outer whorls is even more marked, whilst the gynœcium also contains 6 loculi, of which, however, only 2 are fertile.

In a third plant the irregularities are even more marked.

The author regards the abnormal terminal flowers as having arisen by the concrescence of 2, 3, and a number of individual flowers respectively.—*J. B. F.*

Dimorphism in Buckwheat (*U.S.A. Exp. Stn. New Jersey, Rep.* 1900).—Buckwheat, like the Primrose, produces both long- and short-styled plants. Experiments were carried out to see whether soil had any influence on the form of the flower produced, and whether the parent exercised any control in this respect on the offspring. The result tended to show that the mother exerted some control.—*F. J. C.*

Dodders (*U.S.A. Exp. Stn. New Jersey, Rep.* 1900; 2 plates).—An account of the germination of Dodder seed is given, with illustrations of the seeds of several species and of the seedling Dodder plants.—*F. J. C.*

Droseras. By F. Rehnelt (*Die Gart.* pp. 169 and 184, 10/1/1903).—Nine distinct species of these interesting little plants are figured and described. *D. pallida, D. lunata, D. prorecta, D. stolonifera, D. rosularis, D. erythrorhiza, D. roridula dentata, D. cistiflora* var. *multiflora,* *D. filiformis*, besides a number of more or less distinct ones, are mentioned.—*G. R.*

Dwarfing of Garden Plants. By Jules Rudolph (*Le Jard.* April 20, 1902, p. 126).—Methods for the permanent dwarfing of suitable subjects are discussed.—*C. W. D.*

Edinburgh Worthies. By R. Hedger Wallace (*Gard. Chron.* No. 826, p. 297; Oct. 25, 1902).—Many of the botanical and horticultural authorities of the end of the eighteenth century and the beginning of the nineteenth appear to have had some connection with Edinburgh. Many of them are probably forgotten, and no attempt is made to name them all; but a short account is given of the life of Dr. Neill, Walter Nichol, J. C. Loudon, Dr. Fothergill, Dr. Withering, and Sir Jas. Smith, who was the founder of the Linnean Society. The writer says in conclusion: "We are aware that there are many more that might have been mentioned. To these we may at some other time refer, if this sketch awakens any interest among those who claim to be the 'Apostolic successors' of the horticulturists of the past century."—*G. S. S.*

Education in Connecticut, Agricultural. By Prof. R. W. Stimson (*U.S.A. St. Bd. Conn. Rep.* 1901).—Gives the text of an address to a farmers' convention on the work of the State-supported Agricultural College in Connecticut and an account of its inception and growth.—*F. J. C.*

Egypt, Flora of. Ed. (*Journ. Hort.* Dec. 25, 1902, p. 584).—The great scarcity of wild flowers in Egypt, and their shabbiness, are noticed.—*C. W. D.*

Egypt, French Gardeners in. Ed. (*Le Jard.* March 5, 1902, p. 66).—As a proof of the appreciation in Egypt of French gardeners it is noted that M. José Lamba has been appointed to an important horticultural post at Cairo, and M. Dérouin to the directorship of the public gardens at Khartoum.—*C. W. D.*

Elm, Branched Leaves in. By M. P. Vuillemin (*Rev. Gén. Bot.* t. xiv., 1902, p. 49).—In a gathering of 92 leaves the author found 48 to be abnormal. These were more or less branched, and the ramification showed all styles from deep lobing up to formation of distinct petiolate leaflets springing from the main petiole, and below the (always larger) primary leaf-blade. M. Vuillemin does not regard this as an example of chorisis, but as a reversion to the semblance of the opposite and decussate leaves of the seedling. The suggestion is that the hereditary tendencies which are manifested in the seedling may be still dormant in the adult, and wakened by any excitation that can provoke a deviation from the normal. The argument does not seem very cogent, for the case is at best one of analogy only.—*J. B. F.*

Elm-leaf Disease. By H. Klebahn (*Zeit. f. Pflanz.* xii. p. 258; 1902).—*Phleospora ulmi* (Fr.) Wallr. occurs on living leaves of Elm in the conidial form. The author reports, in a preliminary note, the discovery of a perithecial ascus-stage on fallen leaves of *Ulmus montana pendula*.—*W. G. S.*

Epiphyllum delicatum. By N. E. Brown (*Gard. Chron.* No. 832, p. 411, fig. 140; Dec. 6, 1902).—This is a new species, which is very nearly allied to *E. truncatum*, but it is of a more erect habit, the flowers are larger and very different in colour, being white, tinted with rose-pink at the base of the petals and on the tube. It was imported from Brazil by Messrs. Bull & Co., and was shown on Nov. 18 last at the meeting of the Royal Horticultural Society.—*G. S. S.*

Equisetum arvense—a poisonous plant. By F. A. Rich and L. R. Jones (*U.S.A. Exp. Stn. Vermont, Bull.* 95, 6/02; 2 figs.).—Records cases of poisoning of horses due to the presence of this plant in hay or pasture.—*F. J. C.*

Eriostemon, The Genus. By B. Othmer (*Die Gart.* p. 1, 4/10/1902).—Full descriptions of *E. salicifolius*, *E. myoporoides*, *E. neriifolius*, *E. cuspidatus*, and *E. intermedius* are given, with illustrations of *E. neriifolius* and *E. cuspidatus* and cultural directions.—*G. R.*

Eschscholzia Douglasii and E. cæspitosa. By S. Mottet (*Rev. Hort.* No. 23, Dec. 1, 1902, pp. 556–7).—Two species sent out by Vilmorin. The merit of the former appears to consist mainly in its rapid development, flowering five to six weeks after sowing in the spring. *E. cæspitosa*, however, appears to be an attractive, very floriferous, dwarf form, 4 to 6 inches high, with golden-yellow flowers, resembling a *Ranunculus*. Flowers from June to September, according as sown.—*C. T. D.*

Ether, Forcing Plants by. By Albert Maumené (*Le Jard.* Oct. 1902, p. 312).—Illustrations are given of Lilacs forced by ether compared with others not so forced, with a dissertation on the subject.—*C. W. D.*

Euryale ferox. By J. Daveau (*Ann. Soc. Hé.* May 1902, p. 95).—A full account is given of the establishment in the open air at Montpellier of this Water Lily, allied to *Victoria regia*.—*C. W. D.*

Fertilisers, Economical buying. By Dr. E. H. Jenkins ((*U.S.A. St. Bd. Conn., Rep.* 1901).—Under the title "Business methods in buying fertilisers" the author gives the following advice: Use artificial manures only in conjunction with thorough cultivation; pay cash; buy on the co-operative principle, but all fertilisers of a guaranteed standard, and subject to analysis.—*F. J. C.*

Fertility in Fruit Lands, The Increase and Maintenance of. By Professor H. E. van Deman (*Rep. Mass. Fruit-growers' Assn.*, March 1902).—The author, in an interesting paper contributed at a two-days' conference of this Association, calls attention to the vast amount of plant foods existing naturally in the soil in an insoluble condition. Before wasting money on artificial manures he recommends that every fruit-grower should by proper tillage operations make the most of this existing supply, the chief points aimed at being to bring a regular supply of available plant food in a soluble condition within the reach of growing crops.

The success of arable *versus* pasture land for orchards is discussed, and an instance is given of a most successful case where the latter conditions prevail. There is more in this, however, than is gathered by the ordinary observer. The orchard is considerably overstocked with sheep during the greater part of years, which keep the grass very close. These are fed largely on dry food as bran, corn, &c., the result being a liberal top-dressing of valuable manure, rich in plant foods which more than doubly compensate for those taken from the soil by the closely cropped grasses. *E. F. H.*

Fig-Coffee. By P. Hariot (*Le Jard.* June 20, 1902, p. 177).—In Austria and more recently in Algeria Figs roasted hard and powdered are largely prepared to adulterate coffee, and for mixture it is preferred to chicory, as being more palatable and nutritious.—*C. W. D.*

Flora of Connecticut. By J. N. Bishop (*U.S.A. St. Bd. Conn., Rep.* 1901).—The author gives "a Catalogue of all Phænogamous and Vascular Cryptogamons Plants at present known to grow without cultivation in the State of Connecticut." 1,743 species are listed, belonging to 574 genera and 115 orders. About one-fourth of the species occur out of cultivation in the British Isles, while fully one half the genera are represented here.—*F. J. C.*

Flora of Middle Europe, Recent Natural Introductions in the (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 211–234).—Dr. Höck continues his list of new arrivals and new localities of foreign plants. *Citrullus Colocynthis, Coffea arabica, Stevia ovata* (Mexico and Argentine), and *Guizotia abyssinica* are recorded for the first time. A great number of localities is given for *Asclepias syriaca, Gilia grandiflora, Phacelia tanacetifolia,* the Tomato, and others. (See previous papers in same Journal.)—*G. F. S.-E.*

Floral Displacements, from Anthesis to Ripening, in the Capitula of Helianthus. By B. Leisering (*Flora,* vol. xc. 1902, pp. 378–432, t. xiii., xv).—By photographs, some of which are reproduced, it is shown that the flowers become displaced, leading to changes in the angles of intersection of the parastichs and in the surfaces of contact of the flowers. The displacements are due to changes in the convexity of the head and the changing ratio between the growth of the parts and that of the whole.—*M. H.*

Fritillaria askabadensis. Anon. (*Gard. Mag.* No. 2559, p. 746; 15/11/1902).—A good illustration of this new species allied to the well-known "Crown Imperial" (*F. Imperialis*), but apparently not such a handsome plant.—*W. G.*

Frost delayed unusually late. Anon. (*Journ. Hort.* Nov. 13, 1902, p. 445).—A writer from Rood Ashton (a place not in the Postal Guide, but perhaps in Wiltshire) makes some remarks on the abnormal effects of the continued absence of frost in autumn 1902.—*C. W. D.*

Fruit Industry in California. By W. J. Allen (*Agr. Gaz. N. S. W.* p. 1100; November 1902).—So long ago as the year 1880 there were many who prophesied that the fruit industry was being overdone; and yet, notwithstanding the many obstacles which have had to be overcome, the people of California have through their energy and push gone on from year to year increasing the area under fruit and, by exploiting other markets and placing a good article on the market, have found sale for all their fruit, at fairly remunerative prices. To attain this end they have to grow good fruit and to place it on the market in the most attractive style possible. The area devoted to fruit culture in California is as follows:—

Grapes, wine .	107,908 acres	Pears . .	17,058 acres
Grapes, raisins	84,211 ,,	Olives . .	15,348 ,,
Grapes, table .	21,517 ,,	Almonds .	14,325 ,,
Prunes . .	81,838 ,,	Lemons . .	13,429 ,,
Peaches . .	60,021 ,,	Walnuts .	10,646 ,,
Oranges . .	52,030 ,,	Cherries. .	5,251 ,,
Apples . .	49,850 ,,	Figs . .	4,054 ,,
Apricots. .	34,938 ,,		

A grand total of 572,424 acres. In making up these figures it is assumed that there are 48 Apple-trees to the acre, 75 Apricots, 100 Cherries, 48 Figs, 75 Olives, 100 Peaches, 100 Pears, 100 Prunes, 100 Oranges, 100 Lemons, 100 Almonds, and 48 Walnuts.—*H. G. C.*

Fruit-trees, A Fungus Disease of young.* Anon. (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 361–363, pl. vi.).—This paper gives a short description of the minute but very destructive fungus *Eutypella prunastri*, Sacc., which attacks young standard fruit trees; those up to the age of eight years being most liable to the disease, and as the stem is the part attacked, the girdling of this portion of the plant by the fungus growing in the bark and cambium means the death of the entire tree.

As a means of prevention the following are recommended:—"All wounds on the stem exposed by cutting off shoots, *however small*, should be protected at once by a coating of gas-tar, until the tree is at least ten years old. In order to prevent spores from germinating on the surface of the stem, . . . the entire stem should be painted with the following composition:—Reduce soft soap to the consistency of thick paint by the addition of a strong solution of washing soda in water. Add one pound of powdered quick-lime to every five gallons of the dissolved soap, and stir the whole until thoroughly mixed. Apply to the trunk with a paint brush, being careful to cover every part. This mixture is tenacious, not easily dissolved by rain, and usually lasts for one season if properly made and applied." The disease is said to be most prevalent in clayey soil; and deep planting should therefore be avoided.—*R. N.*

Fruit Trees and Potash (*Le Jard.*).—Experiments made in Germany regarding the fertilisation of fruit trees show that the most

* See also abstract from the *Gard. Chron.* (Sept. 1902, p. 235) on "Fungoid Disease of Nursery Stock," by G. Massee, in JOURNAL R.H.S. vol. xxvii. p. 691, figs. 173 A—I.

important part is played by potash. The crops are considerably heavier, especially in the case of Cherries and Plums. Also, in the trees manured with potash the trunk and branches are better developed, the wood acquires greater power of resistance, the branches are more vigorous, and the flowers and fruit are much less liable to fall. In short, the general health of the tree is improved.

Fruit-trees in Pots. By O. Thomas (*Garden*, No. 1616, p. 328; 8/41/1902).—In the autumn, during October, every plant should be repotted; then all we have to do is to place them out of doors and protect the roots from extreme cold until January, when they should be brought under glass to start growth. Top dressing must be done when young roots appear through the surface soil. Three illustrations and full cultural details are given.—*E. T. C.*

Fruit Trees in Prussia. Ed. (*Le Jard.* May 5, 1902, p. 130).—A census of these shows that, counting only the four leading kinds of fruit, the number of trees is five for every two inhabitants. The proportion per cent. of the trees is thirty Apples, thirteen Pears, forty-two Plums, fifteen Cherries.—*C. W. D.*

Fumigation of Fruit-trees. By Paul Noel (*Le Jard.* Jan. 5, 1903, p. 8).—A long article, with seven illustrations and a loose supplemental leaf, describing the best method of using this remedy against insects and fungoid diseases.—*C. W. D.*

Fungi, Diseases of Crops caused by. By Prof. S. A. Beach (*U.S.A. St. Bd. Conn. Rep.* 1901).—After giving some account of the various forms assumed by fungi and their mode of growth, the author classifies the diseases according to the accepted methods of treating them.

I. By Bordeaux mixture or a similar fungicide.

(1) Injuring Apple fruit or foliage. Bitter rot (*Glœosporium fructigenum*, Berk.); fly speck (*Leptothyrium pomi*, Mont. & Fr.); leaf spot (*Phyllosticta* sp.); scab (*Venturia inæqualis*, Cke.); sooty blotch (*Phyllachora pomigena*, Schw.).

(2) Pear diseases. Leaf blight (*Entomosporium maculatum*, Lev.); leaf spot (*Septoria piricola*, Desm.); and scab (*Venturia pirina*, Aderh.).

(3) Quince. Leaf blight (*Entomosporium maculatum*, Lev.).

(4) Apricot, Plum, and Cherry diseases. Fruit rot (*Monilia fructigena*, P.), and leaf spot (*Cylindrosporium padi*, Karst.).

(5) Peach diseases. Fruit rot (*Monilia fructigena*, P.), and leaf curl (*Exoascus deformans*, Berk.).

(6) Grape diseases. Anthracnose (*Sphaceloma ampelinum*, De By.); black rot (*Laestadia Bidwellii*, Ell.); brown rot or downy mildew (*Plasmopora viticola*, B. & C. Berl. & De T.); powdery mildew (*Uncinula spiralis*, B. & C.).

(7) Currants and Gooseberries. Leaf spots (*Septoria ribes*, Desm., and *Cercospora angulata*, Wint.) and anthracnose (*Glœosporium ribis*, Lib.).

It is better to use liver of sulphur than Bordeaux mixture for Gooseberries.

(8) Vegetable diseases. Early blight of Potato (*Alternaria solani*, E. & M.); Potato disease (*Phytophthora infestans*, De By.); Cucumber mildew (*Plasmopora cubensis*, M. B. & C.); Celery-leaf blight (*Cercospora apii*, Fries); Celery-leaf spot (*Septoria petroselina*, var. *Apii*, Br. & Car.).

It is not claimed by the author that Bordeaux mixture is equally efficacious in all the cases quoted above, or that its application would be profitable in all cases.

II. Disinfection of seed or soil.

Onion smut (*Ustilago cepulæ*, Frost); Barley smuts (*U. hordei*, P., and *U. nuda*, Jens.); Rye smut (*Urocystis occulta*, Rabh.); Oat smuts (*Ustilago avenæ*, P., and *U. lævis*, Kell.); Wheat smuts (*Ustilago tritici*, P., *Tilletia fœtens*, B. & C., *T. tritici*, Bjerk.); Potato scab (*Oospora scabies*, Thax.).

III. Pruning or, in extreme cases, burning.

Black knot of Plum and Cherry; Peach yellows (whole tree burnt); Apple canker.

Fungicides may be used in conjunction with arsenical poisons against insect and fungal attacks at the same time, *e.g.* for Apple-leaf spot, &c., and Codlin moth.—*F. J. C.*

Fungus Diseases of Stone-fruit Trees in Australia, and their Treatment. By D. McAlpine (*Bull. Dep. Agr. Vict.* March 1902, with 10 coloured plates and 327 figs., 165 pp.).—This treatise consists of two parts, the first containing a general description of the principal diseases and their treatment. The second part is devoted to technical descriptions of the various fungi.

In the first part the diseases treated of are confined to those of the Almond, Apricot, Cherry, Peach, Nectarine, Plum, Cherry Plum, and Japanese Plum. Those treated in full are Peach-leaf curl, Prune rust, Shot-hole fungi, Peach freckle, Brown rot, Bark rot (attributed to *Polystictus cinnabarinus*), Gummosis, Leaf scorch, and Split stone.

The majority of these diseases are well known in this country, except perhaps the Peach freckle, which is caused by *Cladosporium carpophilum*, and the bark rot of Cherry and Apricot trees, which is attributed to a saprophyte common enough in tropical and subtropical climates, but not found in Britain. The writer, however, thinks that it becomes parasitic, not only on the above fruit-trees, but also on living *Eucalypti*; nevertheless he admits that it is most common on dead wood. The treatise is profusely illustrated.

The second part, being technical descriptions of well-known species of fungi, requires no comment; it includes 117 species.—*M. C. C.*

Galeruca Cratægi. By Lucien Iches. (*Le Jard.* Jan. 5, 1902, p. 13).—A twig of Elm leaves showing the destruction of the foliage caused by this coleopterous insect, together with magnified figures of the larva, pupa, and perfect insect, with a full description.—*C. W. D.*

Gardens, Royal, in England. Anon. (*Gard. Mag.* No. 2537. Supplement).—A descriptive account of the King's private gardens at Windsor, Sandringham, Osborne, and others, accompanied by excellent illustrations.—*W. G.*

Gas Liquor. (*Bol. R. Soc. Nac. Hort.* iv. p. 95, 1902).—Attention is called to the value of the water of condensation at gas-works as a fertiliser. An exceptionally heavy crop of Sugar-Beet, yielding on analysis a very large percentage of sugar, resulted from its use. It is important that it should be applied to the land some weeks before the seed is sown. *G. M.*

Gazania, Hybridisation of. By C. Sprenger (*Bull. R. Soc. Tosc. Ort.* 10, p. 313, October 1902).—All known species are natives of South Africa, and extend as far as the Equator, where they are found chiefly on the higher mountains. They are more or less perennial, woody and evergreen, sometimes even shrubby. Some species, e.g. *G. nivea* and *G. pygmæa* of Natal, have caducous leaves. Besides *G. splendens*, which is an old hybrid emanating from some English garden, we only possess in cultivation the following: *G. coronopifolia*, *G. longiscapa*, *G. nivea*, *G. Pavonia*, *G. pinnata*, *G. pygmæa*, and *G. rigens*. *G. splendens*, introduced into Italy since 1860, is sometimes used for borders or for beds. In the author's garden, besides above species, occurs also *G. montana*, with yellow flowers, which was introduced by him and published in "Gartenflora" of Berlin. He also obtained from Lemoine the hybrids *G. coronata*, *G. diademata*, and *G. nivea latiflora*. Some other species, possibly natural hybrids, also came from South Africa. With all this material he began the operation of hybridisation, and with splendid results. He had also some species of *Arctotis* and *Garteria*, natives of South Africa, and closely allied to *Gazania*. The various hybrids he obtained are then enumerated and vividly described; they are the following: *G. vomerensis* (*G. rigens* × *G. nivea*); *G. elmensis* (*G. rigens* × *G. splendens*); *G. Italia* (*G. splendens* × *G. rigens*); *G. Arctotis* (parentage uncertain); *G. Firenze* (parentage uncertain); *G. romana* (*G. nivea* × *G. Pavonia*); *G. Trinacria* (*G. pygmæa* × *G. rigens*); *G. illustris* (parentage unknown).

Fecundation of Gazanias is comparatively easy, and should be undertaken in bright sunshine and when the flowers are fully open and mature. Hybrid Gazanias have also been obtained in Stuttgart, Nancy, and Erfurt, besides those already mentioned as obtained in England in 1860. Crossing between *Gazania* and *Garteria* is difficult; the former will probably cross more easily with *Arctotis*.—*W. C. W.*

Gentians. By G. Magne (*Le Jard.* Sept. 5, 1902, p. 263).—Their kinds described according to the quarters of the world of which they are natives, with hints on the cultivation of each.—*C. W. D.*

Geraniums, Culture and Distillation of. By F. S. Margiochi (*Bol. R. Soc. Nac. Hort.* iv. p. 70 1902).—Some interesting notes are given respecting the cultivation of Geraniums for the purpose of distillation. It appears that essence of Geranium is used for adulterating essence of Roses, the latter being valued at 1,000 francs per kilogramme, whereas an equal amount of the former realises only from 50 to 70 francs.—*G. M.*

Gerbera Jamesoni, Culture of. By R. I. Lynch, Cambridge (*Garden*, No. 1624, p. 5, 3/1/1903).—The writer says: "Plant at the foot of a south wall of a plant house which has hot-water pipes behind it. During summer give it the fullest exposure, and in winter fix a small light over the plant to keep off excessive wet. Do not close it in, but shake a little Bracken or similar material over the plant when the weather is cold. In this way I have had flowers from April to well into September, and a development which could never be obtained by pot culture. A plant I have under this treatment must be nearly if not quite fourteen years old, but this age is too great, and perhaps that individual will never again be so fine as it has been."—*E. T. C.*

Ginseng. By H. Garman (*U.S.A. Exp. Stn. Kentucky, Rep.* 1898, pp. 128–156; 12 figs.).—An account of this plant (*Panax quinquefolium*), which the Chinese and Japanese esteem an excellent tonic producer, is given. Up to the present it has formed an important article of commerce, but is rapidly diminishing in numbers as a wild plant. Its cultivation is urged, and necessary directions are given.—*F. J. C.*

Gladiolus × Princeps (*Amer. Gard.* 1902, pp. 818, 819, fig. 170; 20/12/1902).—A fine new hybrid out of *G. cruentus* by *G.* × *Childsii* var. raised by Dr. Van Fleet. The flower has a natural "expansion" of 5½ inches, and its colour is bright scarlet and white. It multiplies with great freedom on a poor soil.—*C. C. H.*

Gooseberry, A Disease of the. By A. Lorrain Smith (*Journ. Bot.* 481, pp. 19–23; 1/1903).—Detailed notes on the attack of a fungus, apparently *Sclerotinia Fuckeliana*, with its conidial form *Botrytis vulgaris*, previously known on the Vine, from Gooseberry plantations in Herefordshire.—*G. S. B.*

Gooseberry Hedges. By Alger Petts (*Gard. Mag.* No. 2564, p. 847; 20/12/1902).—A somewhat unusual way of growing Gooseberries is that of making hedges of them, and the writer describes in detail the way hedges should be made, their planting, pruning, stopping, training, and general culture. The subject is continued in the following number.

W. G.

Grafting, Curious Results of. By Lucien Daniel (*Rev. Hort.* No. 20, Oct. 16, 1902, p. 470).—*Scopolia carniolica*, belonging to the *Solanum* family, flowers very early in the spring, and dies off in May under normal conditions; but when the perishing tips are successfully grafted on the Tomato early in May, the time when active growth commences in the stock, the *Scopolia* receives a new lease of life, to the extent even of flowering once again. This fact is adduced as evidence that similarity of habit in stock and scion is not essential, and that the natural period of growth may be greatly modified by such alliances, and successional flowering be obtained. It would also seem to indicate that the perishing of foliage is due in some cases rather to cessation of root-function than of foliar vitality.—*C. T. D.*

Grafting, Specific Variations caused by. Anon. (*Gard. Chron.* No. 832, p. 409; Dec. 6, 1902).—In the "Revue Horticole" of Sept. 1, there is a very interesting article by M. Grignan on this subject, much of which is reproduced in the article of which this is an abstract. The writer of the article says, speaking of the paper by M. Grignan which "we reproduce, hoping that some of our cultivators may be disposed to repeat the experiments for themselves and to chronicle the results": "It is needless to say how much practical importance attaches to these experiments. They afford another illustration of the urgent necessity for an experimental garden where such researches can be carried out in a manner that is not practicable in purely business establishments." An account is then given of the result of various grafts made by a M. Daniel, and of some made by Herr Lindemuth, head gardener of the Royal University Garden at Berlin, which are of the most interesting description. This subject is again alluded to on p. 419, in a paragraph headed "Effects of Grafting," in which a note by M. Daniel in the "Comptes Rendus" is quoted, giving an account of some of his experiments, and particularly of grafting *Scopolia carnicola* on the Tomato.—*G. S. S.*

Grape, Hybrids (*Amer. Gard.* 1902, pp. 767, fig. 160, 29/11/1902; p. 833, fig. 173, 27/12/1902).—Mr. Nelson B. White of Norwood, Mass., after fifty-two years' work in the hybridisation of Grapes, has succeeded in blending together no less than five species, viz.: *Vitis Labrusca*, *V. vulpina*, *V. Linsecomii*, *V. rupestris*, and *V. vinifera*. Two distinct groups of hybrids have resulted: (1) the 'Five Nations,' which are especially suited to the production of wine; (2) the 'New Era,' especially selected for table purposes. Fig. 173 shows a genealogical tree of the 'New Era' group with two parents, four grandparents, eight great-grandparents, and two of the great-great-grandparents, and of these only one seems to have been repeated. It would be interesting, from the Mendelian point of view, to know how many of the eight original ancestors can be traced in the present group, and in what characters.—*C. C. H.*

Grape Pollen, A Study of (N. O. Booth in *Amer. Gard.* 1902, pp. 767, 768, 29/11/1902; pp. 784, 785; 6/12/1902).—A very interesting paper presented to the International Conference on Plant-Breeding at New York City, September 30 to October 2, 1902. The investigations were carried out on the lines of original research and field experiments combined (a happy combination) by Professor Booth at the State Experiment Station, New York, the object being to determine the reasons why certain varieties of Grapes are self-sterile. After elaborate laboratory tests and field experiments it was found that the chief reason of self-sterility was "a lack of viability or potency in the pollen itself." There are apparently no "distinct classes of self-fertile and self-sterile forms, but all gradations exist from one extreme (pseudostaminate) to the other (pseudopistillate)." It is suggested that the Grape is "now in a state of evolution from an assumed older hermaphrodite form to forms which are essentially staminate and pistillate. The practical results are summed up as follows:—

"(1) The self-sterility which is known to exist among many varieties of cultivated Grapes is frequently, if not always, due to a lack of potency in the pollen.

"(2) This lack of potency is indicated in the pollen grains by a shape which is quite different from that of potent pollen.

"(3) It is also shown in the arrangement of the pollen, either dry or in liquid media.

"(4) Certain varieties of Grapes bear pollen in which both the potent and impotent forms are mixed."

The details of this important paper will be looked for with much interest.—*C. C. H.*

Grapes. By A. Dickens (*U.S.A. Exp. Stn. Kansas, Bull.* 110, 5/1902; 8 figs.).—Gives an account of Grape cultivation outdoors, illustrates various methods of training, lists varieties uninjured, &c., by great frost of 1899, and describes a large number of varieties.—*F. J. C.*

Grapes, Keeping when cut. By Francis Charmeaux (*Le Jard.* Nov. 5, 1902, p. 331).—A method is described, with diagrams, by which it is said that cut Grapes may be kept for nearly a year as fresh as if just gathered.—*C. W. D.*

Gums, Blue, as Forest Trees. By C. H. McNaughton (*Agr. Jour. Cape G. H.* vol. xxi. No. 6, 1902, pp. 567–588).—This intensely interesting and valuable Report deals with the introduction of the Blue Gum-tree (*Eucalyptus Globulus*, Labill.) into the locality south of the Outeniqua range of mountains in the Midland Conservancy, C.C. In his summary the author states there can be little doubt that the introduction of the Blue Gum has been eminently satisfactory, and that it is a species which has proved itself as thoroughly satisfied with the factors of locality. There also can be no doubt that it is one of the most generally useful and valuable exotics yet introduced, and that while other Eucalypts &c. may be as profitably grown for definite purposes, the *Eucalyptus Globulus* will prove the most advantageous for the small grower to cultivate, and that no farm situated in a locality suitable to the species should be without its few acres of plantation, which cannot fail to pay over and over again its cost of establishment, whether by a yield of fuel or timber. Its introduction should be as widely recommended as possible.—*R. N.*

Harpalium (Helianthus) rigidum. By J. Aymard (*Ann. Soc. Hé.* May 1902, p. 98).—A variety is described which does not run at the root. It is said also to have other improved characters.—*C. W. D.*

Hemerocallis or Day Lilies. By G. B. Mallett (*Garden*, No. 1626, p. 38; 17/1/1903; No. 1,627, p. 52; 24/1/1903).—Many of the taller species are admirable plants. The smaller species, a few of the new hybrids, and the double-flowered varieties of *H. fulva* make excellent border plants of limited growth, while *H. minor* is worth a place in the rockery. Full cultural remarks with descriptions of the best species.

E. T. C.

Heucheras, Hybrid. By C. Wolley-Dod (*Garden*, No. 1611, p. 227, 4/10/02).—Notes upon a race of hybrid Heucheras raised in the garden at Edge Hall, Malpas. *H. sanguinea* has become the parent of a very varied race of hybrids, all of them hardier than itself, and many worth cultivating, but requiring selection.—*E. T. C.*

Hibiscus Rosa-sinensis. By H. Lemoine (*Le Jard.* Feb. 5, 1902, p. 45, and March 5, p. 72).—Full directions for the cultivation of this as a summer bedder, or to flower under glass.—*C. W. D.*

Hidalgoa Wercklei. Ed. (*Le Jard.* Feb. 20, 1902, pp. 61, 62).—An illustration is given of this novel climbing Dahlia, introduced by M. Heinemann, of Erfurt, but the name does not appear in the Supplement to "Index Kewensis."—*C. W. D.*

Hillside Lands, Tillage of. By Charles A. Keffer (*University of Tennessee Record*, January 1903, p. 52).—In East Tennessee, where the sloping hillsides are frequently washed by heavy rains and the best part of the soil carried away, a cover crop of rye is found of great use. It should be sown early (September 10), to have made good growth before frost checks it, and should be ploughed under in the spring.

In addition to this cover crop, where possible, parallel ditches, all converging to a central drain, should be made, as the heavy rush of water is by this means carried off with very little washing.—*C. H. C.*

Holland House and Garden. Anon. (*Gard. Mag.* No. 2539, p. 401, 28/6/02.—A descriptive account of this historical and beautiful place, accompanied by numerous illustrations.

The earlier and later history of the place has a peculiar interest for all, as it has always been connected intimately with the political and social life of the period.

To-day the place stands as one of the few existing examples of early design in gardening, and may it never be subject to the vagaries of fashion.—*W. G.*

Hollyhock, The. By Alger Petts (*Garden*, No. 1625, p. 21; 10/1/1903).—No plants surpass this in grandeur when the Hollyhock is properly treated. In starting to grow Hollyhocks it is better not to buy plants of named sorts, as these have always been propagated by cuttings, and they may have the seeds of disease in them already. A much better method is to buy a packet of the best seed. Full instructions are given for the culture of the Hollyhock from seed.—*E. T. C.*

Hollyhock, The. By R. P. Brotherston (*Gard. Chron.* No. 825, p. 280; Oct. 18, 1902).—In this article a very good account is given of the history &c. of this old-fashioned but highly ornamental plant, which is such a favourite in almost every garden. It does not appear to be very certain when this plant was first cultivated; in old times it seems to have been known by various names, some of which were given to other plants as well, so that there is some confusion in its ancient nomenclature.—*G. S. S.*

Honeysuckle, The. By W. Dallimore (*Garden*, No. 1617, p. 347; 15/11/1902).—The Honeysuckles met with in gardens may be readily divided into two distinct groups by their habit of growth and manner of flowering. The difference in growth lies in one section being climbers, requiring the aid of something wherewith to support the branches, and the other being of a bushy habit. The climbing ones, most of which have been known under the generic name of *Caprifolium*, are well represented by two British species, *Lonicera Caprifolium* and *L. Periclymenum*. Of the numerous cultivated species and varieties of Honeysuckle selections and descriptions are given.—*E. T. C.*

Honeysuckle, The. By G. (*Gard. Mag.* No. 2551, p. 613; 20/9/1902).—An account of the species of *Lonicera* commonly cultivated, but chiefly concerns the Honeysuckle of the poets, whose songs on the sweet flower are liberally quoted.

Beautiful illustrations of the Japanese Honeysuckle (*L. japonica*) and *L. Periclymenum* accompany the article.—*W. G.*

House-Sparrow, The. By John Percival (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 338–342). General observations on the food, habits, and distribution of *Passer domesticus*, are given; and the author also sets forth a scheme of rules for sparrow [and rat] clubs which can be amended or curtailed according to the peculiar requirements of the district.

R. N.

Insecticides and Fungicides, The Chemical Composition of. By J. K. Haywood (*U.S.A. Dep. Agr. Bur. Chem. Bull.* No. 68, pp. 1–62, 1902).—This work deals with the chemical composition of the various insecticides and fungicides, a number of which are now obtainable in various countries; together with the methods of analysis employed, and some discussion as to whether such compounds are injurious to plants or will serve the purpose for which they are intended.

The insecticides and fungicides are considered in the following order:—(1) Paris greens; (2) London purples; (3) insecticides and fungicides other than Paris greens and London purples, that contain arsenic, copper, or both; (4) soaps; (5) hellebores; (6) pyrethrums; (7) mixtures containing borax; (8) mixtures containing free phosphorus; (9) tobacco extracts; (10) miscellaneous solid insecticides and fungicides; (11) miscellaneous liquid insecticides and fungicides.—*R. N.*

Insect Pests and Remedies. By C. A. Keffer (*University of Tennessee Record*, January 1903, p. 55).

Common Caterpillar.—Spray with Paris green, 4 oz. to 50 gallons of water, or burn them on the branch.

Basket Worm.—Strong washes (soap or carbolic acid), cases of fine screen wire round trees, applications of coal tar—preventives. Once in the tree, the only thing is to cut them out.

Woolly Aphis.—Heavy applications of tobacco-dust to roots of trees.

San José Scale.—If taken in time, spraying with 25 per cent. solution of kerosene or petroleum and water. Spray evenly and quickly, but stop before dripping begins. Use "Kerowater" pump, which blends water and petroleum at nozzle, thus avoiding necessity of making an emulsion.

Fungous enemies—Peach-leaf curl, Apple-leaf rust, &c.—can be successfully treated with Bordeaux mixture.—*C. H. C.*

Insect Pests on Market Crops. By F. W. Mally (*U.S.A. Exp. Stn. Texas, Bull.* 64; 4/02).—After brief notes on insects in general, directions are given as to preparation of beds and management of frames &c., in order to check increase of insects; notes on the nature and use of insecticides; outlines on the principal insects troublesome in Texas, and advice on the selection of spraying apparatus.—*F. J. C.*

Insects in relation to Agriculture. By W. E. Britton (*U.S.A. St. Bd. Conn., Rep.* 1901).—Of the various families of insects, 116 are injurious, 113 useful, 71 contain but harmful and useful species, or their habits are not known. Dr. Riley estimates loss to agriculturists annually in the United States at $300,000,000 to $400,000,000 from the depredations of insects.

The introduction of insects has proved beneficial in several instances in the United States. The Ladybird (*Novius cardinalis*), introduced from Australia, has almost exterminated the cottony scale (*Icerya purchasi*) in California, and it is now hoped that another Ladybird (*Chilocorus similis*) introduced from China, a natural enemy of the San José scale, will have a similar effect on that insect. Notes are given on scale insects (San José scale, Oyster scale, Scurfy scale), the Tomato worm (*Protoparce celeus*), Green Pea louse (*Nectarophora pisi*), the Celery caterpillar (*Papilio asteris*), Codlin moth (*Carpocapsa pomonella*), Gipsy moth (*Porthetria dispar*), Maple borer (*Plagionotus speciosus*).

The Pea louse is a recent introduction from Europe, and did many million dollars' worth of damage to Green Peas used in the canning industry in the Eastern States. The insect passes the winter on Clover, and goes on to Peas at the beginning of June, so that early Peas escape. Spraying is too expensive; brushing the rows twice a week, so that the insects fall to the ground, then sending a cultivator between the rows so as to crush some and bury others, proved effective. When rows were too close for that, the aphides might be brushed into a long tank of kerosene.

F. J. C.

Irises, Dwarf bulbous. By E. J. (*Garden*, No. 1612, p. 244, 11/10/02).—These Irises may be grown in many ways. They are easily managed, and the best are to be obtained cheaply. In pots or pans, window boxes, or ornamental bowls, they can be successfully cultivated. For the latter method soil is not necessary, but a special fibre is now sold by nurserymen. In a cold house or even an ordinary frame these Irises may be grown perfectly, and indeed, where these are not available, there is still scope for their enjoyment.—*E. T. C.*

Iris Gatesii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7867).—Nat. ord. *Irideæ*, tribe *Moræeæ*. Native of Kurdistan. It has the largest flower of any species, being 5–7 ins. broad, very pale rose-lilac in colour, suffused with yellow towards the base, covered with veins and purple dots.

G. H.

Iris Kaempferi, Special Culture of. By Jules Rudolph (*Rev. Hort.* No. 20, Oct. 16, 1902, pp. 478–9).—One woodcut of varieties. Description of cultivation for cut flowers in wooden trenches, irrigated at first, about the middle of April or a month after planting, once a day, and subsequently twice a day, until flowering ceases. Directions are also given for raising from seed, sowing in warmth in March; some flowers showing the second year, when the plants are transferred to a site on a stream-side or other humid place, and utilised as outdoor decorative groups. Well-manured soil is an essential to success. In a subsequent number (No. 21, Nov., 1902, pp. 505–7), S. Mottet states that this Iris is far more accommodating as regards water supply than the above implies, water being only given in the dry season, and yet they flower as freely as when inundated, though perhaps not so large.—*C. T. D.*

Jack Fruit, Artocarpus integrifolia. By the Manager, State Nursery, Kamerunga (*Qu. Agr. Journ.* xi. pt. 3, Sept. 1902, with plate).—This paper gives a detailed account of the Jack fruit tree, its botanical history, varieties, use of the fruit, timber, &c., and methods of cultivation. It is found mostly in old gardens in North Queensland, but is not much recommended. In fact it is remarked that "the principal use of the Jack tree in the northern portions of Queensland would be as a fodder, and in this way it would probably prove as valuable as the Algaroba, or Mesquit Bean tree." The leaves are readily eaten by stock, and it is a tree that will grow in a dry as well as in a hot climate.—*M. C. C.*

Jacobinia chrysostephana. Ed. (*Journ. Hort.* Dec. 11, 1902, p. 543).—An engraving of this neglected stove plant, of which a group was exhibited on Nov. 18 at the Drill Hall by Messrs. Veitch. It is figured in *Bot. Mag.* tab. 5887, under the generic name of *Cyrtanthera*.
C. W. D.

Japan, Horticulture in. Ed. (*Le Jard.* March 20, 1902, p. 84).—The gayest month for flowers near Tokio is April. In that month a grand "Garden Party" [*sic*] is given in the Imperial Gardens to privileged guests.—*C. W. D.*

Justicia Kaessneri. By Spencer Moore (*Journ. Bot.* 478, p. 345; 10/1902).—Description of a new species, collected by Mr. Kässner at Gadu, British East Africa, from specimens in the Natural History Museum.—*G. S. B.*

Kalanchoe Kirkii. By Sir J. D. Hooker (*Bot. Mag.* tab. 7871).—Nat. ord. *Crassulaceæ.* Native of Nyassaland. The whole plant is glandular-pubescent. Leaves ovate-lanceolate, crenate. Cymes terminal, with crowded flowers, with 4-petalled orange-red corollas.—*G. H.*

Ker, John Bellenden. By James Britten (*Journ. Bot.* 480, pp. 419–422; 12/1902).—A chronological enumeration, with annotations, of Ker's botanical papers. A reclamation of priority for some of Roxburgh's descriptions of species of *Crinum* and *Pancratium* is the chief feature in these notes.—*G. S. B.*

Laburnums. By W. Goldring (*Gard. Mag.* 2534, p. 316, 24/5/1902). A descriptive account of the species and varieties of *Laburnum*, with notes on the soil and positions best suited to them in the adornment of a garden. Good illustrations are given of two of the finest varieties, *Watereri* and *pendulum*, and of *L. alpinum*, the so-called Scotch Laburnum.

W. G.

Lælia × autumno-cinnabarina (Cogniaux in *Dict. Icon. Orch.* Lælia x. t. 7; December 1902).—A new hybrid out of *L. autumnalis* by *L. cinnabarina*, sent by Sir Trevor Lawrence, the President of this Society. It is intermediate in form, but, curiously enough, *L. autumnalis* dominates almost entirely in the colour of the flowers.—*C. C. H.*

Lælia anceps and its Varieties. By de B. Crawshay (*Gard. Chron.* No. 832, p. 414; Dec. 6, 1902).—The writer says: "After many years' careful study of this beautiful Mexican *Lælia*, I have come to the conclusion that many of the so-called varieties of it are no more to be considered as its varieties than are the various sub-species or so-called varieties of *Cattleya labiata*." He then proceeds to give his reasons and shows how he would rearrange the varieties. The article concludes with an alphabetical list of fifty-nine varieties of *Lælia anceps*, and under the heading of "Allied Species" enumerates five forms and their varieties.—*G. S. S.*

Lælia Digbyana and its Hybrids. (*Garden*, No. 1626, p. 45; 17/1/1903).—"First sent to England in 1846 from British Honduras by Mrs. MacDonnell to Mr. St. Vincent Digby, of Minterne, Dorset; there this extraordinary Orchid flowered in 1847 for the first time in cultivation." Its interesting history is given, and an account of its hybrids.

E. T. C.

Lælia × juvenilis Fournieri (Cogniaux in *Dict. Icon. Orch.* Lælia x. t. 8; December 1902).—A new variety of this hybrid raised by M. Louis Fournier, of Marseilles, out of *L. Perrinii* by *L. pumila præstans*. It is a dark variety of the type, and has flowered no less than three times in one year, viz. in March, July, and November, 1902.—*C. C. H.*

Lælio-Cattleya × Aleschiana (L. Linden in *Lind.* xvi. t. 754; 25/11/1901).—A hybrid between *Lælia purpurata* and *Cattleya Schilleriana*, raised at Moortebeck by Messrs. Linden. According to the text, **L.-C. × Pringiersii** is of the same parentage, though originally recorded differently under t. 750, **L.-C. × Duchesnei**, *Id.* t. 777; **L.-C. × Pauli**, *Id.* t. 784.—*C. C. H.*

Lælio-Cattleya 'Constance Wigan' (*Orch. Rev.* p. 325, Nov. 1902).—Interesting particulars of this distinct hybrid, derived from the intercrossing of *L. xanthina* and *C.* 'Rex,' are recorded.—*H. J. C.*

Lælio-Cattleya 'Ira' (*Orch. Rev.* p. 325, Nov. 1902).—Particulars describing this hybrid derived from the intercrossing of *L. longipes* and *L.-C. Schilleriana*.—*H. J. C.*

Lamarck's Herbarium. Anon. (*Gard. Chron.* No. 827, p. 326; Nov. 1, 1902).—This well-known herbarium, which hitherto has been kept at Rostock, has recently been acquired by the French Government, who have placed it in the Museum at the Jardin des Plantes, where it may be consulted.—*G. S. S.*

Lavatera acerifolia. By Sir J. D. Hooker (*Bot. Mag.* tab. 7865). Nat. ord. *Malvaceæ*, tribe *Malveæ*. Native of the Canary Islands. It is a shrub 4–8 ft. high, with axillary flowers 3 ins. in diameter, the corolla being pale violet or rose-coloured with crimson base.—*G. H.*

Lawn Grasses, Sowing. By J. Bracken (*Gard. Mag.* 2532, p. 285; 10/5/1902).—A clear and practical article upon this subject. The kinds of Grass for particular soils are named, and also the Grasses that succeed best in dry and damp situations and in shade. The quantity of seed to sow for each hundred yards is stated in varying proportions for particular soils, as well as the details of sowing and after treatment.

The writer finds that black thread stretched across the newly sown plots at different heights is a good way of protecting the seeds from birds. He recommends various mixtures for different soils, and in all cases includes Clover, which serves well for ordinary lawns; but for tennis and other lawn games there should never be Clover sown with the Grass, as it becomes slippery in moist weather and from dew on evenings of hot and dry days, thus making the lawns dangerous to the players.

W. G.

Lettuce-forcing in Utah. (*U.S.A. Exp. Stn. Agr. Coll. Utah Bull.* 76, 1902; 2 plates).—The details of some experiments in forcing Lettuce at the Experiment Station of the Agricultural College of Utah. The attempts were necessarily on a very small scale through lack of space, and were continued for two years, two crops being reared each year. The varieties chosen were Grand Rapid and Denver Market, and the results showed that 1 part manure, 1 part sand, and 1 part leaf-mould is the soil to be recommended, and that Grand Rapid is the most valuable variety for the purpose.—*M. L. H.*

Lichens, New (*Beih. Bot. Cent.* bd. xiii. ht. 2, pp. 149–163).—Dr. A. Zahlbruckner describes a series of new Lichens from Los Angeles, California, collected by Dr. H. E. Hasse.—*G. F. S.-E.*

Lilies of the World. By Peter Barr (*Journ. Hort.* Oct. 16, 1902, pp. 364 and 377).—This experienced traveller describes the cultivation of these in different climates visited by him.—*C. W. D.*

Lippia nodiflora (*U.S.A. Exp. Stn. Arizona, Bull.* 45; 1902).—This plant has been distributed by the station as a sand-binder, and is said to be an excellent drought-resister.— *F. J. C.*

Liverworts in Baden (*Beih. Bot. Cent.* bd. xiii. ht. 1, pp. 91–104).—Herr Karl Muller (Freiburg im Breisgau) publishes a list of 78 Liverworts, with localities and critical remarks. Two new species of *Cincinnulus* are described, as also several new or imperfectly understood varieties.

G. F. S.-E.

Logwood Root-rot. By F. S. Earle (*Journ. N. Y. Bot. Gard.* vol. iv. Jan. 1903).—This disease is prevalent in Jamaica, and is spreading. It seems first to attack the small rootlets, spreading to the larger roots, and to the crown, when the tree dies. It appears to be caused by the mycelium of one of the Hymenomycetes. An examination of dying trees shows the roots to be badly rotted. These surface tissues are invaded by a white fungus mycelium that is usually more abundantly developed in the space between the bark and the wood.

It is recommended that dying trees should be dug out and the roots burned as soon as the disease can be detected. Where it is confined to small definite areas, it is advisable to dig a trench three feet deep just outside the diseased area, in order to prevent its spreading underground to the roots of healthy trees. Whatever the cause or the nature of the fungus, leaving stumps of trees that have died from this disease in the neighbourhood of living trees is clearly dangerous.—*M. C. C.*

Locust Disease and Katydids (*U.S.A. Exp. Stn. New Jersey Rep.* 1901, pp. 511 *et seq.*).—Reports failure of Katydid (*Scudderia texensis*), and of grasshoppers to contract the fungus disease of locusts imported from America.—*F. J. C.*

Lumber Industry in the State of New York, A History of. By William F. Fox (*U.S.A. Dep. Agr. Bur. For. Bull.* 34; 1902).—No more complete and interesting history of the lumber industry has been got together than the present, and from the opening page onwards the reader is fascinated with the pleasantly written account of what might well be called the life-history of this vast and important industry.

From the time when the pioneers first swung their axes in the primeval forest of New York—when the whole was a silent unbroken wilderness, a primeval forest which in grandeur and undeveloped wealth was unsurpassed in all the region of the Atlantic coast—down to the present day, with its sawing and wood-pulp machinery, and vastly increased volume of business, we have a very lucid account of the rise and progress of this far-reaching industry.

It would appear that about 1614 the first houses were built at Albany and on Manhattan Island, the territory which now constitutes the State of New York, and so rapidly has business developed that in 1880 the combined lumber product of the 2,822 saw-mills was no less than 1,148,220,000 feet, which necessitated the employment of 17,509 men.

New York was not originally a forest State, but essentially a white-pine State, the trees ranging from 150 feet to 160 feet in height, with a diameter, at breast high, of from two feet to four feet. The numerous beautifully executed illustrations of rafting in many of its stages, pit-sawing, &c., still further enhance the value of a most creditable account of the history of the lumber industry.—*A. D. W.*

Lycoris Sprengeri. By J. G. Baker (*Gard. Chron.* No. 835, p. 469, fig. in Supplement; Dec. 27, 1902).—This is a new and distinct species of this genus, with purplish-rose-coloured flowers, and said to be a native of Japan. Its nearest relative is *L. squamigera*, from which it differs in several respects.—*G. S. S.*

Malaga Raisins, Preparation of. By Victor Sebastian (*Qu. Agr. Journ.* xi. pt. 5, Nov. 1902).—Describes the methods used in the preparation of Malaga raisins, and the best varieties of grape to be used for the purpose. This communication is of interest chiefly to the viticulturists of Australia, and other tropical and subtropical countries where the vine can be cultivated in the open. It concerns itself with the culture and gathering of the fruit, the methods of drying, packing and pressing, and finally with extracts from a paper read at the Viticultural Convention held at San Francisco in 1888 on the Raisin Industry of California.

M. C. C.

Malvastrum capense (*Gartenflora*, 15/10/1902, p. 554).—An exhibition was given in September by H. Lindemuth, at a meeting of a German Gardeners' Society, of plants obtained by grafting *Malvastrum capense* on *Abutilon Thompsoni*. The plants bore leaves which were variegated as in the latter species. Specimens were afterwards propagated by cuttings.—*J. P.*

Manures, Chemical, for Vegetables. By W. (*Bull. R. Soc. Tosc. Ort.* 11, p. 344, November 1902).—Experiments conducted in Belgium in 1901 by Dr. J. Aeby and E. Hegh. Plants used were Carrots, Cabbages, Spinach, French Beans, Lettuce, Onions, Leeks, Radishes, Scorzonera, and others. Four parcels of land were chemically manured with perphosphate of lime, sulphate of potash, and nitrate of soda. One parcel was left unmanured; one was manured with dung; four with both chemical manure and dung. One of the chief aims was to determine for each piece of land and each kind of vegetable the action on them of an increasing quantity of nitrate of soda. The various methods of applying the manure and dung are given. The following is the result of the experiment: (1) The best crops were obtained on the pieces of land treated with both dung and chemical manure. Exceptions to this were afforded by some crops of Spinach, Onions, and French Beans; in these the best results were obtained with chemical manures alone, without dung, this latter appearing useless and perhaps injurious. (2) The product of those portions manured solely with dung are, in general, far inferior to the best crops obtained with chemical manures. Exceptions to this are the Leeks grown at Mons, the Carrots at Oosterloo, and the Onions at Gembloux, which yielded produce treated with dung equal to that obtained with manure consisting of a mixture of dung and chemical manures. (3) The produce of land treated with chemical manure alone equalled, and very often surpassed, that of land treated with dung alone, and considerably surpassed that of land without any manure. Exceptions to this were Carrots at Oosterloo, and Onions at Gembloux and Ostend.

The general conclusion is that rational doses of chemical manures added to that consisting merely of dung is highly advisable if one would obtain really good crops of vegetables.—*W. C. W.*

Manures, Garden. By C. A. Keffer (*University of Tennessee Record*, January 1903, p. 59).—A comparison between the value of (1) manure alone; (2) lime and manure; and (3) acid-phosphate and manure in the cultivation of garden vegetables, as shown by the growth of Sweet Corn, Tomatos, Beets, and Beans.

The addition of lime to manure produced no marked results. The acid phosphate with manure caused increased vigour of plants and earlier maturity of the crop.

In the early stages of growth this latter combination appeared to be the most satisfactory, but the results as a whole show that plain manure had the best effect.—*C. H. C.*

Maples, Japanese. By J. Clark (*Garden*, No. 1618, p. 360; 22/11/1902).—*Acer japonicum*, *A. palmatum*, and their respective varieties, all of which are characterised by finely cut leaves, and most by highly coloured foliage at certain seasons of the year, are commonly known as Japanese Maples. These two species, however, are not the only Acers natives of Japan: there are more than a dozen others. In this article they are described.—*E. T. C.*

Medicinal Plants, The Cultivation of. Anon. (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 368–370).—This paper is the result of an inquiry regarding the prospects of growing various medicinal plants in this country as a profitable industry. A Report from the Secretary of the Pharmaceutical Society of Great Britain shows that the prospect of success in growing medicinal plants and herbs in this country for the drug market is very slender. The plants enumerated in the Report are:—*Digitalis purpurea*, Linn., the dried leaves of which realise about 34*s.* per cwt.; Henbane (*Hyoscyamus niger*, Linn.); Belladonna (*Atropa Belladonna*; Lavender, the cultivation of which "for the distillation of oil is reported to yield no profit at present prices." "Peppermint is a more remunerative crop, but it is stated that only an experienced person can hope to make it pay."

Aconite, Poppy (for capsules), Rhubarb, Roses, Chamomile, and Liquorice are also mentioned, but no definite information is given about them.—*R. N.*

Mesembryanthemum racemosum. By N. E. Brown (*Gard. Chron.* No. 829, p. 350; Nov. 13, 1902).—A new species from South Africa, of which a full description is given. The plant grows from 12 to 18 inches in height, with deep rose-pink flowers. It belongs to a group in which the outer stamens are without anthers; these barren stamens are very numerous and bend inwards, completely covering the fertile stamens, so that it would be impossible for the stigma to be fertilised by any insect unless they opened at night; but whether this was so or not the writer had no opportunity of finding out.—*G. S. S.*

Mesembryanthemums. By S. W. Fitzherbert (*Garden*, No. 1618, p. 362; 22/11/1902).—These are not everybody's plants, and the fact that there are few localities in the British Isles where they can be grown successfully doubtless accounts for the scant attention they receive. The best collection is undoubtedly that contained in the gardens of Tresco Abbey, Isles of Scilly, where 120 species are grown. Here the porous soil consists of peat and disintegrated granite, and the sea is close at hand.—*E. T. C.*

Michaelmas Daisies, The best. By Edwin Beckett (*Garden*, No. 1611, p. 229, 4/10/02).—Few flowers have been so improved during the past thirty years as the Michaelmas Daisy. There are now many varieties, and great care is necessary in making a selection. We replant, trench and manure the border every two years, dividing the clumps into small pieces. The best varieties in each section are given.—*E. T. C.*

Mites attacking Begonias. By C. R. Fielder (*Gard. Chron.* No. 824, p. 264; Oct. 11, 1902).—The rusty and crippled appearance of Begonias which is only too common, particularly with 'Gloire de Lorraine,' which has generally been attributed to a fungus, has now been proved to be caused by a mite belonging to the genus *Tarsonymus*. This mite is so small as to be hardly visible to the naked eye; it may be destroyed by dusting the infested shoots with tobacco powder, or dipping the plants in tobacco water (any of the remedies which kill "Red Spider" would be useful).—*G. S. S.*

Morina longifolia. By H Olbrich (*Die Gart.* p. 5, 4/10/1902).—Illustration of a fine group in flower, which when well grown is perhaps the best of the "Thistles," and a truly showy and interesting perennial. Quite hardy in the whole of Europe.—*G. R.*

Mosquitos. By Dr. J. B. Smith (*U.S.A. Exp. Stn., New Jersey, Special Bull.*, 8/1902; 2 figs.).—The salt-marsh mosquito, *Culex sollicitans*, is very troublesome near the coast. It is recommended that the breeding-places, *i.e.* pools, and marshy land near the sea, should be destroyed; in cases where these cannot be immediately drained, sprinkle paraffin oil over the pool, and sweep the surface well with a broom, so as to get the oil between the grass, &c. This will kill the larvæ and pupæ within an hour.—*F. J. C.*

Mosses (exotic), Doubtful (*Beih. Bot. Cent.* bd. xiii. ht. 1, pp. 105–111).—Herr Adalbert Geheeb gives a list of synonymies as well as critical remarks regarding nineteen Mosses from South America, South Africa, Australia, Madeira, Canary, China, Georgia, West Indies, and the South Sea Islands.—*G. F. S.-E.*

Moss on Tree-trunks. By P. Hariot (*Le Jard.* July 20, 1902, p. 209).—Researches on this subject show the different effects of the same aspect in different climates.—*C. W. D.*

Mulberry Disease in Japan. By U. Suzuki (*Zeit. f. Pflanz.* xii. pp. 203–226, 258–278, 2 plates; 1902).—This disease, which has caused much loss to the silkworm industry in Japan, has been investigated by a committee. Professor U. Suzuki (University of Tokyo) gives an account of his chemical and physiological studies. The disease has only a secondary interest in Britain, but the methods of research are useful because they are of a kind not generally used in investigating diseases of plants. The Mulberry-trees become reduced in size and dwindle away. Micro-organisms are only secondary agents in destruction. The chief cause is summer pruning and excessive removal of leaves, whereby a deficiency in nitrogenous materials results, and reacts on the structure of the plants and the development of new shoots and leaves. There is an interesting examination of the condition of reserve and other food-materials at different periods. Results obtained by Woods (while examining the mosaic disease of Tobacco in the United States) have been followed up; the two diseases are somewhat similar in character. and an interesting similarity in the increase of oxydases and acidity is shown to exist.

W. G. S.

Musa Basjoo, syn. *M. japonica.* By F. Rehnelt (*Die Gart.* p. 2, 4/10/1902, with illustration).—This species of Banana, which is quite hardy in Italy and the South of France as well as the Western counties of England, stood under slight cover out of doors in Germany. In order to give the plants a fair chance, however, it is recommended to plant strong specimens established in pots early in the summer.—*G. R.*

Musa Wilsoni. By W. J. Tutcher (*Gard. Chron.* No. 834, p. 450, fig. 151; Dec. 20, 1902).—This is a new species from Yunnam, known by the natives as the 'Elephant Head' Banana. It is cultivated for the sake of the inner portion of the stem, which is used for food. "It is a highly ornamental species, with broad arching leaves 10 to 12 feet long. The trunk is conical, 5 feet long below the lowest leaves. All the bracts are persistent, but only the lower ones contain fertile flowers. The male flowers continue to open until the fruits are ripe, and as all the bracts are then withered and brown, it can easily be understood why the natives of Yunnam call the plant the 'Elephant's Head' Banana. The resemblance is certainly very striking." It appears to be closely allied to *M. glauca.*—*G. S. S.*

Musa religiosa, Resistance to Wind of. By Prof. Giorgio Roster (*Bull. R. Soc. Tosc. Ort.* 11, p. 342, November 1902).—In the author's Garden of Ottonella, in Elba, during last October violent northerly and southerly winds, the latter amounting to a hurricane, occurred, from the effects of which *Musa Basjoo*, *M. paradisiaca*, and *M. sapientum* suffered severely. *M. chinensis* and *M. Arnoldiana* received less injury, *M. religiosa* escaped wholly. The tree was somewhat smaller than the other species, but nevertheless bore 10 leaves 50 cm. long and 20 cm. broad, none of which were either broken or torn along the transverse veins. The author points out that the resistance of a *Musa* to wind depends on three conditions, viz. (1) the size and robustness of the leaf-stalks and rachis; (2) the density and thickness of the parenchyma of the leaf; (3) a special tendency of the leaves, more or less accentuated according to the species, to become torn along the transverse veins. The wind easily snaps the relatively weak and delicate leaf-stalk and rachis of *M. Basjoo*, but has less effect on the robust leaf-stalk and large rachis of *M. Ensete.*

The fact that moderately strong winds leave the foliage of *M. Ensete* in a tattered condition is due to the circumstance that the special structure of the leaf exposes it, more than others, to laceration into as many pendent laciniæ as there are transverse veins.

The author is unable as yet to speak about the qualities in this connection of *M. Arnoldiana* and *M. imperialis*, on account of their present small size; but it can be seen that they behave differently from *M. religiosa*, which they adjoin in position. It is hoped that *M. Arnoldiana*, from the shortness of its robust leaf-stalks, its prominent veins, and the dense tissue of the leaf, will be able to resist the wind better than other species. *M. imperialis* received two fractures from the wind, and one would expect its longer and more delicate leaf-stalks to be more susceptible to such injury than is the case with *M. Arnoldiana*.

W. C. W.

Mushroom Culture. By O. Thomas (*Garden*, No. 1620, p. 403; 6/12/02, No. 1622, p. 430, 20/12/1902).—The first two chapters of an article of some length dealing with the culture of Mushrooms in garden, field, and cottage plot. The system of culture both out of doors and under cover is thoroughly explained, and the manufacture of spawn is also treated of.—*E. T. C.*

Nemophila, Revision of the Genus. By H. P. Chandler (*Bot. Gaz.* xxxiv. p. 194, No. 3; 4 pls.).—The author reduces this polymorphic North American genus to eighteen species. Two belong to the Southern States, one to the Rocky Mountains, and the rest to the Pacific slope, principally California. The author observes that "the almost infinite variation makes an accurate limitation of species absolutely impossible; and most of the species described include a great variety of more or less inconstant forms." Each species is described in full, with localities and references to authors.—*G. H.*

Nepenthes. By R. Jarry Desloges (*Le Jard.* Dec. 20, 1902, p. 375).—A long dissertation on the different methods of the cultivation of this genus, with illustrations.—*C. W. D.*

Odontoglossum × Adrianæ leopardinum (L. Linden in *Lind.* xvii. t. 782; 15/9/1902).—A pretty form of this well-known natural hybrid, **O. × A. tigrinum,** *Id.* t. 791; a dark form.—*C. C. H.*

Odontoglossum × Adrianæ Victoria-Regina (*Orch. Rev.* p. 329, fig. 35, Nov. 1902).—A fine illustration of this beautiful natural hybrid *Odontoglossum*, and interesting records are given.—*H. J. C.*

Odontoglossum crispum, A remarkable Series of (*Orch. Rev.* p. 9, fig., Jan. 1903).—Here are included illustrations, well reproduced, of one of the most wonderful series of *Odontoglossum crispum* ever brought together. Historical particulars and records are given with the illustrations, which include *O. c. Luciani*, *O. c.* 'Imperator,' *O. c.* 'Queen Victoria,' *O. c.* 'Franz Maserul,' *O. c. heliotropium*, *O. c. Stevensii*, and *O. c.* 'Prince of Wales.'—*H. J. C.*

Odontoglossum crispum 'La Veine' (L. Linden in *Lind.* xvi. t. 758; 31/12/1901).—A beautiful form, pure white with a large regular vinous-brown blotch on each of the sepals, petals, and lip.—*C. C. H.*

Odontoglossum crispum Leoniæ (Cogniaux in *Dict. Icon. Orch.* Odont. t. 1 P; December 1902).—A lightly spotted variety, of good shape, which recently flowered with M. Jules Closson of Liége.

C. C. H.

Odontoglossum crispum 'Memoria Bulli' (L. Linden in *Lind.* xvii. t. 780; 24/6/1902).—A beautifully blotched form, with broad segments.—*C. C. H.*

Odontoglossum crispum 'President Roosevelt' (L. Linden in *Lind.* xvii. t. 787; 25/10/1902).—A good form, with chocolate blotches.

C. C. H.

Odontoglossum crispum 'Prince Albert' (L. Linden in *Lind.* xvii. t. 789; 25/10/1902).—A peculiar form, with truncate blotches.

C. C. H.

Odontoglossum crispum 'Reine Emma' (L. Linden in *Lind.* xvii. t. 785; 25/10/1902).—A fine form, with large blotches; flowers rather smaller than usual, but from a small plant. This should develop into a magnificent variety.—*C. C. H.*

Odontoglossum loochristiense 'Etoile de Moortebeek' (L. Linden in *Lind.* xvii. t. 792; 25/10/1902).—A form of this well-known hybrid raised at Moortebeek by Messrs. Linden, canary-yellow with chocolate blotches and spots.—*C. C. H.*

Odontoglossum × sceptro-crispum (L. Linden in *Lind.* xvii. t. 773; 24/6/1902).—A hybrid raised at Moortebeek by Messrs. Linden, the name of which denotes the parentage. If *O. sceptrum* be considered a form of *O. luteopurpureum*, this hybrid would be a form of *O.* × *Denisoniæ*.—*C. C. H.*

Onion Industry, The Brined. Anon. (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 349–354).—"Representations were recently made to the Board of Agriculture by the Biggleswade Trades and Agricultural Association to the effect that the cultivation and preparation for pickling of Onions, Gherkins, and Cauliflowers, which was until a few years ago a flourishing industry in the Biggleswade district, had declined since 1895, owing, it was said, to the increasing competition of Dutch and Belgian producers, who were apparently able to place their goods on British markets at lower prices than the market-gardeners of North Bedfordshire could afford to accept. This decline was not only a matter of deep concern to the gardeners at Biggleswade, but it had been accompanied by a large reduction in the incomes of the working classes in the neighbourhood, as the various operations connected with the growth and brining of pickling Onions gave employment to a large number of women and children. The Board accordingly sent an officer, who was accompanied by a representative of the Biggleswade Association, to investigate the conditions under which the brined Onion industry is carried on in Holland and Belgium.

"It appears that the chief centres of the production of Onions in the Netherlands are the provinces of Zeeland and North and South Holland,

and that an area of 7,500 acres, exclusive of market-gardens, is estimated to be annually under the crop.

"The small white Onions, known as 'Silverskins,' the competition of which was more immediately the subject of complaint, are grown mainly in the provinces of Gelderland and North Brabant, though in recent years they have also been cultivated on a small scale in South Holland and Zeeland. The total acreage sown with this variety does not, however, exceed 125 acres. The growers are mostly small market-gardeners or peasant farmers occupying about $2\frac{1}{2}$ acres of land; a few of them rent larger areas, but the holdings seldom exceed 5 acres. They are nearly all tenants paying rents ranging from 3*l*. 7*s*. to 5*l*. per acre according to the quality of the land, and their cottages are rented at 2*s*. to 3*s*. 6*d*. per week.

"On the holdings of $2\frac{1}{2}$ acres little outside labour is required, as the occupier is usually able to work the land with the aid of his wife and children: and large families are the rule rather than the exception among the small growers. It is the practice to put children to work on the land at 10 or 11 years of age, when they are taken away from school. Sometimes, however, and especially in cases where the area cultivated amounts to 5 acres, occasional labourers are employed to help in digging and clearing the land, and again at harvest, sufficient work being found for two men for about three months in the year. But, wherever it is possible, women and children are employed, as their labour is cheaper. Children are largely employed for pulling the Onions.

"Adult male labourers earn from 2*s*. 6*d*. to 3*s*. 4*d*. per day. Women are paid 2*s*., and children 1*s*. a day. No food or other perquisites are given by the employers."

"After the Onions have been pulled and dried they are sold raw and unpeeled to the agents of the brining factories. The price paid for them varies with the supply and with the quality. This year the average price paid for the greater part of the crop was exceptionally low, amounting to only 3*s*. 4*d*. per bag of 110 lbs. Last year the growers received from 5*s*. to 5*s*. 10*d*. per 110 lb.; and in 1900, when Silverskins were scarce, as much as 16*s*. 8*d*. per bag was paid in some cases. These prices are paid for the crop when pulled on the holding, all expenses for bags and transport to the factories being borne by the factories.

"Owing to the frequent variations in the crop and the fluctuations in prices, the cultivation of Silverskins is looked upon as a speculative business. On this season's crop, for example, with prices as low as 3*s*. 4*d*. per bag, cultivators have incurred a loss.

"The Dutch growers, however, are a sober, hard-working class with few wants beyond the bare necessaries of life. They remain, as a rule, very poor, and their food consists for the most part of bread, milk, and potatos. They usually fatten a pig, and grow sufficient Potatos and other vegetables to meet their own requirements.

"The peeling is chiefly done by women and children at their own homes in the towns where the factories are situated. The peelers fetch the raw Onions from the canal wharf and deliver them peeled and washed to the factories. The usual price paid for peeling is 1*d*. per kilo. of 2·2 lbs. for Silverskins, and $\frac{3}{5}$*d*. per 2·2 lbs. for large white and brown Onions, known as 'bread and cheese Onions.'

"One advantage of the factory system is the great facilities it affords for turning out large quantities of brined Onions of uniform size and appearance selected from the produce of a large number of small growers. In the case of one of the largest factories, which exports a considerable quantity of Silverskins to Great Britain, this process of selection is assisted by the practice of sorting the Onions when purchasing them from the growers in order to exclude outside sizes.

"Another important feature noticed in one of the Dutch brining factories is the use of improved apparatus for grading the Onions. In place of the round hand-sieves with cane bottoms and a square mesh, which are still used in Biggleswade, an oblong riddle is employed, about four feet long by three feet six inches wide. This consists of three trays fitting into each other, with zinc bottoms perforated with round holes, according to the sizes of the different grades of Onions that each tray is intended to deal with, the tray with the largest holes being at the top, and that with the smallest at the bottom. A further improvement observed is the use of horizontal troughs for the sorting of the riddled Onions, in order to pick out discoloured specimens, 'pipes,' and bad shapes. The Onions are sorted into four sizes, the finest being, on the whole, smaller than the best English; and are then put into casks and brined.

"As regards prices, the first grade fetched this year 70*s.* per hogshead, f.o.b. Rotterdam, according to the latest quotations, and other grades ranged down to 24*s.*, the latter being for very large sizes. These prices are, however, low, and due to the exceptionally abundant crop of this year. Last year the first grade fetched 80*s.* per hogshead, and the other sizes were correspondingly dearer.

"Freight rates are quoted from Rotterdam to London, from which it appears that about 2*s.* 6*d.* to 3*s.* per hogshead, or at least 10*s.* per ton, must be added to the Rotterdam prices for brined Onions in order to get at the actual cost of the goods to the London pickling firms; and something must also be allowed for the cartage from the wharf or station, as the case may be, to the picklers' premises.

"Railway charges from Biggleswade to King's Cross vary from 9*s.* 2*d.* per ton for a single ton, to 6*s.* 3*d.* per ton for 4-ton lots.

"The foregoing observations embody the principal points brought out by the inquiries made with regard to the Dutch trade in brined Onions. The social and economic conditions under which the industry is conducted in the Netherlands differ in many respects from those existing in this country, and these differences must be taken into account in any attempt to institute a comparison between the expenses of cultivation on the Dutch small holdings and on the large market-gardens in the Biggleswade district. For instance, it has been suggested that the cost of labour in Holland is so much cheaper than in this country, that it has enabled the Dutch exporters to undersell the British producer. But it has already been pointed out that the Dutch gardeners may themselves be regarded as labourers, inasmuch as they perform practically the whole of the work on their holdings, with the aid of their wives and children. They are a sober, hard-working class with little or no ambition, and their standard of living is of the humblest description. In seasons of low prices, such as is the case this year, the Dutch cultivator is worse off than a labourer, as his net profits would not represent a return for his work equivalent to the wages ordinarily paid to male labourers in the neighbourhood, which range from 15*s.* to 20*s.* a week. When prices are high his profits naturally rise, but after he has paid his rent and manure bill they seldom much exceed the weekly wages of a day labourer. So that, though wages in Holland are actually not much less than those paid in the market-gardening districts in this country, they do not enter so largely into the cost of production, because the Dutch grower of Silverskins employs little outside labour, and is content to work on his holding for a return which in some seasons is not equivalent to the wages of ordinary labourers.

"On the other hand, his outgoings for rent are higher per acre than those ruling in this country, and he can claim little advantage on his manure bill. It is clear, therefore, that, even under the most favourable conditions, the net profits realised by the cultivator of Silverskins in Holland would be quite inadequate to satisfy the social requirements of agriculturists and market-gardeners in this country.

"In connection with this question of the relative cost of labour it must, however, be observed that in the Netherlands all the expenditure involved in dealing with the crop after it is gathered is borne by the brining factories. And in the case of the cost of peeling, which is the largest item in the labour bill, there would seem to be a difference of nearly one penny per peck between the prices paid to Dutch peelers and those quoted by the Biggleswade growers. The former received one penny per kilo., which is under $7\frac{1}{4}d.$ per peck of peeled Onions, while at Biggleswade the price paid is stated to be 8*d.* a peck.

"These differences, however, have not been of sufficient influence to enable the brining factories to place their goods on our markets at prices persistently lower than those at which English goods have been quoted; and, in fact, the evidence collected by the Board both in the Netherlands and in this country has gone to show that the prices paid by pickling firms for first quality Dutch Silverskins in brine delivered in London have, in some seasons, been higher even than the prices quoted for home produce. It is, indeed, a mistake to assume that the increasing demand for Dutch Silverskins in this country is to be explained by reference merely to the question of prices. Nor is it to be explained by any real difference in the quality of the Onions, since the Silverskins grown in Holland do not possess any inherent properties which make them intrinsically superior to the Onions of the same species produced in this country. The secret of the success of the Dutch competition is to be found mainly in the fact that the Onions exported from the Netherlands present, on the whole, a better appearance and more readily meet the requirements of the pickling firms, because more effective methods and greater care are employed in their preparation for brining. The organisation of the brining industry in the Netherlands has enabled the factories, by collecting their supplies of raw Onions from a large number of growers and by the use of improved apparatus, to send to this country large consignments of Onions in brine possessing greater uniformity in size, shape and colour than it seems possible to obtain by the methods at present adopted at Biggleswade. It is just this uniformity in the bulk which the great pickling firms in this country desire, and for goods possessing it they are prepared to pay a higher price than for produce which is deficient in this respect.

"Summing up the results, it may be said, therefore, that the success of the Dutch trade in brined vegetables is due to the better organisation of the industry, and to the humbler standard of living of the Dutch growers, which enables them to be satisfied with the smaller profit, and by these means to overcome the disadvantages of heavier rents and freights."

R. N.

Orangeries. By Louis Lemoine (*Le Jard.* Oct. 5, 1902, p. 295).—It is regretted that the successful cultivation of the Orange in the latitude of Paris, formerly considered in France an important test of a good gardener, has fallen into disuse. Hints for success in this are given.

C. W. D.

Orchids in Leaf Soil. By J. C. Tallack (*Garden*, No. 1614, p. 289; 25/10/1902).—The illustration given may help to dispel doubts as to the suitability of leaf soil for Cattleyas. It shows a plant of *C. Mendelli* which has been in a 6-inch pot for over three years, and is only one of many now growing well in leaf soil. The improvement in colour of leaf of plants which have made one year's growth in leaf soil is so marked as to enable one easily to distinguish them.—*E. T. C.*

Palms and Camellias out of doors. By F. R. S. (*Garden*, No. 1617, p. 340; 15/11/1902).—Of the most beautiful and interesting perennials I have been able to grow successfully in the light, very dry, sandy soil of the north part of Surrey, I give to *Chamærops excelsa* the palm, but several Bamboos and Camellias come next. The experiences of an amateur gardener in growing these plants out of doors form instructive and interesting reading. Illustrated from a photograph of *Chamærops excelsa.*—*E. T. C.*

Pansy, The English. By R. Dean (*Garden*, No. 1612, p. 245; 11/10/02).—Few persons in the South now cultivate the English Pansies—the yellow grounds, white grounds, and selfs. There is a persistency in many of these that I miss in some of the newer Violas, which seem to go down rapidly after blooming freely for a few weeks. The finest blooms are obtained from plants put out in the autumn. The cultivation of Pansies in pots to secure fine exhibition blooms was much followed fifty years ago, but is now practically a lost art.—*E. T. C.*

Pansy, The Fancy. By R. Dean, V.M.H. (*Gard. Mag.* No. 2544, p. 491; 2/8/1902).—The first of a series of articles on "florist's flowers" by a well-known veteran florist. He gives a brief sketch of the history of the development of what are termed "Fancy Pansies" as distinguished from the Show Pansies. This history, as in all cases of flowers that have been developed by florists from primitive material, is interesting.

The names of Salter and Downie in this country and Meillez in France are prominent in connection with the early improvement of the Fancy Pansy, and the work is still going on. The writer gives a descriptive list of the finest sorts, which will be useful to lovers of the flower.

W. G.

Papaver hybridum fl. pl. fol. aur. By F. and O. Spittel (*Die Gart.* p. 17, 11/10/1902).—A new annual form with large golden yellow foliage, of compact but vigorous growth, attaining a height of about a foot. The colour of the flowers varies from scarlet to cream, &c.—*G. R.*

Papaver hybridum 'Santa Lucia.' By W. Muetze (*Die Gart.* p. 62, 8/11/1902).—A new double-flowering Poppy of the annual class. It is very variable in colour. Recommended as a cut flower.—*G. R.*

Parasites on Roots. (*U.S.A. Exp. Stn. New Jersey, Rep.* 1901, pp. 434–436; 2 plates).—A few notes on Broomrape (*Orobanche minor*) on Clover, and *O. ramosa*, L., on Tomato, are given. The latter is a common parasite on Hemp and Tobacco. Both species are illustrated.
F. J. C.

Peaches of the Peen-to Group (*U.S.A. Exp. Stn. Florida, Bull.* 62; 7/1902; 3 plates).—Peaches of this group are described as being specially adapted for growing in Florida and the coast regions of the Southern States. This Peach was introduced early in the nineteenth century to England under the name of Java Peach (*Trans. Hort. Soc.* vol. iv., 512–513, pl. xix.), and into America about 1828. It has given rise to about twenty-two varieties, which are described in the present bulletin.—*F. J. C.*

Peach Scales, Two. By H. A. Gossard (*U.S.A. Agr. Exp. Stn. Florida, Bull.* No. 61, 1902, pp. 473–498).—The species dealt with are the San José (*Aspidiotus perniciosus*) and *Diaspis pentagona*; neither of which is found in Great Britain.

"Crude petroleum of 43 to 45 degrees specific gravity applied in 20 per cent. mechanical mixture with water is an efficient winter remedy for both of the above-named scales.

"The trees should be banked with earth about the roots to catch the surplus spray, and the application should be made on a bright sunny day. The spray-soaked earth about the roots should be removed within half an hour after the work is completed.

"One thorough application while the buds are swelling or ready to burst is sufficient and is recommended.

A Kerowater machine with Vermorel nozzles should be used, or if an ordinary pump is employed an emulsion must be prepared.—*R. N.*

Pear Gnat Midge, The. By E. Bartrum, D.D. (*Gard. Mag.* No. 2554, p. 664; 11/10/1902).—The writer describes another enemy to the Pear, *Diplosis pyrivora*, a very small fly not unlike a gnat, the grubs of which attack the young fruits, causing them to turn brown, then black. With characteristic devotion to detail, he gives the life history of this little pest, and suggests remedies against its attacks; but on this point he is apparently undecided. Probably later on an effectual remedy will be discovered, but at present it seems that science is not superior to insect attack (see p. cxxxvii).—*W. G.*

Pear-leaf Blister Mite. Anon. (*Gard. Mag.* No. 2544, p. 503; 2/8/1902).—A descriptive note (illustrated) of the insect pest which causes what is popularly known as Pear-leaf Blister. Spraying with paraffin emulsion diluted with water is stated to be an effectual remedy for the disease.—*W. G.*

Pear 'Madame Ballet.' By F. Morel (*Rev. Hort.* No. 20, Oct. 16, 1902, p. 480).—Coloured plate representing a very handsome Pear, fully described and highly recommended. Raised by M. Ballet, nurseryman, Parenty (Rhône).—*C. T. D.*

Pear-Trees, Treatment of non-fruiting. By George Bellair (*Rev. Hort.* No. 20, Oct. 16, 1902, pp. 483-4; two woodcuts).—Trees which have a tendency to run to unfruitful wood should not merely have their shoots shortened, but the upper buds on the retained portions should be destroyed, retaining the leaves intact. The result is a determination of vigour to the basal buds, which thus become flower-buds, while otherwise the upper buds are apt to start into infertile growth instead.

C. T. D.

Pecans. By F. H. Burnette, Wm. C. Stubbs, and H. A. Morgan (*U.S.A. Agr. Exp. Stn. Louisiana, Bull.* 69, illustrated).—A pamphlet prepared to meet the increasing demand for information concerning the cultivation and habits of the Pecan Nut *Hicoria Pecan* (Britt.), *Carya olivæformis* (Nutt.), a species of the Hickory.

It is found growing naturally in the alluvial soils of the Mississippi valley, and evidently prefers a moist subsoil; yet, with cultivation, proper fertilisation, and the use of improved varieties, profitable orchards may be established upon poor soils.

It is a rapid grower, and in Louisiana becomes a large forest tree, bearing very large, thin-shelled nuts. Further north the trees are still large, but the nuts are small, with hard shells.

The old method of raising trees from seedlings having been found very uncertain (the resulting nuts being, in many cases, inferior to those sown), the general practice now is to grow seedlings and then graft or bud proved varieties upon them.

Ring or annular, and veneer or flute budding, are both used; and whip and tongue, or the common cleft-grafting, is practised in spring.

The buds and grafts should be taken from bearing trees, as these fruit sooner than those taken from young undeveloped trees.

Seventy feet apart in the orchards is close enough for most varieties.

In transplanting young trees from the nursery the greatest care should be taken to preserve the long tap-root from damage.

Trees planted in rich alluvial soil require little or no fertilising.

Where the fertiliser is to be applied to mature trees in poor soil, nitrogen, potash, and phosphoric acid should be mixed in equal proportions.

In alluvial soils, where potash is frequently present, it may be omitted.

For young growing trees, nitrogen should be in excess, two parts to one each of phosphoric acid and potash. Upon sandy soils, nitrogen is so important for young trees that they should be constantly cropped with leguminous plants, as Cowpeas, Velvet-Beans, &c., which can be ploughed in.

Besides nitrogen, this process will increase the humus in the soil, which for its water-holding properties is most valuable to the pecan tree.

Old trees can be renewed and made to bear good marketable nuts, by being gradually worked over.

The number of varieties has been increased until now there are about fifteen desirable sorts of Louisiana origin, amongst them being 'Centennial,' 'Carman,' 'Frotscher,' 'James's Giant,' &c.—*C. H. C.*

Perfumes of Flowers. By P. Hariot (*Le Jard.* May 5, 1902, p. 129).—Many of these so-called "Extracts" are chemical forgeries unconnected with the flowers they represent. Some are products of other plants, as Essence of Violets, from Iris root. But extract of sour milk and rotten cheese is made to imitate the flavour of Pears, Melons, Bananas, &c.—*C. W. D.*

Pernettyas. By W. T. (*Gard. Mag.* No. 2534, p. 313, 24/5/1902).—A good account of these beautiful shrubs, descriptive of the varieties or rather the garden forms, with berries ranging in colour from white to pinks and crimsons. Notes on the culture, both in the open air and in pots under glass, are given.—*W. G.*

Phæoptilum spinosum. By Spencer Moore (*Journ. Bot.* 480, pp. 408–9; 12/1902).—Admitting the specific identity of the recently described *Amphoranthus spinosus*, ascribed to the *Cæsalpinieæ* (see Journ. R.H.S. vol. xxvii., p. 724) with this previously described member of the *Nyctagineæ.*—*G. S. B.*

Philadelphus, Species of. By G. G. (*Gard. Mag.* No. 2555, p. 677; 18/10/02).—The Mock Oranges or Syringas, the popular names by which the various species of *Philadelphus* are known in gardens, are reviewed in this article, which is accompanied by illustrations of some of the most valuable kinds. Special note is made of the several beautiful hybrids which have been obtained during recent years by hybridising the eastern and the western species, and for those we are indebted to the veteran hybridist M. Victor Lemoine, of Nancy.

This is a large genus of flowering shrubs, many species of which are introduced, but they so nearly resemble each other that the selection of kinds should be discriminatory.

All the hybrids are, however, without exception, worth cultivating. The article is beautifully illustrated.—*W. G.*

Phyteumas, The. By Henry Correvon (*Garden*, No. 1626, p. 39 17/1/1903; No. 1627, p. 57; 24/1/1903).—The genus *Phyteuma* is one of the most completely alpine of the *Campanulaceæ*. Among the fifty-one species recognised by the "Index Kewensis," eighteen are special to Eastern Europe and Asia Minor, one to Siberia, one to the Himalayas, and one to Japan. From the horticultural point of view, the one chiefly under consideration, there are many more Phyteumas than appear in the Kew list. A description of the best garden species is given, with cultural details.—*E. T. C.*

Plane-leaf Scorch. By H. Klebahn (*Zeit. f. Pflanz.* xii. p. 258; 1902).—Preliminary note on discovery of a perithecial ascus-stage on fallen leaves of Oriental Plane, which in summer bore the conidial form (*Glœosporium nervisequum*).—*W. G. S.*

Plant-growth, Effect of Acetylene Gas-light on. By F. W. Rane (*U.S.A. Agr. Exp. Stn. New Hampshire, Tech. Bull.* No. 4; October 1902)—This is a description with photos of experiments on several plants, under a cluster of 8 burners and a 20-inch reflector. One half of the bed was curtained off during the night for comparison. On January 1 the lights were started and run each night till February 15, 1901. On January 8 the plants, especially Lettuce, began to show an increase of growth. By January 16 there was a marked difference in Lettuce, Parsley, and Beans, but not so much with other plants. The following were the conclusions ultimately arrived at:

1. That acetylene gas-light has a marked effect upon greenhouse plants.
2. That no injurious effects occurred.
3. It stimulates and appears to be beneficial to foliage crops. The Lettuce was more erect and weighed more.
4. Most plants were taller.
5. It is doubtful whether this light can be used economically; while its effects are marked in winter, little difference was seen in other seasons.
6. There are many points about the acetylene gas-light that make it desirable for lighting greenhouses. It is not expensive, is easily piped, and comparatively simple to run.—*G. H.*

Platyosprion platycarpum. By G. Nicholson (*Gard. Chron.* No. 824, p. 259; Oct. 11, 1902).—This handsome tree, though collected in Japan on Fusiyama in 1864, has only just found its way into cultivation. It is probably rare in its native country. It somewhat resembles the well-known *Sophora japonica*, but it differs from that plant in many distinct particulars.—*G. S. S.*

Platytheca galioides. By W. T. (*Gard. Mag.* No. 2544, p. 496; 2/8/1902).—Mention is made of this descriptive and cultural note on this beautiful Australian greenhouse shrub in order to draw attention to the fact that it is a new name for a well-known plant known under the names of *Tremandra verticillata* and *Tetratheca verticillata*.—*W. G.*

Polemoniums. By G. (*Gard. Mag.* No 2544, p. 494; 2/8/1902).—A good account of the various species and varieties of this genus (Jacob's Ladder), with practical cultural notes, for, though the species are as a rule easily grown plants, some, such as *P. confertum*, are among the most capricious plants in the rock garden. A good illustration is given of *P. humile*.—*W. G.*

Pollen. By C. Druery (*Journ. Hort.* Dec. 11, 1902, p. 521).—Interesting notes on the nature and form of the pollen grains of different plants.—*C. W. D.*

Pollination, Orchard. By F. Martin Duncan (*Gard. Mag.* No. 2532, p. 291, 10/5/1902).—In this article on an important matter the writer discusses the causes of unfruitfulness among orchard trees, whether due to frost, rain, wind, or other causes. The writer has evidently made a minute study of the subject, as he records his observations in a clear way. If the causes of sterility in orchards can be obviated by simple means, such as the selection of varieties and the carrying out of other details, such as soil and site for an orchard, then the matter is of the utmost importance to the fruit-grower.

There are, however, other causes of unfruitfulness in orchard trees which are beyond the control of cultivation.—*W. G.*

Polygonum polystachyum, Wallich. By P. Hariot (*Le Jard.* Jan. 5, 1902, p. 4).—An article recommending and describing this little-known Himalayan 'Knot-weed,' which bears long spikes of white flowers in late autumn, and, being very hardy, is suitable for rough rocky wildernesses where little cultivation is required. It is less encrcaching and more ornamental than *P. cuspidatum*, and half the height.—*C. W. D.*

Potato Cultivation (*U.S.A. Exp. Stn. New Jersey, Ann. Report.* Oct. 1901, pp. 388, 389).—A mulch of two inches of wood shaving in July on land planted with Potatos gave an increased yield over that on unmulched land in the proportion of 360 : 310; there was also less scab on the mulched portion.—*F. J. C.*

Potato Disease, A new. By M. C. Potter (*Jour. Bd. Agr.* vol. ix. No. 3, 1902, pp. 320–323, pl. iv).—This fungoid disease is attributed to *Chrysophlyctis endobiotica* of Schilberszky.* It produces large, irregular, convoluted, tumour-like swellings on the potato-tuber. "Judging from some sections in an early stage, the attack appears to commence at the 'eyes,' the parasite easily gaining an entrance into the outer cells of the young and tender structures which normally would develop into leaves. In these the cells are readily stimulated to divide, and, as a result of the injury caused by the parasitic invasion, irregular cell-division is set up. The destruction of any one cell causes those in contact with it to divide in the attempt to heal the wound; when these latter cells are attacked in their turn, a further cell-division is induced, and by a repetition of the process the leaf-protuberances become converted into an irregular cell-mass which in the initial stages may be seen as finger-like outgrowths. From these points the irritation spreads along the cork-cambium, so that the cells over a large portion of the surface of the Potato gradually undergo this irregular division and multiplication, which is extended also into the internal tissues."

The disease has been reported only from Cheshire.†—*R. N.*

Potato Diseases, Some. Anon. (*Journ. Bd. Agr.* vol. ix. No. 3, 1902, pp. 307–311, pls. i–iii.).—i. Black Scab (*Œdomyces leproides*,

* "Ein neuer Schorfparasit der Kartoffelknollen." *Berichte d. Deut. Bot. Gesell.* Bd. xiv., 1896.

† Many examples of potato-tubers infected with this curious fungoid disease were sent to me in 1902 from several localities in Cheshire.—*R. N.*

Trabut). This parasitic fungus was first observed attacking Beetroot at Rouiba, near Algiers. On this plant it produces irregularly wrinkled tumorous outgrowths, which, when mature, contain numerous irregularly shaped cavities filled with the dark-coloured resting spores of the fungus.

"On the Potato, the fungus does not cause the tumour-like outgrowths, but a continuous rough or nodulose, black, scab-like, thick crust, which commences at one or several distinct points, and finally covers the entire surface of the Potato."

The disease was first received from the neighbourhood of Liverpool in 1901; subsequently from several widely separated localities in England.

Preventive Measures.—"Diseased roots and tubers should be very carefully collected and *burned or deeply buried*, because, if allowed to rot on the ground, resting spores of the fungus would be liberated into the soil, and future crops thereby endangered."

"The temptation to feed stock with diseased Potatos must also be resisted, otherwise the resting spores of the fungus, after passing through the intestinal canal of some animal, would eventually be returned to the land along with the manure." * A dressing of gas-lime or of ordinary lime, is also recommended.

ii. Bacteriosis of Potatos (*Bacillus Solanacearum*, E. F. Smith). This bacterial disease has been recorded from several localities in this country during the past season.

"The earliest indication of the presence of the parasite is the sudden wilting of the leaves, which soon hang limp and shrivel up. This is followed by discolouration and collapse of the stem. If a stem is split down at this stage, brown streaks, corresponding to the position of the vascular bundles, will be seen. These brown streaks are the vessels crowded with bacteria, which gradually descend the stem and finally pass into the tubers, where they first manifest their presence by a more or less interrupted pale-brown zone, situated some little distance from the outside of the Potato. This zone corresponds to the position of the vascular bundles in the tuber, which eventually become rotten, the skin alone resisting the disintegrating action of the bacterium."

Preventive Measures.—"The important point to attend to is the destruction of insects that feed on the leaves of the Potato. This can be accomplished by spraying with Bordeaux mixture to which an insecticide has been added."

"If Potatos are dug as soon as the disease is indicated by the wilting of the leaves, a considerable portion of the crop may be saved by storing the tubers in a cool dry place. If allowed to remain in the ground, not only do the tubers become rotten, but the soil is also badly infected."

"Potatos or Tomatos should not be planted in soil that has produced a diseased crop, nor should Potatos from a diseased area be used for 'sets.'"

iii. Sclerotium disease of Potatos (*Sclerotinia sclerotiorum*, Massee). "In this instance the tubers are not directly attacked by the fungus, but their growth is either checked or entirely arrested, owing to the entire destruction of the leaves of the plant."

* Boiling the tubers (a method frequently adopted by farmers and cottagers) would effectually destroy the fungus or its resting spores.—*R. N.*

"The base of the stem just above the ground-line becomes covered with a white fluffy substance, the mycelium of the fungus. This mould gradually grows up the outside of the stem if the atmosphere remains moist and the temperature sufficiently high. After some time the fluffy mould collapses and becomes more compact, and bears numerous variously shaped black bodies, which sometimes attain the size of a grain of wheat, imbedded in its substance. These bodies, which consist of densely compacted fungus spawn, are called sclerotia. During this period of development of the fungus the Potato stem becomes limp, and the leaves wilted, and both perish early in the season."

"When the weather is dry and warm, the mycelium extends most vigorously in the hollow of the stem, whose numerous sclerotia are formed, very little fluffy mycelium appearing on the surface of the stem."

"Collecting and burning diseased plants is the only certain method of stamping out the disease. If infected tops are left on the ground to decay, the sclerotia remain in the ground until the following season, when they form reproductive bodies that bear spores which infect the growing crop. In addition to the Potato, Beans, Peas, Cucumbers, Marrows, Turnips &c., are also attacked; in fact, probably every kind of cultivated plant and also many weeds are susceptible to the attacks of fungus."

R. N.

Potato Failures: a preliminary Report. By F. M. Rolfs (*U.S.A. Dep. Agr., Exp. Stn. Colorado,* No. 70, March 1902, with 12 plates).—This report is of special interest in drawing the attention of Potato-growers to a destructive disease of the Potato, which is attributed to *Rhizoctonia Solani,* Kuhn. The first account of its occurrence in America was recorded in 1901.

During the summer of 1900 it was brought to the notice of the writer in Long Island, where Potato-growers complained of the early wilting or drying of the vines caused by a stem rot resembling the stem rot of Carnations. Examination of plants recently killed revealed the presence of this fungus on stems and roots. In thirty plantations on this island the *Rhizoctonia* was constantly present in the pith and on the outside of the stems and roots, and by experiment it has been proved that it is an active parasite on the Potato plant.

In many sections it is reported that large vines gave promise of an abundant yield, but when digging time comes it is found that so few tubers have set that it does not pay to dig them. Many vines do not produce a single tuber. It is by no means an uncommon occurrence for the vines to set an abnormal number of small Potatos, or "Little Potatos" as they are called. These often occur in compact clusters, and are so small as to be worthless. Another condition is the dying of Potato plants. All of which conditions may be produced by attacks of *Rhizoctonia.*

The hyphæ of the fungus are often found on the surface and in the scab ulcers of Potatos. These hyphæ give rise to irregularly shaped dark masses known as sclerotia, which vary in size from that of a mere speck to half an inch or more in diameter. These sclerotia resemble small bits of earth, but by placing the Potatos in water, these bodies become black and quite conspicuous. Many of them adhere very firmly. The hyphæ spread through the soil in various directions; hence a single diseased Potato may be the means of infecting an area of considerable size.

Plants which are attacked when young, if not killed outright, are often dwarfed, and frequently die long before the close of the season. The parts below ground are thoroughly infected with the *Rhizoctonia*. In some cases the disease attacks the plant just below the surface of the ground, and under favourable conditions a stem rot called "Collar Rot" or "Black Ring" is produced. When the attacks on the stem are not so severe as to cause death the injuries may prevent the assimilated food from being stored in the subterranean portion of the plant, large tops are produced, and green tubers often form in the axils of the leaves.

It is unnecessary to refer here to the inoculation experiments, except to state that they confirm the above conclusions.

It is confessed to be difficult to treat this disease, as there is no practical method of checking its spread after it is once introduced into the soil. The only way of dealing with it is by preventive means. A heavy poorly drained soil seems to favour the disease. It is recommended to treat seed Potatos with a corrosive sublimate solution a week before planting, spreading them on the floor or ground in the sunlight thereafter.

Treatment with formalin, of which eight ounces to fifteen gallons of water should be used, is recommended, and the seed Potatos soaked therein for two hours.

Seed Potatos should be carefully sorted, disinfected, and planted on land that is well under-drained. Then, by practising a long and systematic rotation of crops, the soil may be prevented from becoming badly infected with the disease.—*M. C. C.*

Potato Scab. By H. Garman (*U.S.A. Exp. Stn. Kentucky, Rep.* 1898, p. 9).—Experiments were carried out to determine to what extent scabbing of Potatos was due to the introduction of a fungus into the soil with seed Potatos, and how far the disease is the work of organisms which live in the soil. Corrosive sublimate ($4\frac{1}{2}$ oz. in 30 galls. of water) was found the most effective bath in which to soak the seed Potatos in order to kill the fungus (*Oospora scabies*). The Potatos should be soaked for one hour. The percentage of scabbed Potatos in the crop was reduced from an average of 93 per cent. to an average of 29·7 per cent. by the use of corrosive sublimate.—*F. J. C.*

Potato; Trials with Fertilisers (*U.S.A. Exp. Stn. Kentucky, Rep.* 1898).—Gives tables showing the results of experiments with a variety of fertilisers. The addition of potash and nitrogen each gave an increased yield, but the best results were obtained by the use of a combination of the two.—*F. J. C.*

Potentillas. By M. H. (*Gard. Mag.* No. 2537, p. 361; 14/6/1902).—The writer of the article on these beautiful and comparatively little-known border flowers evidently knows all about them, as he gives all the information required for their culture and propagation, as well as the places best suited for them in a garden. A list of the finest varieties is given, a selection which is useful to those who wish to grow only the best. The *Potentilla* is raised to the dignity of a "florist's flower," its origin being *P. insignis* and *P. argyrophylla*.—*W. G.*

Pritchardia filifera, Inflorescence of. By Angiolo Pucci (*Bull. R. Soc. Tosc. Ort.* 10, p. 309, October 1902).—This plant flowered for the first time in Europe in Italy, viz. at Palermo, in 1893. It has since that time produced a good deal of seed. The plant of which the following account is given stands in the garden of the Countess Parravicino at Campo Romano, near Viareggio; is 24 years old; has attained the height of 10·50 m., that of the trunk alone being 6 metres; the latter has a circumference at the base of 3 metres, and the number of leaves it bears is 84. The spadix issues from the axils of the leaves, is at first extended, and later recurved and bent downwards; slightly winged at the base, about 4 metres long and branched. The panicled inflorescences, 20–40 cm. long, issue from long, coriaceous, brownish spathes, which are divided at the end, the upper ones free and strap-shaped, clothed laterally by a woolly white caducous substance. The spikes are numerous, 6–10 cm. long, with a sinuous rachis, the lower branched, the upper simple, producing along their whole length small white, odorous, compactly placed, sessile flowers; the calyx is tubular, with three obtuse apical lobes; the corolla is open, expanded about halfway, with three oblong, lanceolate, persistent lobes; the six stamens are inserted in the throat of the corolla, with flattened filaments, and oblong, versatile, straw-coloured anthers. The ovary is nearly oval, trilocular, crowned with a filiform, erect, sinuous, white style. The oblong-ovoid fruit has two prominent lateral sutures; is 6–7 mm. long and 4 mm. broad, at first green, afterwards a deep brown, unilocular, one-seeded, crowned by the persistent style, with a slightly branched pericarp; the seed is ovoid-oblong, regular, dark, with a horny endosperm. Two interesting photographs, one of the entire plant, the other of the entire spadix, accompany the text.—*W. C. W.*

Prunes, Spurious French. By P. Hariot (*Le Jard.* Nov. 20, 1902, p. 337).—Besides importations from California, called 'French Prunes,' it is said that from Servia there are imported annually into France two hundred thousand tons (225 million kilos) under the title of 'Agen Prunes,' Agen being the centre of the Prune industry on the Garonne. It is admitted that these imported Prunes are of first-class quality, but measures of protection for this important French product are demanded.
C. W. D.

Quercus, Pedigree of the Genus. By Wilh. Brenner (*Flora*, vol. xc. 1902, pp. 466–470).—In continuation of his previous paper on the relations between climate and leaf-form in the Oaks (abstracted in JOURN. R.H.S., vol. xxvii. p. 233, the author seeks to trace the phylogeny of the group. As deeply lobed forms are inconstant, he infers that their origin is recent—a view confirmed by the fact that the older, pre-Pliocene, fossil Oak-leaves are entire or but slightly lobed. As tests of consanguinity, the weakest is the character of the margin; the next, the nervation for both these, is dependent on climate; the safest is the relation of the secondary veins to the primary nerves. He concludes that the actual characters are not due to the direct transmission of acquired characters, but to the *spontaneous* ("selbstthätige") reaction of the organism to its surroundings, the strengthening (or weakening) of the venation, coming gradually into operation, becoming more fixed, and finally maintained. This, we note, is a Neo-Lamarckian conclusion.—*M. H.*

Red Cedar, Notes on the. By Charles Mohr, Ph. D. (*U.S.A. Dep. Agr. Div. For. Bull.* No. 31).—In a truly commercial sense, this may be considered as one of the most useful, valuable, and interesting of forest trees: in fact no wood is more frequently in the hands of civilised man, of every station of life, than the Red Cedar of his lead pencil. Unfortunately, however, like many other trees, the demand for the Red Cedar is far in excess of the supply, and the question of its reproduction and maintenance is therefore of no little importance, and is at present receiving attention at the hands of the Department of Agriculture. Some idea may be formed of the consumption of Red Cedar wood when it is stated that for lead pencils alone fully 500,000 cubic feet, the produce of at least 125,000 trees, are annually required. Large quantities are also consumed in the manufacture of small cooperage—buckets, churns, tubs, &c.—while it has a wide range of application in naval construction and in various mechanical arts and industries.

North of the Tennessee River the Red Cedar was at one time abundant, but the removal, a few years ago, of the cedar pencil works at Gurley clearly points out that the supply of wood for this particular purpose is wellnigh exhausted.

The present scarcity, coupled with the great importance of a steady and adequate supply, makes systematic forest management of the Red Cedar imperative; but fortunately it is a tree that readily reproduces itself on suitable soils, is of fairly rapid growth, and not at all subject to disease. In this country the Red Cedar grows with perfect freedom, a specimen felled at Esher, Surrey, having exceeded fifty feet in height, and when measured having been found to contain forty-five feet of excellent timber. In Central Germany the attempt to establish a forest of pure Cedar has so far met with promising results.—*A. D. W.*

Rhododendron Gall, The. By F. Martin Duncan (*Gard. Mag.* No. 2548, p. 565; 30/8/1902).—A somewhat uncommon fungoid disease attacks the European alpine Rhododendrons, *R. ferrugineum* and *R. hirsutum*, and the fungus called *Exobasidium Rhododendri* is described by the writer, and illustrations are given showing how the leaves of these Rhododendrons are attacked. Fortunately, the disease does not attack the American and *ponticum* races, but confines itself chiefly to the less popular species.—*W. G.*

Rhododendron ponticum Hybrids. By E. Wocke (*Die Gart.* p. 161, 3/1/1903, with illustrations).—The author describes Dutch hybrids of 50–60 years ago inferior to those of our time, but perfectly hardy, although in the N.-E. of Germany, in the neighbourhood of Danzig, with its severe arctic winters, the plants have to be protected during the winter.—*G. R.*

Rice, Irrigation of, in the United States. By F. Bond and G. H. Keeney (*U.S.A. Dep. Agr. Office Exp. Stn. Bull.* No. 113; 29 plates, 6 coloured, 10 figs.).—A most interesting report on investigations to ascertain means of overcoming difficulties now obstructing the progress of Rice-growing in the U.S.

Clear and practical information is given on the following phases of the industry:—

Rice canals, their construction and preservation.

Measurements of water used.

Pumps; water rights and laws relating to irrigation; suitable soils; varieties of Rice; its culture, harvesting, and preparation for market; Rice products; and depredation by birds.

The plates and figures are excellent; most of the former are from photographs. It is pleasing to learn that in Louisiana and Texas, with the exception of a few isolated localities, the native birds are to be regarded as friends rather than foes, as they glean the fallen grain after harvest, which, if left, grows and produces an inferior grain known as Red Rice, too soft to be milled, which soon spreads and sometimes necessitates leaving fields idle for a year for its extermination by burning. The arrival a few years since of *Passer domesticus* is regarded as a possible danger should it increase to any great extent.

In Carolina, on the contrary, the Rice-bird causes much damage, and when the flocks arrive before the grains have hardened the crop is sometimes ruined.—*E. A. B.*

Robinias. By G. (*Gard. Mag.* No. 2545, p. 512; 9/8/1902).—An account of the four species and varieties of *Robinia* in cultivation. The historical notes on the common False Acacia (*R. Pseud-acacia*) are especially interesting, as the tree is so intimately associated with William Cobbett, whose observations and writings on trees are among the best in the English language, though his well-known eulogy of the False Acacia has been considered unwise, so far as its value in this country is concerned. Good illustrations accompany the article.—*W. G.*

Rock Garden in a Week. By F. W. Meyer (*Garden*, No. 1623, p. 442; 27/6/1902).—An article illustrated from four photographs, showing how a rock garden may be made in a week. The material used was about twenty-five tons of granite. The first picture shows a weedy bank; the second gives the site cleared and prepared for rock building; the third shows the principal stones placed in position, and the fourth, the rock garden planted and finished.—*E. T. C.*

Rock-garden Making. By F. W. Meyer (*Garden*, No. 1610, p. 213, 27/9/1902; No. 1614, p. 286, 25/10/1902; No. 1619, p. 378, 29/11/1902).—A series of articles detailing the preparatory work; appliances for moving and carrying stones, the best stone to use, geology in the rock garden, igneous rocks, sedimentary rocks, are dealt with. Later chapters will give selections of plants and how to plant them.

E. T. C.

Roof-gardening. Leader (*Garden*, No. 1617, p. 337; 15/11/1902).—Dwellers in cities and large towns are usually supposed to be debarred from participating in the delights of gardening, by reason of their environment; yet since roof-gardening has been proved to be possible, the citizen without a square yard of land may, if he will, enjoy the sweets of home-grown flowers. This article shows how these flowers may be grown in the roof garden, and gives the most suitable ones for the purpose.

E. T. C.

Roof-gardening. By C. Hinze (*Die Gart.* p. 42, 25/10/1902).—A most exhaustive and very interesting article, with illustrations, treating landscape gardening on the flat roofs of town houses or mansions. The houses with roof gardens are nearly always those of the working or middle classes, recently built in wide streets with all the newest improvements, and of course not "jerry-built." The roofs are usually covered with zinc on which wood, cement, and asphalte are put to prevent the water from entering the building. On the top of this first gravel is put and the soil of whatever depth is permissible—or necessary—from a few inches to a foot depth. Early in the summer previously prepared plants, either annuals or bedding plants, are planted, with here and there foliage plants in pots, such as Dracænas &c.

In the suburbs of such model towns as Berlin, Paris, &c., roof-gardening is done quite on a large scale. The houses are usually several stories high, substantially and in many cases artistically built, but, though having wide streets, have very small courtyards.—*G. R.*

Root-grafting. By G. T. Grignan (*Rev. Hort.* No. 21, Nov. 1, 1902, pp. 508–9).—A description of the process employed by M. W. Geucke, of Reutlingen, for propagating species of *Ficus* by means of portions of living roots, detached from pot-plants, being inserted, graft fashion, just below the eye of the buds, from year-old wood. These buds are separated with about half an inch of the wood below the bud, and in fifteen days, with bottom heat of 30° to 38° C., they become well rooted.—*C. T. D.*

Rose Garden, The University. By C. A. Keffer (*University of Tennessee Record*, January 1903, p. 61).—A new garden formed of what was, two years ago, a patch of Wild Onion, and now "the most attractive place in the grounds."

The treatment accorded to the Roses—a very representative collection—is as follows:—Spring finds the beds heavily mulched. This is forked in when the buds begin to swell. In June, when hot weather begins, a mulch of farmyard manure, three or four inches thick, is applied. A weekly inspection, when dead blossoms are cut off and judicious dis-budding practised, keeps the flowering more evenly distributed.

A second mulch is often necessary in September owing to the repeated hoeings which have incorporated the first with the soil. The Rose garden is at its best in autumn, having, when the notice was written (October 24), about 3,000 blooms in it. When frost comes the plants are littered with pine boughs and corn stalks (Indian), and in March pruned somewhat severely.

A list of varieties follows, hybrid teas being the favourites.—*C. H. C.*

Rose 'Mme. Jules Grolez.' By Arthur R. Goodwin (*Garden*, No. 1611, p. 232, 4/10/02).—A description of this lovely Hybrid Tea, with an illustration. In a season like that of the past summer it is a great deal to be able to say that no other Hybrid Tea Rose has endured the inclement weather so well as this variety, and if I were asked to name the twelve best Hybrid Teas, it would certainly be among them.—*E. T. C.*

Rose 'Maria-Leonida' (*Ann. Soc. Nant.* 1902, p. 112).—Notice is invited to the fact that the Rose 'Maria-Léonida' was first produced at Nantes by a grower whose name has perished, and was exhibited there in 1832. It is here said to be a hybrid between the Macartney Rose and the tea-scented Rose.—*M. L. H.*

Rose, Tea, Lady Roberts (*Garden*, No. 1624, p. 9; 3/1/1903).—A coloured plate appears with a note about this beautiful Rose, raised by Messrs. Frank Cant & Co., Colchester. The writer says: "Its beautifully shaped, warm apricot-coloured flowers have attracted much attention."
E. T. C.

Rose, The Christmas. By T. B. Field (*Garden*, No. 1622, p. 427; 20/6/1902).—Christmas Roses flower from the end of the year to the middle of March, according to their situation and the weather. They will grow in almost any ordinary garden soil and in almost any aspect, except full sun. A heavy soil and a shady place suit them well, and it is of the utmost importance to leave them for many years undisturbed. Many other valuable hints are given in this illustrated article.—*E. T. C.*

Rose, Wild Brier, Hybrids, Several interesting new. By P. Graebner (*Gartenflora*, 1/11/1902, p. 562, pl. 1504).—Descriptions and coloured plates of the following hybrids:—(i) *R. blanda* × *indica* = *R. Aschersoniana*; (ii) *R. californica* × *nitida* = *R. Scharnkeana*; (iii) *R. carolina* × *rugosa* = *R. Spaethiana*; (iv) *R. Carolina* × *humilis* var. *lucida* = *R. Mariæ Graebneriæ*.

(i) Arose from crossing *R. blanda*, a Rose belonging to a race of *R. virginiana*, with a dark purple double garden form of *R. chinensis* var. *indica*. The plant resembles a form of *R. virginiana*, is about six feet high, with very slender brown-red shoots. The flowers appear at the beginning of June, and are semi-double and purple-red; they are always sterile.

(ii) Is a small shrub about two feet high, suitable for covering rocky places. It blooms from beginning of July into August; the flowers are purple-red.

(iii) From the cross indicated three seedlings were obtained, one of them much like some of the *rugosa* crosses already known. The others are somewhat stiff, more or less erect shrubs, about three or four feet high, with a mixture of many prickles of the *rugosa* and *Carolina* types. The leaves, in size and consistency, resemble those of *R. rugosa*, while the shape of the leaflets is more that of *R. Carolina*.

The flowers last a long time, and are purplish, with large obovate petals. Fruit mostly absent. Useful for planting singly or in groups.

(iv) This is a Rose about three to five feet high, somewhat like *R. humilis*, but with more upright shoots. The flowers have a strong perfume, and are rose-red, suggestive of 'La France,' in colour. Fruits

abundant. It is stated to be one of the best forms of Wild Roses (Briers); flowers first in June, and goes on producing flowers until late in autumn.
J. P.

Roses: their *rôle* as Decorative and Picturesque Plants. By Ed. André (*Rev. Hort.* No. 20, Oct. 16, 1902, pp. 472–475).—An interesting article in this connection, with descriptive lists of species and varieties recommended for various positions.—*C. T. D.*

Roses for Arches. By Philomel (*Garden*, No. 1615, p. 300; 1/11/1902).—When well covered with flowers, an arch of Roses is one of the most beautiful features of the garden. The selection of suitable varieties is necessary, as nothing is so unsightly as an arch partly covered. Deep tillage, liberal treatment, and pruning to consist merely of removing old or dead wood, are essential points. The best Roses for arches are given.—*E. T. C.*

Roses, New. By H. E. Molyneux (*Gard. Mag.* No. 2541, p. 444; 12/6/1902).—Descriptive notes on the newer sorts of Roses, which may be helpful to those who are unacquainted with the relative merits of the numerous new Roses that are continually being brought under notice at exhibitions and in catalogues.

The writer describes each in a critical way, comparing the novelties with older sorts that are similar, which is the information required by amateurs, who are often perplexed with catalogue descriptions.—*W. G.*

Roses of Japan. By W. Goldring (*Gard. Mag.* No. 2540, p. 419, 5/7/1902).—Notes on some of the native roses of Japan that have become common in this country. The *Multiflora*, *Rugosa*, and *Wichuraiana* hybrid Roses are described.—*W. G.*

Roses, Weeping. By Philomel (*Garden*, No. 1614, p. 285, 25/10/02).—A well-developed weeping standard Rose is a thing of beauty. Isolated on the lawn, or grouped near a walk, the huge heads of growth, after the trees have been planted some four or five years, are very charming. As weeping Roses attain such large dimensions, obviously they need special care when planting. They are usually budded upon the finest Brier stocks procurable, and should have an abundance of fibrous roots to be successful. An illustration of a large standard weeping Rose (Bennett's Seedling) is given.—*E. T. C.*

Salt-bushes, Seeds of Commercial. By G. N. Collins (*U.S.A. Dep. Agr. Div. Bot., Bull.* No. 27; 1901).—This consists of eight plates of photos of seeds of twenty-three species of *Atriplex*, with descriptions of the character of the fruit and seeds. The object is expressed in the Introduction as follows:—"The increasing and already extensive use of Salt-bushes (*Atriplex* spp.) as forage plants in the arid regions of the West renders it desirable to provide some means of distinguishing the seeds of the various species now in use or likely to become of economic importance."—*G. H.*

Salvia Russellii and S. Bornmülleri. By Spencer Moore (*Journ. Bot.* 480, pp. 406–7; 12/1902).—Discrimination between a type described by Bentham from a specimen in the British Museum, collected at Aleppo in the eighteenth century by Dr. Patrick Russell, and an allied form common in Eastern Turkey.—*G. S. B.*

Salvia splendens: Forms. By H. Hartmann (*Die Gart.* p. 90, 22/11/1902).—These are not alone much in demand for bedding out during the summer but for furnishing of conservatories &c. during the winter. The sorts have all bright-coloured flowers lasting; and even when ultimately the flowers are drooping, the equally bright-coloured calyx will remain for a long time, seeming to the uninitiated another kind of flower.

S. s. '*Ruhm von Stuttgart*' has long, very thick racemes; it grows rather high and is the best for late and winter flowering.

S. s. '*Freudenfeuer*' is like the former, but very early; of a deep crimson colour.

S. s. '*R. Pfitzer*' is very free; bright scarlet.

S. s. '*Triumph*' is the earliest of all, and the best for early bedding.

G. R.

Salvia splendens 'Surprise.' By Jules Rudolph (*Rev. Hort.* No. 14, Dec. 16, 1902, p. 581).—One woodcut, representing an attractive variety, the foliage having a large yellowish-white area in centre, of deeply serrate outline. Raised by Messrs. Cayeux & Le Clerk, Paris.—*C. T. D.*

Sandalwood Tree. By Mr. Barber (*Gard. Chron.* No. 823, p. 249; Oct. 4, 1902).—Mr. Barber, who is the Government Botanist at Madras, has recently made the interesting discovery that the roots of this tree are parasitic. He says: "It appears to me that sufficient attention has not been given in past attempts at artificial reproduction, and a careful study of the liking of the Sandalwood for its different hosts is sure to be productive of useful results."—*G. S. S.*

Scale, San José, and Insecticides. By S. A. Forbes (*U.S.A. Exp. Stn. Illinois, Bull.* 80, 10/1902, 9 plates).—The State Entomologist was required to "treat and disinfect once thoroughly at the expense of the State all orchard property which that officer had reason to believe had become infested with the San José scale." The bulletin gives an account of the methods employed, four insecticides being tried, viz. hydrocyanic acid, whale-oil soap, kerosene emulsion, and the California wash. It was concluded that the last was most satisfactory for winter use. This mixture was made as follows: 15 lbs. of stone lime were slaked in a kettle over a fire; 15 lbs. of sulphur were sifted in as the lime was slaking, and the mixture boiled until the lime and sulphur were completely dissolved; then 15 lbs. of salt were added and the mixture again boiled for a quarter of an hour; enough warm water was added to make 50 gallons, and the whole was sprayed on while warm. (See also *Journ. R.H.S.* xxvii. 787).—*F. J. C.*

School Gardening in Surrey. Anon. (*Gard. Mag.* No. 2564, p. 845; 20/12/1902).—An account of the methods practised in the Continuation Classes in practical gardening in Surrey, in connection with the Technical Education Committees of County Councils. A careful digest of the work done throughout the course, and illustrations are given of the School Garden at Hale, Surrey.—*W. G.*

Scolopendrium officinarum var. **dædalum.** By R. Wehrhahn (*Die Gart.* p. 93, 22/11/1902), with illustration).—A curious and pretty rare form discovered by a German botanist, Mr. Wehrhahn, on the Weser Mountains in Central Germany.—*G. R.*

Semolina and Macaroni, Manufacture of. By Robert Skinner (*U.S.A. Dep. Agr. Bur. Pl. Ind. Bull.* 20, 1902; 5 plates).—A further contribution to the subject of the creation of a native manufacture of semolina and macaroni in America in the shape of a pamphlet by the United States Consul-General at Marseilles. It contains the results of interviews with several of the largest semolina and macaroni manufacturers on the Continent, and while impressing upon American farmers what a large and increasing market there is in Europe for a really suitable hard wheat, the writer reminds native millers that a large demand also exists in Russia for American semolina, which, though hardly up to the requirements of the French market, is in consequence obtainable at a price more suited to the Russian buyer. He repeats the opinion of a well-known semolina broker at Marseilles that Canadian so-called Wild Goose wheat, of which 100,000 tons were shipped to Marseilles in 1901, is as good as any macaroni wheat ever sold in that market, though at the same time he quotes other experts to the effect that it is not quite up to the best Russian hard wheat in the possession of gluten, and a footnote by the Cerealist of the United States Department of Agriculture adds that it is well known that Canadian Goose wheat is inferior to that grown in North and South Dakota.

The ancestral home of macaroni is Naples, and it was at first made exclusively from the hard wheats grown in Sicily and in that part of South Italy known as La Pouille. Gradually, however, Italian farmers ceased to pay much attention to the cultivation of grain, and the manufacturers found at the same time a greatly increased demand for their macaroni and a complete falling off in their supplies of native wheat. Here, however, the town of Marseilles, always much occupied in the grain trade, came speedily to the rescue and supplied the Italians with semolina manufactured from durum wheats imported from South Russia and Algeria.

To the preparation merely of semolina for the Italians followed naturally the further process of turning it into macaroni, and this industry has now become an important one not only at Marseilles but in other parts of France.

The French manufacturers made use at first of none but imported durum wheat, but since the present French tariff imposed a duty on wheat about ten years ago, there has been a steady increase in the cultivation of what is called in France "Metadiné" wheat; that is, wheat grown from durum seed, but which, in consequence of the unsuitability of the soil and climate, loses its distinctive character. From this wheat semolina is being more and more extensively produced, and, though not suitable for the best macaroni, is consumed largely in France itself in the inferior forms of vermicelli and what is known as Italian paste, &c. It is felt as a great drawback by the French semolina millers that, being forced to import grain from various sources, it comes to them in varying degrees of size and hardness, so that they are always altering their machinery to suit the new material, and never really get thoroughly to understand any one kind. It is suggested that in America one variety of wheat could be grown in practically unlimited quantities, and that native semolina millers would therefore be able to concentrate their attention on perfecting the process best adapted to that one sort.

Though it is impossible to produce semolina from more than one class of wheat at one milling, it is the custom with the best macaroni manufacturers to blend several sorts of semolina together in mixing their paste, either to attain just the right amount of gluten or for economic reasons. No formula is apparently forthcoming for a theoretically perfect semolina, but macaroni manufacturers know by long experience when any given sample is up to the standard of their requirements.

The writer aims not only at awakening American farmers and millers to the possibility of building up an export trade in semolina, but also at encouraging the manufacture of macaroni in the United States for home consumption. It has never been anything like so popular an article of food there as in most European countries, for the simple reason that the imported article necessarily reaches the consumer in such poor condition.

He gives minute descriptions of all the processes to be gone through in the preparation of semolina and macaroni, with figures of the various machines in use in Europe, and discusses the comparative advantages of wet or dry cleaning of the wheat, the problem being to produce the greatest quantity of large-grained semolina, a residuum of flour of the most saleable appearance, and at the same time to prevent the rapid deterioration of the semolina which is a frequent result of damping the grain.

On the whole, this drawback is said to be greatly outweighed by those attending dry-cleaning.

Various tables follow, giving all the statistics connected with the macaroni trade, of the exports of semolina and of edible pastes from Marseilles, of the importation of wheat to Marseilles, range of prices of semolina at Marseilles from 1885 to 1900, and declared values of imports of macaroni and vermicelli into the United States in 1900.

M. L. H.

Senecio, A new Hybrid. By F. W. Burbidge and Nathaniel Colgan (*Journ. Bot.* 480, pp. 401–6, 12/1902; pl. 444).—Description of a natural hybrid of *Senecio Cineraria*, DC., and *S. Jacobæa*, L., from Sorrento Park, Killiney Bay, co. Dublin, for which the name × *S. albescens* is proposed.—*G. S. B.*

Sensitive Plant as a Weed in the Tropics. By D. G. Fairchild (*Bot. Gaz.* xxxiv. p. 228, No. 3).—The author describes *Mimosa pudica* as a most troublesome weed, and gives a photograph showing its luxuriance and how cattle avoid it in Ceylon fields. They had eaten the herbage closely around the plant, leaving it strictly alone; and as it crept across the meadow it killed out all other plants, forming a dense deep patch of spiny creeping stems with pink blossoms.—*G. H.*

Silage Studies. By Fred. W. Morse (*U.S.A. Agr. Exp. Stn. New Hampshire, Bull.* 92, Sept. 1902, illustrated).—This bulletin deals with various considerations in the treatment of silage which have arisen during the last ten years of investigation.

Amongst these are:

1. The composition of the crop at different stages of growth. Results show that the best silage is obtained from corn that has nearly reached maturity. It then contains most dry matter and essential nutriments, protein and soluble carbohydrates. Varieties should be chosen yielding a mature crop at cutting time, rather than a larger but immature plant.

2. Comparison of varieties of corn for silage was based on the relative merits of the 'Sanford' flint, the 'Leaming' dent, and 'Mosby's Prolific' corn, which are placed in order of precedence.

3. The amount of seed sown per acre affects the yield of green fodder and also its composition. A medium stand (one bushel to the acre) gave the best results.

4. Changes in the composition of corn fodder while in the silo. This is chiefly confined to the destruction of the soluble carbohydrates in the plant, notably sugar, whereas starch is little affected, rendering important the exact period at which to cut the corn for the silo, for as the ear ripens the sugar changes to starch in the kernels and decreases in the stalk and leaves.—*C. H. C.*

Slugs and Snails. By W. C. Worsdell (*Gard. Chron.* No. 829, p. 349, Nov. 15, 1902, and No. 831, p. 390, Nov. 29, 1902).—Some observations and experiments made by Prof. Stahl have thrown quite a new light upon the relationship between these creatures and plants. In this article Mr. Worsdell gives, as he says, "a general account, taken from his [Prof. Stahl's] book 'Pflanzen und Schnecken,' of the different ways in which various plants are protected from slugs and snails." "Certain chemical substances are contained in the soft tissues of many plants, which, although other parallel functions are not denied them, appear to chiefly serve the purpose of warding off the attacks of snails" (in this term slugs are included). Of these tannin plays a very important part: "those plants which contain this substance in considerable quantity are seldom molested. Some plants possess an acid sap, caused by the presence of binoxalate of potash, which is very distasteful to these molluscs; other plants have acid-secreting hairs, or their leaves contain ethereal oils or bitter substances, which are also disliked. There are also various mechanical means by which plants are protected, such as bristle hairs, calcification of the cell membranes, the silicification of cell membranes, mucilage, gelatinous structures, raphides, or isolated sharp-pointed crystals of oxalate of lime. Experiments were made in many cases, by depriving the leaves of the supposed noxious substances or qualities, to see if the snails would then eat them, and in most cases it was found that they would."—*G. S. S.*

Soiling Crop Experiments. By Clarence B. Lane (*U.S.A. Agr. Exp. Stn. New Jersey, Bull.* 158, June 11, 1902, illustrated).—The results of the experiments carried out in New Jersey tend to show that:

1. A rotation of certain crops, such as Wheat, Alfalfa, Crimson Clover, Indian Corn, Cowpeas, &c., and various combinations of these crops, some of which thrive best early, some late, may be grown as forage, to provide a continuous supply for a dairy herd, May 1 to November 1.

Amongst these, no one plant is capable of supplying forage continuously throughout the entire season, Alfalfa, a perennial, being the best in this respect.

2. The value of a plant for forage is decided by its yield, composition, palatability, the season of the year in which it may be grown, the time it requires to mature, and its influence on the flavour of the milk.

3. The soiling system is preferable to pasture, as it provides a uniform supply of succulent food throughout the season.

4. Three crops can be grown upon the same acre in one season; for instance, Rye, Oats and Peas, Corn, yielding 20 tons, while the perennial Alfalfa admits of five cuts, yielding about 25 tons of green forage to the acre.

5. A herd of thirty to forty cows consumed an average of 60 lbs. of green forage per cow per day with 6–8 lbs. of fine feed.

6. Three to four cows can be kept upon one acre for six months, the forage being fed to them from cribs.

7. Five years' records show that the average yield of milk and butter per cow during the six months of forage feeding was 3,423 lbs. and 172·7 lbs. respectively.

The same cows yielded an average of 3,050 lbs. of milk, and 157·4 lbs. of butter during the other six months of the year when they were fed with silage. The average percentage of fat in the milk in the former case was 4·32, in the latter 4·42.

The disadvantage of forage crops as compared with permanent pasture is that the land must be prepared and sown annually. As against this there are the greatly increased yields per acre, and the maintained succulence.—*C. H. C.*

Soil Sterilisation in Greenhouses for Fungoid Diseases. By G. E. Stone and R. E. Smith (*Rep. U.S.A. Exp. Stn. Hatch, Mass.* p. 74; Jan. 1902).—A Report of the botanists dealing with the subject of soil sterilisation and its value as a preventive against fungoid attacks. The crops experimented with were Lettuce, grown in large houses for market purposes and planted out in the soil. The most satisfactory method of sterilising is by steam, and good results were shown over the portions thus treated.—*E. F. H.*

South African Gardening. Anon. (*Journ. Hort.* Oct. 30, 1902, p. 403).—A correspondent in Johannesburg, responding to an article in this Journal a few weeks ago, admits that the high prices for all garden produce are tempting, but warns adventurers that competition is sure to be great, living very expensive, labour dear and hard to get at any price, and that only those with capital and patience can hope for success.—*C. W. D.*

Spain and Portugal. By M. J. Daveau (*Ann. Soc. Hé.* May 1902, p. 102).—Notes of flowers observed in a tour across these countries.
C. W. D.

Sparrows in Tunis. Ed. (*Le Jard.* Oct. 20, 1902, p. 307).—By a decree of the Regency of Tunis, 1892, every proprietor or tenant occupying land is bound to destroy all the nests and broods of sparrows on his holding from April 1 to June 30 in each year. Anyone neglecting this may have a written notice served upon him to perform the duty within forty-eight hours, under pain of a fine and of having the destruction effected at his expense.—*C. W. D.*

Spruce Gall Chermes. By Martin Duncan (*Gard. Mag.* No. 2546, p. 529; 16/8/1902).—An illustrated account of this very common insect pest (*Chermes abietis*), which attacks chiefly the Norway Spruce (*Picea excelsa*). The cone-like galls, the results of the insect's attacks, are to be seen in most plantations of Spruce in this country, but fortunately it does not appear to attack the rarer species of *Picea* and *Abies*. The remedy given by the writer, which is that of dipping the infested parts in an infusion of soft soap, tobacco, and bitter aloes, is, of course, only practicable in the case of a specimen tree.—*W. G.*

Strawberry-growing in Kentucky. By C. W. Matthews (*U.S.A. Exp. Stn. Kentucky, Rep.* 1898).—Gives an account of Strawberry culture in Kentucky and notes of 65 varieties.—*F. J. C.*

Strawberry Industry. By H. J. Wright (*Gard. Mag.* No. 2549, p. 582; 6/9/1902).—An interesting and instructive article upon the important industry of Strawberry culture for market, both under glass and in the open air. The account deals with the varieties chiefly grown, as well as the chief centres of the industry. Numerous illustrations are given with the article, including reproductions of photographs of boxes and baskets of fruit packed for market.—*W. G.*

Sugar-Beets in Montana. By F. W. Traphagen (*U.S.A. Agr. Exp. Stn. Montana, Bull.* 33, Jan. 1902).—A general *résumé* of the results of careful experiments, conducted during 1901 in three different localities in Montana, in connection with the growing of Sugar-Beets.

Even in former cases, where the Beets were only grown by the farmer to accommodate the Experiment Station, and where they did not receive any particular care, the results were very striking; much more so when attention was given to careful culture. The yield, sugar-content, and purity were found to be of a far higher standard than the minimum adopted by Sugar-Beet experts. The bulletin concludes with a series of tables dealing with the averages obtained in various counties, under the headings of yield per acre, sugar-content, purity, &c., and also a comparison of the yields in Montana with those of other countries, notably Germany and France, showing that notwithstanding increased yields in these countries owing to improved cultivation, they yet fall short of the results obtained in Montana.—*C. H. C.*

Sugar-cane Borer. By H. A. Morgan (*U.S.A. Exp. Stn. Louisiana, Bull.* 70, April 1902 ; 11 figs.).—The larva of the moth *Diatræa saccharalis,* does extensive damage to Sugar-cane by boring into the stem. It also attacks Maize and *Sorghum.* A life-history of the insect in Louisiana is given, and the following remedies are suggested: Autumn planting; removal of all cane from fields after cutting, and deep burial of refuse; care in the introduction of new varieties of cane, and the cutting off of all young sprouts from stubble so that grubs with which the sprouts may be infested shall perish by the frost.—*F. J. C.*

Sugar-cane, Experiments in Cultivation. By W. C. Stubbs (*U.S.A. Exp. Stn. Louisiana, Bull.* 66, 1901).—In addition to the record of some results in sugar cane growing, this bulletin contains an excellent summary of some of the reasons for soil cultivation, and the means of carrying out that process to the best advantage.—*F. J. C.*

Tent Caterpillar. By W. E. Britton (*U.S.A. Exp. Stn. Connecticut, Bull.* 139, 7/1902 ; 3 figs.).—The tent caterpillar (*Clisiocampa americana,* Harris) is nearly related to our "lackey" moth, and the habits of the two species are similar. A list of twelve trees upon which it feeds is given. The remedies suggested are the destruction of the egg-mass during winter, spraying when leaves appear with arsenate of lead, Paris green, or Bordeaux mixture, brushing out the nests with their included caterpillars (an ingenious brush for this purpose is figured) and crushing the caterpillars.
F. J. C.

Thunbergia schimbensis. By Spencer Moore (*Journ. Bot.* 478, p. 342 ; 10/1902).—Description of a new species, collected by Mr. Kässner at the Schimba Mountains, British East Africa, from specimens in the Natural History Museum.—*G. S. B.*

Tomato Forcing. By A. C. Beal, B.S. (*U.S.A. Exp. Stn. Illinois, Bull.* 81, Nov. 1902 ; 7 figs.).—The results of some experiments in Tomato forcing for use in winter and spring are detailed. It was found that Tomato plants might be had in fruit 50 days after benching and 128 days from sowing. The main points tending to success seem to be: (1) checking the plants by growing in small $3\frac{1}{2}$-inch pots until ready to plant out, when they should be showing open blossoms and be very much pot-bound. (2) planting so as to allow as much light as possible to reach the plants. (3) hand pollinating. (The pollen is shed *only on bright days,* and should then be collected and placed on stigmas of flowers. Care in this direction results in the setting of a larger number of fruits of more uniform size.) (4) Careful selection of varieties.

Plants trained to a single stem gave better results than those trained to three stems, the yield of the former being $1\frac{1}{3}$ lb. per square foot of bench against $\frac{4}{5}$ lb. of the latter. The average yield for the winter and spring crops was from 2 to nearly $2\frac{1}{2}$ lbs. per square foot of bench, or from 7 to almost 9 lbs. per stem.

Fifty-one plants from seed sown August 20 yielded as follows :—

Month.	No. of Fruits.	Weight.	
		lbs.	oz.
December	52	7	$9\frac{1}{4}$
January	131	22	$10\frac{1}{2}$
February	399	80	$9\frac{3}{4}$
March	494	104	$9\frac{1}{4}$
April 1 to 9	142	29	$8\frac{1}{2}$
Total	1,218	244	$15\frac{1}{4}$

These Tomatos were sold at 30 cents per lb. during January and February, and 20 cents per lb. during March, at which prices they were a profitable crop.—*F. J. C.*

Tomato Manures. By H. A. Huston (*U.S.A. Exp. Stn. Indiana, Bull.* 92, 4/02).—The soil on which the experiments were tried was a moderately heavy clay loam, in good mechanical condition. 2,240 plants were set to the acre. The fertiliser which gave the best result was a mixture of muriate of potash 250 lbs., nitrate of soda 200 lbs., azotin 120 lbs., acid phosphate 200 lbs. (per acre). This gave 6·28 tons per acre against 3·27 tons on the unfertilised plot and 3·46 tons on the plot receiving nitrate alone. The fruit also ripened earlier.—*F. J. C.*

Transplanting Large Trees. By J. Luquet (*Le Jard.* May 20, 1902, pp. 149, and 184).—Methods pursued by the Administration of Paris are fully described and illustrated.—*C. W. D.*

Trees, large, Transplanting. By W. W. Pettigrew (*Garden*, No. 1624, p. 7, 3/1/1903).—The writer says: "When trees and shrubs can be removed and planted with the necessary-sized balls of earth around their roots, the result is such as to justify the extra expense, for new plantations can be made to appear many years older than they really are without the risk of losing a single shrub. As one can hardly expect to get plants of this description from nurserymen, the practice of planting large trees and shrubs can only be carried out on an estate or in a park where plantations and shrubberies may be thinned out by transplanting from one part to another, and during the winter months there is no work in connection with the garden more interesting and fascinating than that of transplanting large trees or shrubs."

E. T. C.

Trees unlawfully cut. By P. Hariot (*Le Jard.* Aug. 20, 1902, p. 241).—The Parliament of Paris in A.D. 1782 sentenced one Charles Moulin to stand in the pillory for two hours on a market day, labelled in front and behind "A Cutter-down of Trees," then to be branded with the letters GAL, and to work in the King's galleys for three years. This is an instance of the severity of forest laws in France shortly before the Revolution.—*C. W. D.*

Trees, Weeping. By W. (*Garden*, No. 1611, p. 233, 4/10/02).—Planting these with a niggardly hand is, after all, not what is wanted :

that is if we are to derive full pleasure from their presence in combination with the general collection of park and woodland trees. Single specimens dotted here and there are by no means to be compared with those clumped or massed in threes or fives. Generally speaking, weeping, upright, or other peculiarly habited trees and shrubs look better in clumps of irregular size.—*E. T. C.*

Trichopilia suavis candida (L. Linden in *Lind.* xvii. t. 788; 25/10/1902).—A beautiful pure white variety, with a little yellow at the base of the lip.—*C. C. H.*

Vanda Sanderiana (*Orch. Rev.* p. 17, fig., Jan. 1903).—The illustration of Mr. J. Gurney Fowler's plant, to which a gold medal was awarded by the R. H. S. in 1896. Particulars of cultivation are given up to the time of flowering. It would have been interesting to have been informed what progress, if any, the plant has since made, under cultivation.—*H. J. C.*

Vanilla, Cultivation and curing of. By A. McFarlane (*Bull. Bot. Dep. Trin.* No. 35; August 1902).—The writer treats of Vanilla growing in Tahiti, and shows that the lesser value of Tahitian as compared with Mexican Vanilla is due, not to soil, but to the neglect of *V. planifolia*, the species which produces that of superior quality: *V. Pompona* having been more largely planted. The advantages are pointed out of the choice of sloping ground; of the trees most suitable for supports; of the turning down of the growing shoot when it has reached a certain height, as only the hanging portions bear flowers; of certain processes for curing the beans and preparing them for market; and of planting both *V. planifolia* and *V. Pompona* where labour is limited, the two species flowering at different seasons and so facilitating fertilisation, which must be performed artificially and during fine weather.—*E. A. B.*

Vanilla, its Cultivation in German and French Settlements of Tropical Africa. By P. Hariot (*Le Jard.* Sept. 5, 1902, p. 257).—This is described in detail. It is shown to be a very artificial production, requiring much skilled attention.—*C. W. D.*

Veratrum viride. By W. Hales (*Garden*, No. 1614, p. 283; 25/10/02).—This plant (illustrated as growing in the Physic Garden, Chelsea) is unfortunately but rarely met with outside botanic gardens, which is possibly owing to the fact that its flowers are not showy, being light green. It is, however, a very handsome plant, and seen to best advantage when on the edge of a shrubbery or woodland walk. It does not mind shade, if not too dark. When well established, the plant produces numerous branched racemes of flowers, four to five feet high. The leaves are broad, beautifully recurved and plaited, and on this account the plant is worth growing.—*E. T. C.*

Viburnum Carlesii. By A. Unger (*Gard. Chron.* No. 824, p. 261; fig. 88; Oct. 11, 1902).—This very little-known plant was received about five years ago from the Corea. It appears to be quite hardy in Japan and will probably prove to be so in England, in which case it will be a very valuable addition to our shrubs. It flowers in the spring; the blossoms are at first somewhat pinkish, but they become perfectly white when they are fully open, and have a most delicious scent.—*G. S. S.*

Vine, A new Disease. Ed. (*Le Jard.* April 20, 1902, p. 115).—Vines introduced as proof against phylloxera from America into Sicily have developed a disease called "Rancet." It attacks the ends of the branches; the fruit is suppressed and replaced by a dense bunch of green shoots. In the result it is fatal to the plant.—*C. W. D.*

Vineyard, The Home. By W. H. Ragan (*U.S.A. Dep. Agr. Farm. Bull.* 156, 1902; 15 figs.).—Advice to farmers in the North to plant vines, at all events for home use, followed by a complete body of instructions for their cultivation. The directions start by describing the proper preparation of the soil, and deal with propagation, planting, supporting and training, pruning, and preserving from the attacks of enemies or disease.

Several good kinds are named, but choice is left to the individual farmer, as it is so largely a matter of local conditions which variety is likely to succeed best.

It is noted, however, that in answer to inquiries sent out from the Bureau of Plant Industry to practical fruit-growers from Maine to California, the most generally recommended kinds, with the one exception of Delaware, which is not hardy enough for inexperienced growers, are 'Concord' and its three seedlings, 'Worden,' 'Moore,' and 'Niagara.'
M. L. H.

Wall-garden Making. By F. W. Meyer (*Garden*, No. 1613, p. 266, 18/10/02; No. 1617, p. 344, 15/11/02).—A valuable series, giving full instructions as to sites, formation, and planting, illustrated from photographs and sketches by the author.—*E. T. C.*

Water as a Plant Food. By J. J. Willis (*Gard. Mag.* No. 2536, 7/6/1902).—A subject of importance to cultivators. The writer deals with the rainfall and the loss of water by evaporation according to the state of the atmosphere, and the nature of the soil, and also the relative capacity of certain soils to retain moisture.

This is a subject that has a direct and important bearing upon tillage both in gardening and farming.—*W. G.*

Watering Plants with Hot Water (*Qu. Agr. Journ.* xi. pt. 4. Oct. 1902).—In a short note it is stated that interesting experiments have been made with Palms, Aspidistras, Dracænas, Primulas, Begonias, and other plants, and the writer adds: "We do not know how we can sufficiently recommend this practice either as a curative or a preventive method. During the winter is perhaps the best time to adopt the hot-water treatment by amateurs, and those having plants in dwelling-rooms. It is a matter of common knowledge that soil enclosed in a pot in which a plant is growing ultimately becomes sour, and has, indeed, a certain poisonous quality. This toxicity is due to the presence of organic acid in excess, and which in the ordinary open-ground conditions would have been removed by bottom drainage. Plants growing in pots are under distinctly artificial conditions, and there are many causes which lead to the accumulation of these toxic acids. For instance, too deep planting, or when roots are not sufficiently aerated, the use of over-hard-baked pots or glazed receptacles, the compacting of the soil, and particularly the absence of, or clogging of "drainage."

The soil was copiously watered with water at the high temperature of 125 – 130° Fahr. The water was applied until it ran out in abundance from the hole at the bottom of the pot. After this washing, the plants were placed in a warmer situation.

After the plants have been treated to a hot-water bath it would be well to replace the loss of food elements by slight applications of liquid manure. It is reasonable to believe that if the hot water will dissolve and wash out the poisonous acids it would also dissolve and carry off all essential elements of plant food. Therefore, they must be supplied artificially.—*M. C. C.*

Water in Soils and Evaporation. By C. B. Ridgway (*U.S.A. Exp. Stn. Wyoming, Bull.* 52; 4/1902).—A mass of statistics recording results of experiments regarding the evaporation of water from a soil under varying conditions, the water-level being constant. The most instructive portion of the report shows that when the water-level was kept at 22 inches below the surface, stirring the surface once a week to a depth of 2 inches retarded evaporation by 19 per cent., stirring to a depth of 4 inches by 23 per cent., and to a depth of 6 inches by 43 per cent.

The method by which the results were obtained is illustrated.

F. J. C.

Water-Melons: (1) Growing in the North, and (2) Classification of. By F. Wm. Rane (*U.S.A. Exp. Stn. New Hampshire, Bull.* No. 86, figs. 1–14).—Part I. The culture of the Water-Melon (*Citrullus vulgaris*) as practised in the Southern States, where thousands of acres are grown annually, and the possibilities for its adaptation as a commercial crop in the North are discussed. It is a native of Africa, and the idea was sometime prevalent that it would only thrive successfully in the warm sunny climate of the South, whence an early and continuous supply has been obtained throughout the summer season.

Occasionally in the North some good fruits were seen, but these were considered uncommon and greatly the result of accident rather than cultural skill. One grower was eventually found who had both grown and disposed of the fruits in the open market for several years at considerable profit, with a variety known as "Cole's Early." This success led to an investigation of the matter, and a series of experiments, with a test of all procurable varieties, was inaugurated as the result. Fifty-one varieties were obtained from various sources, and the tests carried out at above station, with the assistance and following the methods of Mr. H. F. Hall, the successful grower.

The plot selected for experimental purposes had a south-eastern aspect, and consisted of old pasture land of a deep sandy loam. This was prepared in the preceding autumn by ploughing in a liberal quantity of long stable manure, followed by a second ploughing the last week in April. Surface cultivation with harrows was continued weekly until planting, for the purpose of killing the germinating seeds of weeds existing in the surface soil. By this means a fine tilth was obtained, which was considered necessary for the successful growth of plant until maturing of crop. The most suitable soil for the Water-Melon is a well-drained sandy loam, rich in humus and sloping towards the south.

The crop is raised from seed sown the last week in May, on slightly raised mounds placed at distances of ten feet apart. Mr. Hall's practice is to dig holes "8 or 10 inches deep and 18 to 24 inches in diameter," and fill up same with 6 to 8 inches of rich well-decayed manure. Sufficient soil is added and mixed with the manure to bring up to the original level. Into the upper portion of above, a small quantity of wood ashes, fowl manure, or phosphates is worked. Ten or twelve seeds are next sown in the centre of each prepared bed in a circle of one foot diameter, and covered with about an inch of soil pressed firmly around seeds and afterwards raked loosely upon the surface to act as a mulch. After germination and all danger of injury from insects are passed, the plants are thinned out, leaving two or three only to mature in each position.

Deep surface cultivation is commenced directly the plants have made sufficient growth, and is carried on regularly until the vines begin to run, after which the operation is shallow. When plants cover the ground, weeds are removed by hand, and in some cases soil is placed on the vines at intervals to prevent damage by wind until fruit is sufficiently large to hold them in position.

The seedlings are liable to injury in the cotyledon stage (similar to our own turnips) by the small striped cucumber beetle, the remedy for which is to sprinkle over with lime or tobacco dust, &c. Cutworms, aphis, and fungoid diseases are sometimes prevalent, but may be kept in check by the usual measures.

The fruits commence ripening during August, and plants continue in bearing until cut down by frost. One test of ripeness in the Melon is to rap with the finger, the ripe fruit giving off a full sound, the green fruit a hollow or ringing one. Both keeping quality and flavour are said to be improved by "gathering in the morning when cool," and if carefully handled and stored it will keep sound from four to six weeks. The best Melon for market is a medium-sized variety with thin rind, red flesh, sweet, and weighing from twelve to twenty-five pounds.

A table showing the relative value of the fifty-one varieties, and giving number ripened, average weight, shape, quantity of fruit per acre, &c., is appended, followed by a concise description of varieties.

Part II. This deals with classification based on the fruit alone, colour of skin, and external appearance. There are six classes enumerated, comprising light, medium, and dark green, light and dull striped, and mottled green. The majority of classes are divided into three types, oval, medium, and long. These are again subdivided into varieties. The work is ably concluded with a brief summary of the principal points, and a selection of most suitable varieties in each class.—*E. F. H.*

Water Supply. By A. J. McClatchie (*U.S.A. Agr. Exp. Stn. Arizona, Bull.* No. 43; 9 figs.).—Deals with the present distribution, and future possibilities, of the water supply of the Salt River Valley.

It is estimated that the available supply, if properly managed, would irrigate 110,000 acres, and that the construction of a dam below the Tonto basin would increase it sufficiently to irrigate 160,000 to 180,000 acres, and support a population in the valley two to three times as great as at present.—*E. A. B.*

Weeds in General: Two newcomers into Pennsylvania. By W. A. Buckhout (*U.S.A. Agr. Exp. Stn. Pennsylvania, Bull.* 58, March 1902, illustrated).—A plea for better and more thorough cultivation as a means of keeping out weeds, together with a more particular account of the Keeled Garlic (*Allium carinatum*) and the Southern Scabious (*Scabiosa australis*), two weeds, new to Pennsylvania, possessing qualities which render them liable to become serious pests.—*C. H. C.*

West Indian and South American Plants (*Beih. Bot. Cent.* bd. xiii. ht. 1, pp. 1–90).—Princess Theresa of Bavaria has made an excursion to the Lesser Antilles, Venezuela, Colombia, Ecuador, Peru, Bolivia, Chili, the Argentine, and Brazil. This paper gives a complete account of the collection, which includes 421 species. The collection has been named and new species described by the most eminent specialists in Austria and Germany. There are new species of *Uredo, Tillandsia, Eutoca, Miconia, Salvia* (two), *Solanum* (two), *Senecio*, and a critical account and localities of all the specimens. There are five plates.

G. F. S.-E.

White Fly (*Aleyrodes vaporariorum*, Westw.). By W. E. Britten (*U.S.A. Exp. Stn. Conn., Bull.* 140, 9/1902; 5 figs. and 4 plates).—This insect, which occurs in this country, is reported as very injurious to Tomatos at New Haven, Conn., and to Strawberries, Asters, Chrysanthemums, &c. in other localities. The insect belongs to the *Aleyrodidæ*, and is allied to the *Coccidæ* (scale insects) and the *Aphididæ* (aphides), differing from the former in having both sexes winged, and from the latter in being fastened to the leaf in the nymph stage. It injures plants by sucking the sap, thus causing the collapse of certain of the plant-cells. A list of sixty plants upon which it feeds is given. Fumigation with tobacco was ineffectual; hydrocyanic-acid gas was tried with excellent results, but care is required in order that the plants (Tomatos in this case) should not suffer; one ounce of potassium cyanide per thousand feet seems sufficient. Spraying with whale-oil soap (1 lb. to 5 gallons water), fir-tree oil ($\frac{1}{2}$ pint to 2 gallons), were both successful, but spraying with common laundry soap and water (1 lb. to 8 gallons) proved the best and cheapest remedy. (For description of insect see *Gard. Chron.* 1856, p. 852.)—*F. J. C.*

White Poplar. Ed. (*Le Jard.* Feb. 20, 1902, p. 58).—A giant tree near Troyes, blown down by a gale, was 400 years old and measured 140 feet high, with a circumference of twenty-five feet at four feet from the ground.—*C. W. D.*

Witches' Broom in Silver Fir. By E. Fischer (*Zeit. f. Pflanz.* xii. pp. 193–202, 2 plates; 1902).—In 1901 the author showed that *Æcidium elatinum* on Silver Fir had as its teleutospore generation, *Melampsorella Caryophyllacearum* on species of *Cerastium*, *Arenaria*, and *Stellaria* (see Abstracts, Sept. 1902, p. 272). The observations of another year are recorded, and confirm the earlier conclusions. The plates show the progress of witches' brooms caused by artificial infection of Silver Fir with teleutospores.—*W. G. S.*

Wood Leopard Moth, The. By E. Bartrum, D.D. (*Gard. Mag.* No. 2538, p. 384, 21/6/1902).—This insect pest, which infests Apple-trees, has evidently been studied by the writer, as he shows an intimate knowledge of its life-history and habits. In this article he describes the various methods for its extermination. The various chemical mixtures (washes) which have been more or less efficacious are described, besides other modes of destruction. In the opinion of the writer fowls, in large orchards, as they scratch the soil, find and devour the larvæ of insect pests. The various remedies for the American Blight on Apple-trees are also discussed in this article.—*W. G.*

Woods inimical to each other (*Rev. Hort.* No. 21, Nov. 21, 1902, p. 496).—Editorial note that certain kinds of wood, when associated, become disorganised at points of contact. Cypress wood is cited as uniting badly with Walnut and Cedar, a phenomenon of which the cause appears to be unknown.—*C. T. D.*

Worms of the Garden and Lawn. By H. Friend (*Gard. Chron.* No. 828, p. 333, Nov. 8, 1902, and No. 830, p. 372, Nov. 22, 1902).—In these two numbers the writer gives the history and a description of the "Red worm" (*Lumbricus rubellus*), one of our commonest earthworms, and gives some particulars about these creatures generally, and says that "In the lawn it is undoubtedly of real service to the gardener, as it helps to keep the ground porous, and produces a fine soft mould from its casts, which is specially adapted to act as a stimulant to the more tender forms of grass. It should not be destroyed, as it seldom gets out of bounds or becomes injurious to plants." The two remaining species will be dealt with in a future paper.—*G. S. S.*

Rock-Garden, Faunmore, Holywood, Co. Down. By Walter Smyth, F.R.H.S.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY.

GENERAL MEETING.

January 14, 1902.

Mr. A. H. Pearson, F.R.H.S., in the Chair.

Fellows elected (71).—E. G. Ashelford, Mrs. S. Atkinson, Sir Randolf L. Baker, Algernon R. Bentley, Thomas V. Bowater, C.C., Walter J. Bowden, C. E. Burge, Lady Burnett, Harry P. Burrell, Dr. R. S. Charsley, Miss A. Crompton-Stansfield, Philip Dashwood, Mrs. E. F. Denison, Drewett O. Drewett, Mrs. Welbore Ellis, D. S. Fish, W. Standford Gates, Mrs. W. Stanford Gates, C. L. Gordes, F. E. Gripper, R. Haddan, W. A. Harford, Eugene J. Tulk Hart, James Hawkes, Miss E. M. T. Holberton, Mrs. H. Jackson, Sydney A. P. Kitcat, Mrs. S. A. P. Kitcat, Mrs. Lancaster, Edward Laxton, Thomas A. Lees, George Legg, William Logan, R. Magee, Philip Mann, J. E. Mason, N. C. Neogy (India), Heaton Nichols, G. Smee Olding, Mrs. Oliver, Dr. John I. Parsons, A. F. Pearson, Miss C. T. Pease, A. Petts, Dr. Philpot, Romolo Nobile Piazzani, Robert Piper, E. Potten, W. D. Prior, Archibald Propert, Miss Harriett Quincey, G. Richardson, W. Sams, Mrs. H. B. Seaverns, Miss Shaw, C. W. Smelt, Miss B. Smith, Mrs. A. Smith-Gordon, Frank G. Storrs, D. Edwyn Thomas, E. Thomas, H. P. Thomasset, Mrs. H. Tien, L. Torkildsen, Ira G. Treseder, I. B. B. Treseder, C. E. West, J. P. White, Miss H. F. Wilson, Alexander Wright, E. Burney Young.

GENERAL MEETING.

January 28, 1902.

Mr. George Bunyard, V.M.H., in the Chair.

Fellows elected (45).—Herbert Boston, Henry Bourhill (S. Africa), W. Bousfield, R. W. Brimacombe, W. J. Bruce, A. E. Carey, E. Carr, C. H. Devereux, James B. Dixon, W. Dowel, John Dudman, jun., John S. Eckford, C. Edwards, G. Evans, N. P. Fenwick, Mrs. German, H. A. Gibson, R. Gordon, F. Greene, C. W. Hall, Mrs. E. C. Hannen, A. Hill, Mrs. Johnstone, Countess of Kenmare, Jaffrey M. LeCocq, G. Little, A. W. Mills, Miss E. Munro, Henry Parr, Mrs. H. J. Royds, R. W. Roylance, E. Scott, Mrs. M. E. Scrivenor, Mrs. C. Seely, Countess of Sefton, Mrs. G. Sheriff, Countess of St. Germans, Mrs. Hardcastle Sykes, Mrs. Thornycroft, R. C. Vaugham, Mrs. Welch-Thornton, H. Winwood, W. N. Wood, John Woolford, J. Pattison Yeoman.

Associates (3).—George Cragg, Henry Lister, William Perkins.

Affiliated Societies (4).—Burton-on-Trent Floral and Horticultural Society, Royston Horticultural Society, Rye and District Gardeners' Society, Sheffield Floral and Horticultural Society.

A lecture on the "Renovation of Old Fruit Trees" was given by Mr. George Bunyard, V.M.H. (See p. 46.)

ANNUAL GENERAL MEETING.

February 11, 1902.

Sir Trevor Lawrence, Bart., V.M.H. (President of the Society), in the Chair.

The Minutes of the last Annual Meeting were read and signed.

Fellows elected (53).—Alfred Allhusen, John Artindale, Leslie Atkins, Mrs. Banger, F. Stewart Barnard, G. H. Baxter, Mrs. Neil Baynes, L. Bigg-Wither, Mrs. Borton, Lady Boston, Mrs. Bray, John Brennand, John P. Brown, C. R. Canney, Thomas G. Cartwright, H. C. Conor, G. H. Cuthbert, James Ewing, Miss Y. Forster, Mrs. John Fuller, W. Green, H. H. Hartshorne, Mrs. Hobhouse, Col. J. Heap, H. Hicks, Henry J. Hopkins, John Innes, Miss B. Jackson, W. A. James, W. Johnson, Harold Ivan Jones, Peter Kay, Mrs. Mahl, Rev. F. W. Mason, Mrs. Mortimer, Mrs. Morton, Mrs. Lee Muggeridge, Mrs. A. Muirhead, C. J. Newbury, Mrs. Nimmo, E. Pitt, R. R. Robbins, Miss Rowland, W. H. Radcliffe Saunders, Mrs. Spragge, Mrs. E. E. Stevenson, G. Thomas Turner, W. Turney, Dan Walborn, J. Walborn, H. C. Wallace, Rev. H. M. Wells, William Wolff.

Associates (3).—W. Bell, D. G. McIver, H. Walker.

Affiliated Societies (4).—Collingham Horticultural Society, Horsham Horticultural Society, Newbury Horticultural Society, Redhill, Reigate, and District Society.

A vote of thanks to the retiring Member of Council, Sir John Dillwyn Llewelyn, Bart., was moved by Mr. George Paul, V.M.H., and seconded by Surgeon-Major Ince, and carried unanimously.

The President moved the adoption of the Report.

This was seconded by Dr. Masters, F.R.S., and carried unanimously.

The President read the names of the proposed new Members of Council, Vice-Presidents, and Officers, and subsequently declared them all duly elected, viz.:

As new Members of Council.—Arthur L. Wigan, Esq., Rev. Hugh A. Berners, M.A., Harry J. Veitch, Esq.

As Vice-Presidents.—The Right Hon. Joseph Chamberlain, M.P.; the Right Hon. the Earl of Ducie, the Right Hon. Lord Rothschild, Baron Sir Henry Schröder, Bart.; Sir John Dillwyn Llewelyn, Bart.; Sir Frederick Wigan, Bart.

As Officers.—Sir Trevor Lawrence, Bart., V.M.H., *President*; J. Gurney Fowler, Esq., *Treasurer*; Rev. W. Wilks, M.A., *Secretary*; Alfred C. Harper, Esq., *Auditor*.

Mr. Arthur W. Sutton, V.M.H., F.L.S., moved, and Surgeon-Major Ince seconded, "That this Meeting is glad to hear from the President that steps are being taken to secure a site for a new Hall, and pledges itself to give its most favourable consideration to any proposal which the Council shall in due course lay before it."

This was carried with three dissentients only in a large and crowded meeting.

Mr. Joseph Cheal moved, and Mr. James Douglas, V.M.H., seconded, "A hearty vote of thanks to the President for taking the Chair."

This was carried unanimously.

REPORT OF THE COUNCIL

FOR THE YEAR 1901.

1. It is very gratifying to the Council to be able to record that in the first year of the new century a larger number of new Fellows have joined the Society than in any year since its first establishment in 1804. The exact number of new Fellows elected this year has been 930, which, if contrasted with the 1,108 who formed the whole number of the Society in January 1888, of whom only 552 were subscribing Fellows, indicates the development which has taken place in the Society recently. The Council hope that every one who has the Society's welfare at heart will continue to endeavour to promote it by enrolling new Fellows.

2. The Council are confident that one feeling alike inspired every Fellow of the Society on hearing of the death of Her Most Gracious Majesty Queen Victoria, Patron of the Society—a feeling of thankfulness for the long years she was spared to her people and of grief at her loss. The Council sent, on behalf of the Society, a tribute of respect and devotion to Her Majesty's funeral; and an address to the King, to which a reply was accorded by His Majesty's gracious command. Copies of these documents will be found on pages ii and xiii of Vol. XXVI. of the Society's JOURNAL. The Council have great pleasure in announcing that Her Majesty Queen Alexandra has been graciously pleased to accept the position of Patron of the Society in the place of the late Queen Victoria.

3. A corrected list of the Awards made by the Society to Plants, Flowers, Fruits, Vegetables, &c., to the end of 1899 has been issued. It has involved a great deal of labour and research, and the thanks of the Society are due to those gentlemen who assisted in the work, especially to those who prepared the section which deals with Orchids. The price of the entire volume has been fixed at 5*s.* (or the Orchid section can be obtained separately, *interleaved*, at 5*s.*), and the Council hope that many Fellows will take advantage of the information it contains in order to meet the unavoidably heavy expense incurred in its publication.

4. During the past year the Council have carried through an appeal against what they considered the unfair rating of Chiswick, and have succeeded in reducing the assessment very considerably. Under the head of ordinary expenditure at Chiswick £1,923 has been spent on the general work and maintenance of the Gardens. The receipts by sale of surplus produce amount to £347, making the net ordinary cost of the Gardens £1,576.

5. The Council wish to call attention again to the good work done at Chiswick under Mr. Wright's superintendence, not only in the Garden, but

among the students. During the last three years of our Chiswick students one has taken a First Class in Honours in Science and Art, one a First in Advanced Botany, two a First in Elementary Botany, at South Kensington; one has been appointed Curator of the Botanic Gardens at Antigua; one is a Botanical Collector for the London School Board; one has been appointed to conduct an important series of experiments with land and crops; thirteen have taken a First Class in the R.H.S. Examination in Horticulture; four have obtained positions at the Royal Gardens, Kew; one is a Botanical Demonstrator at Owens College, Manchester; one is editor of a garden paper; one is fruit growing and farming in Ireland, and another in Canada. Mr. Wright reports to the Council: "The demand for energetic, trustworthy young men from Chiswick is rapidly increasing; there is no difficulty in placing such in good situations, our supply being unequal to the demand; but they *must all be workers*. During the past year applications were received for thirty-four head gardeners, nine single-handed gardeners, six foremen, eight journeymen, and several miscellaneous men, such as landscape gardeners, propagators, &c."

6. At Westminster twenty-two Fruit and Floral Meetings have been held in the Drill Hall, Buckingham Gate, Victoria Street, besides the larger Shows in the Temple Gardens on May 22, 23, and 24; at the Crystal Palace on October 10, 11, and 12; and at Chiswick on July 16 and 17 on the occasion of the Conference on Lilies. Lectures or Demonstrations have been delivered at almost all of the Meetings.

7. The number of Awards granted by the Council, on the recommendation of the various Committees, will be seen from the following table:—

Award	Provincial Show	Purchased by Affiliated Societies	Temple Show	Crystal Palace Fruit Show	On Recommendation of				Total
					Fruit Committee	Floral Committee	Orchid Committee	Narcissus Committee	
Gold Medal	—	—	8	2	4	9	2	—	25
Silver Cup	—	—	21	1	—	—	—	—	22
Hogg Memorial Medal ...	—	—	—	3	1	—	—	—	4
Silver-gilt Flora	1	—	9	—	—	29	11	2	52
Silver-gilt Knightian	—	—	1	4	11	—	—	—	16
Silver-gilt Banksian	1	—	9	3	—	27	—	—	40
Silver Flora	1	18	16	—	—	47	35	5	122
Silver Knightian	—	—	3	2	17	—	—	—	22
Silver Banksian	4	40	25	2	20	94	19	1	205
Bronze Flora	—	14	—	—	—	17	—	—	31
Bronze Knightian	—	—	—	—	1	—	—	—	1
Bronze Banksian	—	21	—	—	1	8	2	1	33
First-class Certificate	1	—	3	—	4	12	31	5	56
Award of Merit	1	—	29	—	32	160	65	13	300
Botanical Certificate	—	—	—	—	—	1	12	—	13
Cultural Commendation ...	—	—	2	—	21	4	14	—	41
Total	9	93	126	17	112	408	191	27	983

In addition to the above:—A Silver-gilt Flora Medal was awarded to Miss E. M. Watkins for having passed first in the Society's Examination.

One hundred Bronze Banksian Medals have also been granted to Cottagers' Societies.

8. During the past year the Scientific Committee of the Society has been greatly revived and enlarged by the appointment and kind co-operation of many new Members, and the energy and skill which they have devoted to the work are evidenced by the valuable report of their labours issued in the Society's JOURNAL. The Council desire, therefore, to draw the attention of Fellows to the more extended use which this Committee might be to them if they availed themselves more freely of their privileges in submitting instances of diseases of or injuries to plants caused by insects or otherwise. The Committee is composed of gentlemen qualified to give the best advice on all such subjects, either in respect to the prevention or cure of disease. The Committee is glad to receive specimens of any subjects of scientific interest.

9. The Society's Great Show held in May in the Inner Temple Gardens (by the continued kindness of the Treasurer and Benchers) was as successful as ever, and it is a matter of satisfaction to the Council to find that this Meeting is universally acknowledged to be the leading Horticultural Exhibition of this country. The best thanks of the Society are due to all who kindly brought their plants for exhibition, or otherwise contributed to the success of this Show.

10. The Council have arranged, at the request of the National Tulip Society, for its Exhibition to be held in conjunction with the Society's Meeting on May 20, 1902, and for the National Dahlia Society to hold a Committee Meeting at the Drill Hall on September 23, and a two days' Show on September 2 and 3. The National Auricula and Primula Society will, as usual, hold its Annual Show, in conjunction with the Society's, on April 22, and the Carnation Society will do the same on July 22. Full particulars of these Meetings will be found in the book of Arrangements, 1902.

11. The Exhibition of British-grown Fruit held by the Society at the Crystal Palace on October 10, 11, and 12 was, from an educational point of view, most satisfactory. Full particulars will be found in Vol. XXVI., Part 4, of the JOURNAL, which will be issued in the course of a few weeks.

12. As an object-lesson in British fruit cultivation this Annual Show stands unrivalled, and is of national importance. Those who have visited it from year to year cannot fail to have been impressed by the wonderful advance which has been made in the quality of the hardy fruits exhibited; and as the importance of fruit growing in this country cannot well be over-estimated the Council invite Fellows and their friends to support them in their efforts to maintain and improve this Exhibition by visiting it, and by subscribing to its funds. For it cannot be too widely known that the continuance of the Show is absolutely dependent on at least £100 being raised by subscription each year towards the Prize Fund. The Show involves the Society in a very large expenditure without the possibility of any financial return. The Council cannot therefore continue it unless sufficient interest in it is taken by Fellows and their friends to provide £100 towards the Prize Fund. And this will in coming years be even more important than heretofore, as the Directors of the Palace have signified to the Council that they feel compelled to still further

decrease their contribution for 1902 by yet another £50. A glance at the list of subscribers will show how small has been the interest taken by the bulk of the Fellows. The Council would point out that this is not a local Show with a few large prizes, but that a large number of small prizes have been provided in order to secure the best fruits in each section: special prizes have been allotted to market growers; and counties have been grouped in such a way that growers should not have to compete with exhibitors from localities more favoured by climatic conditions. These points will be still further extended should sufficient financial support be forthcoming. Subscriptions should be sent at once to the Secretary, 117 Victoria Street, Westminster, and if the list proves satisfactory the Schedule will be issued in April, and the Show held on September 18, 19, and 20, 1902. The list of subscribers for 1901 will be given in Vol. XXVI., Part 4, of the Society's JOURNAL.

13. An invitation has been received and accepted for sending a deputation to visit a Show of Daffodils and other early spring flowers and produce, to be held at Truro on April 15, 1902.

14. The Council have accepted an invitation to send Delegates to a Conference on Hybridisation, which is to be held at New York in the autumn of 1902, and are glad to be able to announce that Mr. W. Bateson, M.A., F.R.S., V.M.H., and Mr. Geo. Nicholson, V.M.H., have consented to attend on behalf of the Royal Horticultural Society.

15. In consequence of the great difficulties experienced in sending plants satisfactorily to Fellows residing abroad, the Council have decided that in future no plants will be distributed to Fellows abroad, but in lieu thereof the Council will endeavour to obtain and supply to such Fellows any rare or unusual seeds (to a reasonable amount) which they may be unable to obtain in their own country.

The JOURNAL of the Society has been continued so as to enable Fellows at a distance to enter more fully into and reap the benefits of the study and work of those actively engaged at headquarters. Vol. XXV., Part 3, Vol. XXVI., Parts 1, 2, and 3, were issued during the year; Vol. XXVI., Part 4, will be ready in March, or as soon after as possible. A new feature has been added during the past year which, it is hoped, may be recognised by the Fellows as one of particular value and interest, viz. NOTES ON RECENT RESEARCH and ABSTRACTS from all the principal horticultural and botanical periodical literature of the world. The Council desire to tender their particular thanks to the distinguished body of experts who have so ungrudgingly devoted their time and attention to this object.

17. An examination in the principles and practice of Horticulture was held on April 24, concurrently in different parts of the United Kingdom, a centre being established wherever a magistrate, clergyman, schoolmaster, or other responsible person accustomed to examinations would consent to act on the Society's behalf, in accordance with the rules laid down for its conduct. No limit as to the age, position, or previous training of the candidates was imposed: 225 candidates presented themselves for examination. The names and addresses of those who succeeded in satisfying the examiners, together with the number of marks assigned to each, will be found in the Society's JOURNAL, Vol. XXVI., p. 267.

18. It is proposed to hold a similar examination in 1902, on Wednesday, April 23. Candidates wishing to enter for the Examination should make application during February to the Secretary, R.H.S. Office, 117 Victoria Street, Westminster. In 1903 and following years it has been suggested that this examination should take place at the end of February, before work in the gardens is so onerous as it must be in April. It is thought that this will be a convenience to many young gardeners who cannot otherwise be well spared to attend the Examination.

19. Valuable books have been presented to the Society during the past year by the Director of the Royal Gardens at Kew, Dr. Maxwell Masters, F.R.S., the Rev. Professor Henslow, V.M.H., Dr. Cooke, M.A., Mr. James Douglas, V.M.H., Mr. F. Sander, V.M.H., and others, to all of whom the best thanks of the Society are due. A full list will be published in March, 1902, in the Society's Journal, Vol. XXVI., Part 4. The Council desire to draw the attention of Fellows possessing horticultural or botanical books to the admirable method adopted in the year 1900 by Mr. Elwes, F.R.S., V.M.H., for enriching the Society's Library without at the same time unduly depleting his own. It is fully explained on page 338 of Vol. XXIII. of the Society's Journal.

20. The thanks of the Society are due to all the Members of the Standing Committees—viz. the Scientific, the Fruit and Vegetable, the Floral, the Orchid, and the Narcissus Committees—for the kind, patient, and often laborious attention which they have severally given to their departments. Many of the members of these Committees have to travel long distances to attend them. The thanks of the Society are especially due to all who are so good as to serve under these conditions.

21. In response to a very general feeling, the Council have decided that when the proposal of an Award has been made at any of the five standing Committees of the Society it shall not be considered as "carried" unless the number of votes recorded for the proposal be at least double the number voting against it.

22. In view of the extended cultivation of old-fashioned Tulips, and at the request of several prominent growers, it has been decided to relieve the already overburdened Floral Committee of the duty of considering these flowers, and to transfer it to the Narcissus Committee, which will in future be known as the Narcissus and Tulip Committee. Should, however, such Tulips be exhibited at any date when this Committee is not sitting, the Floral Committee will be requested to take them in hand.

23. The Society has also to thank all those who have so kindly presented plants or seeds to the Gardens. A list of the donors has been prepared, and will be included in the next issue of the Society's Journal.

24. The Council wish to express, in their own name and in that of the Fellows of the Society, their great indebtedness to all who have contributed, either by the exhibition of plants, fruits, flowers, or vegetables, or by lectures or papers, to the success of the fortnightly Meetings in the Drill Hall. They are glad to find by the increased and increasing number of visitors that the Society's fortnightly Meetings are now fully appreciated by the Fellows and public in general.

25. The Lectures given at the Society's Meetings during the past

year have been or will shortly be published in the JOURNAL, and are as follows :—

Jan.	15	"Recent Treatment of Diseases and Insects injurious to Orchards," by Professor Beach, U.S.A., F.R.H.S.
Feb.	26	"The Making and Unmaking of Flowers," by the Rev. Professor Henslow, M.A., V.M.H.
March	26	"Inconspicuous and Rarely Cultivated Orchids," by Mr. W. H. White, A.R.H.S.
April	23	"British Plants worth improving for Gardens," by Mr. F. W. Burbidge, M.A., V.M.H.
May	7	"Small Plants for Walls," by Mr. E. H. Jenkins, F.R.H.S.
June	4	"Recent Discoveries in Heredity," by Mr. W. Bateson, M.A., F.R.S., V.M.H.
,,	18	"Gardening in the London Parks," by Colonel Wheatley, C.B.
July	2	"Mimicry amongst Plants," by the Rev. Professor Henslow, M.A., V.M.H.
Aug.	13	"Tender Plants for Outdoor Gardening," by Mr. Wm. Townsend.
,,	27	"Garden Manures," by Mr. F. J. Baker, A.R.C.S.
Sept.	10	"Cactus Dahlias," by Mr. C. G. Wyatt, F.R.H.S.
,,	24	"Autumn Roses," by Mr. Arthur W. Paul, F.R.H.S.
Oct.	15	"Hardy Fruits in Scotland" :— North, by Mr. Donald Maclean, F.R.H.S. South, by Mr. James Day. Central, by Mr. Wm. Wright.
,,	29	"Mechanical Forces in Plants," by the Rev. Professor Henslow, M.A., V.M.H.
Nov.	12	"Insecticides and Spraying," by Mr. R. Newstead, F.E.S.
,,	26	"Whole Fruit Preservation," Mr. J. E. Austin, F.R.H.S.

Besides these Lectures, there have been the valuable papers recently published in the Report of the Lily Conference, as well as several Floral Demonstrations by Professor Henslow. Two Series of Lectures have also been given to the students and others at Chiswick, one Series by Professor Henslow and another by Mr. George Massee, F.L.S., short accounts of which have appeared in the JOURNAL. The best thanks of the Society are due to these lecturers.

26. Several Fellows having represented the difficulty they find in identifying the attendants in charge of the different exhibits at the Society's Meetings, the Council have caused a badge to be prepared which may be worn by attendants, but will carry no special right of admission or other privilege. These badges can be obtained at a small cost by applying at the Society's Offices; and will bear the Exhibitor's name. No other badges will be allowed to be worn by attendants.

27. The Council have the sad duty of recording the death of ninety-three Fellows during the year, and among them they regret to find the names of H.I.M. the Empress Frederick of Germany, His Serene Highness the Duke of Teck, Lord Wantage, V.C., K.C.B., Lord Bateman, Maj.-Gen., Sir Francis de Winton, Sir Cuthbert Peek, Bart., Martin Hope Sutton,

Thomas Meehan, Sir Henry Gilbert, Sir Douglas Galton, K.C.B., Lady Whittaker Ellis, Miss Ormerod, LL.D., V.M.H., Dr. Henry Armstrong, Rev. H. Ewbank, M.A., D. T. Fish, Prof. Maxime Cornu, A. H. Smee, F. W. Campion, F. Rowley Parker, Henri Michelin, Welbore S. Ellis, Charles Pilcher, Mrs. R. S. Holford, Thomas Rochford, W. Balchin, James Richards, J. H. Krelage, A. Bleu, James Cypher, T. S. Ware, and others.

28. It will be fresh in the memory of the Fellows that at the Jubilee of the late Queen in 1897 the Council, with Her Majesty's gracious assent, established the Victoria Medal of Honour in Horticulture in order to perpetuate the remembrance of Her Majesty's glorious reign, and to enable the Society at the same time to confer a conspicuous honour on those horticulturists whom it might from time to time consider as deserving special honour at the hands of the Society. At the time of its institution this Medal was confined to sixty recipients corresponding to the then sixty years of Her Majesty's reign. It therefore seemed to the Council only fitting that at Her Majesty's death the number of Medallists should be increased to sixty-three, representing the full number of years of her reign. During the past twelve months the Medal has been conferred upon Miss Ormerod, LL.D., Sir George King, K.C.I.E., Mr. William Bateson, M.A., F.R.S., Mr. James Sweet, and Mr. George Norman.

29. The following table will show the Society's progress in regard to numerical strength during the past year:—

DEATHS IN 1901.

		£	s.	d.
Life Fellows	24	0	0	0
4 Guineas	0	0	0	0
2 "	21	44	2	0
1 "	48	50	8	0
	93	£94	10	0

RESIGNATIONS.

		£	s.	d.
4 Guineas	0	0	0	0
2 "	18	37	16	0
1 "	101	106	1	0
	119	£143	17	0
Total Loss	212	£238	7	0

FELLOWS ELECTED, 1901.

		£	s.	d.
4 Guineas	3	12	12	0
2 "	170	357	0	0
1 "	718	753	18	0
Associates	10	5	5	0
Affiliated Societies	11	11	11	0
Commutations = £500. 2s. 6d.	18			
	930	£1140	6	0
Deduct Loss		238	7	0
Net Increase in Income		£901	19	0

New Fellows, &c.	930
Deduct Resignations and Deaths	212
Numerical Increase	718

The total number of Fellows, Members, Associates, and Affiliated Societies is now exactly 5,468.

30. A scheme for the Affiliation of Local Horticultural Societies was put forward a year or two since, and 116 Local Societies have availed themselves of it. In order to enhance the utility of the Society to others affiliated to it, the Council have caused a Special Card to be prepared suitable for use by Affiliated Societies, for the purpose of granting Certificates or Awards, or for Complimentary Cards of Thanks, Commendation, &c. They have also caused a New Medal to be struck which is to be used by Affiliated Societies only. Details regarding the prices of the Medal and Cards will be found in the book of the Society's Arrangements,

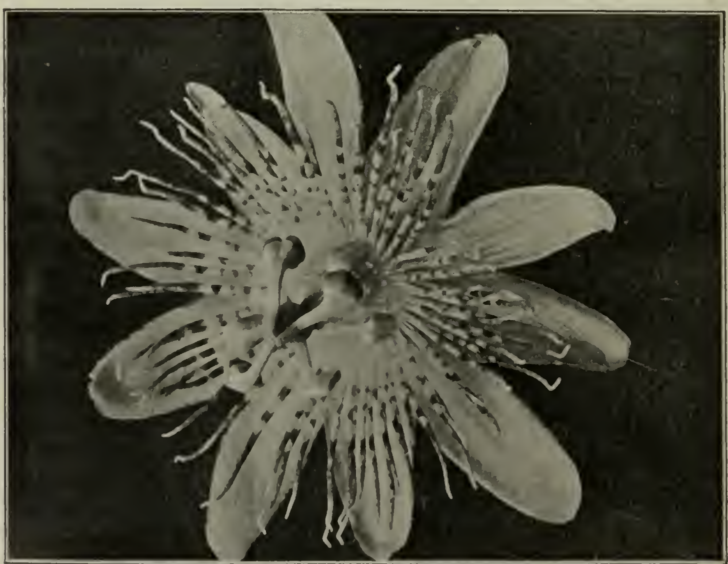
1902, or they can be obtained from the Society's Office, 117 Victoria Street, S.W. The Council express the hope that Fellows will now actively promote the affiliation of Local Horticultural or Cottage Garden Societies in their own immediate neighbourhood.

31. On the kind invitation of the Earl and Countess Ilchester the Council have decided to hold a Conference on and Exhibition of Roses at Holland House, Kensington, in connection with one of the ordinary fortnightly Meetings of the Society. This Conference and Show will take place on Tuesday, June 24. The Exhibition of Flowers will be continued on Wednesday 25 unless it should be found impracticable on account of the arrangements for His Majesty's Coronation, in which case due notice will be given. A special Schedule of Prizes has been prepared with the kind co-operation of the National Rose Society, and will be found incorporated with the Arrangements, 1902. Fellows are particularly requested to correct the dates given for this Conference on their tickets, most of which had been printed before the date of the Coronation was announced.

32. At the request of some of the Fellows, the Council have arranged to send (in the week preceding it) a reminder of every Show to any Fellow who will send to the R.H.S. Office, 117 Victoria Street, Westminster, twenty-four Halfpenny Post Cards, *fully addressed* to himself, or to whomsoever he wishes the reminder sent.

33. The Programme for the ensuing year will be found in the Arrangements for the year 1902, lately issued to all Fellows.

34. Subjoined is the usual Revenue and Expenditure Account, with the Balance Sheet for the year ending December 31, 1901.



ROYAL HORTICULTURAL SOCIETY.

BALANCE SHEET, DECEMBER 31, 1901.

	£	s.	d.	£	s.	d.
To SUNDRY CREDITORS—						
Head Office	97	9	3			
Chiswick	58	11	7			
Painting Orchid Certificates	13	7	9			
				169	8	7
,, SUBSCRIPTIONS, 1902, paid in Advance ...	176	18	6			
,, ADVERTISEMENTS, 1902, paid in Advance	5	10	0			
				182	8	6
,, LIFE COMPOSITIONS, Dec. 31, 1900 ...	1,195	10	0			
Do. do. do. 1901 ...	500	2	6			
				1,695	12	6
,, CHISWICK SCHOLARSHIPS—						
Amount Received	75	0	0			
,, Expended	72	18	4			
				2	1	8
,, GENERAL REVENUE ACCOUNT—						
Balance, January 1, 1901	9,237	5	8			
Less Orchid Certificate Paintings ...	36	1	3			
	9,201	4	5			
Less Bad Debts	4	7	9			
	£9,196	16	8			
,, Balance for the Year 1901, as per Revenue and Expenditure Account	2,251	4	6			
Adjustment of Interest on Investments ...	25	5	10			
				11,473	7	0
				£13,522	18	3

	£	s.	d.	£	s.	d.
By SUNDRY DEBTORS—						
Annual Subscriptions outstanding, estimated at	5	5	0			
Garden Produce	21	4	5			
Advertisements	103	0	1			
Rates and Taxes (Chiswick) paid in advance	25	18	4			
Interest on Investments	112	6	11			
				267	14	9
,, INVESTMENTS—						
$2\frac{3}{4}$ % Consols £2,122. 8*s.* 9*d.*... ... *cost*	1,892	11	3			
(£2,022. 8*s.* 9*d.* of this sum is held by the Society subject to the provisions of the will of the late J. Davis, Esq.)						
$2\frac{3}{4}$ % Consols £2,813 ... ... *cost*	2,768	5	0			
3 % Local Loans £5,800 ... ... ,,	6,006	16	6			
37,000 Rupees, Indian Rupee Paper... ,,	2,462	14	4			
				13,130	7	1
,, CASH AT LONDON AND COUNTY BANK—						
On Current Account	118	10	6			
Petty Cash (Head Office)	6	5	11			
				124	16	5
				£13,522	18	3

We have audited the books from which the above Accounts are compiled, and certify that they exhibit a true and correct statement of the position of the Society on December 31, 1901.

HARPER BROS., *Chartered Accountants*,
10 Trinity Square, E.C.

ROYAL HORTICUL

Dr. ANNUAL REVENUE AND EXPENDITURE

	£ s. d.	£ s. d.
To ESTABLISHMENT EXPENSES—		
Salaries and Wages	756 14 0	
Rent of Office	203 3 0	
Printing and Stationery	319 9 11	
JOURNAL—Printing and Postage	1,506 19 3	
Postages	179 2 8	
Coal and Gas	6 4 9	
Donation to Primula and Auricula Society ...	10 0 0	
Miscellaneous	102 8 3	
Commission on Advertisements, JOURNAL, &c.	50 17 7	
Painting Orchids Pictures	22 13 6	
		3,157 12 11
,, LINDLEY LIBRARY		16 18 9
,, EXPENSES OF NEW CHARTER...		140 13 6
,, SHOWS and MEETINGS—		
Rent of Drill Hall and Cleaning	118 16 0	
Temple Show	716 7 11	
Crystal Palace Fruit Show	305 11 2	
Labour	88 16 8	
Expenses of Floral Meetings and Conferences	104 16 3	
		1,334 8 0
,, PRIZES and MEDALS—		
Rose Show	57 0 0	
Committee Awards, &c....	431 4 3	
		488 4 3
,, CHISWICK GARDENS—		
Rent, Rates, Taxes, and Insurance	260 11 6	
Superintendent's Salary	220 16 8	
Pension, late Superintendent	180 0 0	
Labour	726 7 5	
Implements, Manure, Soil, Packing, &c. ...	129 7 4	
Coal and Coke	297 8 6	
Repairs	33 19 2	
Water and Gas	23 17 1	
Miscellaneous Expenses	51 7 6	
		1,923 15 2
		7,061 12 7
,, BALANCE, carried to Balance Sheet		2,251 4 6
		£9,312 17 1

TURAL SOCIETY.

ACCOUNT for YEAR ending DECEMBER 31, 1901. Cr.

	£ s. d.	£ s. d.
By ANNUAL SUBSCRIPTIONS		6,025 1 11
„ SHOWS AND MEETINGS—		
Temple Show	1,540 5 1	
Crystal Palace Fruit Show	279 5 0	
Drill Hall Meetings	47 14 0	
		1,867 4 1
„ ADVERTISEMENTS IN "JOURNAL"	523 1 5	
„ SALE OF "JOURNALS"	68 11 10	
„ MISCELLANEOUS RECEIPTS	36 16 0	
		628 9 3
„ DIVIDENDS—		
Davis Bequest and Parry's Legacy	56 18 4	
Consols	57 11 6	
Local Loans	164 4 3	
Rupee Paper	78 14 6	
		357 8 7
„ INTEREST ON DEPOSIT ACCOUNT		22 9 1
„ PRIZES and MEDALS		65 1 0
„ CHISWICK GARDENS—		
Produce sold	265 0 4	
Students' Fees	10 10 0	
Admissions	9 16 0	
Inspection of Gardens	21 0 0	
Miscellaneous Receipts	40 16 10	
		347 3 2
		£9,312 17 1

HARPER BROS., *Chartered Accountants*,
10 Trinity Square, E.C.

GENERAL MEETING.

February 25, 1902.

Sir John T. D. Llewelyn, Bart., in the Chair.

Fellows elected (69).—Crosier Bailey, H. M. Baker, Marchioness of Bath, Arthur Beazley, W. B. M. Bird, J. W. Botsford, Edward J. Brittan, Lieut.-Col. James Campbell, Frank E. Cartwright (South Africa), Thomas M. Crook, F. Dennison, Miss Mary Dobrée, James P. Dodd, John Drewett, Frederick W. Dunn, Lady Ebury, Dr. Alfred Eteson, Mrs. G. Forbes, Francis F. Fox, H. Fox-Adams, Major W. D. Garnett Botfield, Thomas Gray, C. P. Hodsdon, H. Humphrey, Miss C. M. Jackson, Mrs. Jukes, Ronald Keep, Albert A. Kerridge, Peter Lambert, Mrs. A. G. Yate Lee, Lady Lewis, F. F. Lidderdale, Miss M. Long, C. J. Longman, C. Lorenz (Germany), Arthur H. Lyell, M.A.; John H. Massey, Mrs. Middleton, T. M. Miller, Mrs. C. Mumford, Miss E. Murfin, Thomas Murray, Francis H. Pain, E. Pallett, M.D.; Hon. Mrs. C. Parker, F. W. Parker, W. H. Parton, jun.; A. J. Paten, F.R.G.S.; Lady Peel, Henry D. Rhodes, R. F. Riddick, Lady Ridley, W. Robinson, Mrs. A. C. F. Royds, Thomas Shaw, C. R. Shilling, Francis Skipwith, P. W. Smith, Dr. Telfordsmith, Mrs. W. R. Stobart, Mrs. J. Stocker, Capt. B. J. St. George, E. Timperlake, Percy D. Uhlmann, Hon. John Wallop, E. L. Whitby, C. B. Winder, M.R.A.C.; H. B. Witty, Frederick V. Woods.

Associate (1).—A. Holland.

Affiliated Societies (2).—Farningham Rose and Horticultural Society, Rock Ferry Horticultural Society.

A lecture on "Nicotine in Horticulture" was given by Mr. G. E. Williams. (See p. 50.)

GENERAL MEETING.

March 11, 1902.

Mr. Harry J. Veitch, F.L.S., F.R.G.S., in the Chair.

Fellows elected (48).—Miss Ruth Ainsworth, F. Bennett-Goldney, F.S.A.; G. Bridgeman, Ernest J. Brown, R. M. Brown, J. W. Browning, Capt. W. O. Cantley, F. E. Chipperfield, W. Miller Christy, George Coates, M.D.; Major H. A. Cummins, M.D., C.M.G., F.L.S.; Miss F. W. Currey, R. J. Cuthbert, Rev. W. H. Dallinger, Sc.D., D.C.L., F.R.S.; E. R. Dolby, Lady Margaret Douglas, H. Driver, C. Percy Fielder, Robert Findlay, Henry L. Gray, Mrs. Neville Grenville, Henry W. Handcock, Mrs. F. M. Hartung, Samuel Heilbut, Lord Hillingdon, C. F. Jackson, S. Jackson, Percy Johnson, Henry B. Loftus, Miss L. Lovegrove, R. Martin-Holland, Mrs. Maurice, Lady Millais, P. Tribhawan Nath, Arthur Newall, Rev. S. S. Orpwood, Cecil F. Parr, Dr. H. F. Parsons, T. H. Prater, Major L. H. Prioleau, J. H. Simpson, Joseph Slater, Mrs. Alderson Smith, M. Thomas, James B. Westropp, A. M. Wilson, Charles Wimbush, Mrs. H. Woods.

Affiliated Societies (2).—Bristol Amateur Horticultural Society, Bristol Chrysanthemum Society.

A lecture was given on "The New Soil Science," by Mr. R. Hedger Wallace. (See p. 70.)

GENERAL MEETING.

MARCH 21, 1902.

Sir TREVOR LAWRENCE, Bart., V.M.H. (President of the Society), in the Chair.

The Secretary read the Minutes of the Annual General Meeting held February 11, 1902.

The Secretary read the notice calling the meeting :—

Royal Horticultural Society,
117 Victoria Street, S.W.

Notice is hereby given that a General Meeting of the Society will be held at 3 P.M. on Friday, March 21, at the Drill Hall (London Scottish), Buckingham Gate, S.W., to receive from the Council and, if approved, to adopt a report recommending a proposed site for a horticultural hall and offices.

Fellows are requested to show their tickets at the door. None but Fellows will be admitted.

By order of the Council,
W. WILKS, *Secretary.*

The following Report, which was circulated at the Meeting, was taken as read :—

Report presented by the Council to the General Meeting of the Society, held on Friday, March 21, 1902, consisting of the Report of a Committee to the Council and of a Memorandum of the Council.

REPORT

Presented to the Council of the Royal Horticultural Society by the New Hall Committee, February 25, 1902.

GENTLEMEN,—Your Committee was appointed on June 4, 1901. It consisted of Baron Sir Henry Schröder, Bart., Chairman ; Sir Trevor Lawrence, Bart., V.M.H., Harry J. Veitch, Esq., F.L.S., Dr. Masters, F.R.S., N. N. Sherwood, Esq., V.M.H., Rev. W. Wilks, M.A., Secretary. It has since been enlarged by the addition of the Rt. Hon. the Earl of Ilchester and Henry B. May, Esq.

The Committee was appointed " to consider the question of a Horticultural Hall, and to report thereupon to the Council."

Your Committee has held fourteen formal meetings, besides several informal for the inspection of sites by various members of the Committee.

At the first meeting Baron Schröder made a statement in regard to finance, concluding with the words : " The financial part of the question need not cause any insuperable difficulty." It was therefore decided that the first matter for the Committee to engage upon should be the finding of a suitable site.

Five different sites have been very carefully inspected and enquired into, with the result that four have been dismissed as unsuitable for one reason or another.

Your Committee strongly advise the adoption of the fifth site, which they regard as suitable for the Society's purposes, all circumstances considered. They do not believe that any better site can be obtained which would not prove to be altogether beyond the financial resources likely to be available.

The first site investigated was that known as Niagara, covering about an acre of land (40,000 square feet), and with a large circular building. The price of the freehold was fixed at a little over £100,000. Probably at least £5,000 would have been required for adapting the building for the Society's purposes, and another £5,000 or more for building suitable offices. The rates and taxes would also have been exceedingly heavy. Long and careful consideration was given to this site, but after the fullest enquiry with regard to borrowing upon the freehold, and the rate of interest required, Baron Schröder announced at the fourth formal meeting of the Committee that the rate of interest required for borrowing on Niagara is so high that, considering the large initial outlay required, he had reluctantly but decidedly come to the conclusion that the property was too large and too costly to be further entertained.

The second site was one in the Buckingham Palace Road, containing 15,190 square feet. This site also received careful consideration, but was eventually dismissed on the ground that a rent of £700 a year, coupled with an obligation to expend at least £20,000 on buildings, was too high a price for the Society to pay for a lease of eighty years only.

The third site was bounded by Vauxhall Bridge Road, Francis Street, and Carlisle Place, and included the fine building suitable for offices &c., known as the Old Cardinal's House. The whole site proposed contained 22,500 square feet. This property commended itself strongly to the Committee, but it had the disadvantage of belonging to three different owners, and also of involving the necessity of obtaining certain permissions from the London County Council. As soon as definite negotiations were entered into with the various owners, it was apparent that an agreement as to price could not be arrived at, and this site was most regretfully dismissed.

The fourth site was in Francis Street, consisting of 15,000 square feet, but the rent asked, viz. £1,400 a year for a long lease, was considered to be beyond the Society's means.

The fifth site is in Vincent Square, at the corner of Bell Street. It has an area of 17,565 square feet, and the rent asked is £690 a year for a lease of 999 years. Your Committee recommend the adoption of this site.

The Ecclesiastical Commissioners, the owners of the land, stipulate that a sum of not less than £15,000 should be spent on a building and offices, and your Committee are advised that the rates would not exceed £400 a year, which with the rent would make an annual expenditure of £1,100; or after deducting the present cost of hall and offices, £320 a year, it would involve an increase of expenditure of £780 a year. The approaches to Vincent Square are not at present all that could be desired, but two new roads are already decided upon: one direct from Francis Street, starting from exactly opposite the new Cardinal's house; and the other from Horseferry Road to the corner of the site in question in Bell Street.

In considering the extra annual cost, your Committee have not made any calculation of either the additional expense of caretaker, light, and fuel, nor for the possible income from letting part of the buildings to horticultural societies, or the great hall for meetings, &c. Your Committee believe that a sufficient sum to cover the erection of the necessary buildings may be raised by public subscription, towards which promises amounting to £8,000 have already been received. Signed on behalf of the Committee, TREVOR LAWRENCE.

MEMORANDUM OF THE COUNCIL.

The Council of the Royal Horticultural Society consider it desirable at the present juncture to make to the Fellows a general statement of the policy they intend to pursue.

The Council are fully aware that a considerable number of Fellows desire that a garden better situated than Chiswick should be secured as a memorial of the Centenary of the Society.

It was also shown unmistakably at the late General Meeting that a widely felt desire exists that a better hall and offices should be provided, which the Society would have completely under its own control.

The Council desire to carry both these objects to a successful issue, and, looking at the history of the Society during recent years, they see no reason why this should not be done.

The practical question at the moment is, which of the two shall have precedence, as they certainly cannot both be proceeded with at the same time.

The policy of the existing Council is to endeavour to secure first a suitable hall and offices near those now occupied at Westminster, and when that is done to devote their attention at once to the acquisition of a site for a new garden.

The reasons which actuate the Council in adopting this order are many, and among the more important are the following :—

1. They consider it to be the more generally acceptable to those Fellows who take an active part in promoting the welfare of the Society.

2. They have already received promises of financial support to the extent of £8,000 towards the building, whereas no such support has at present been tendered towards securing a garden.

3. A site for a hall, 400 yards from Victoria Street, and in a rapidly improving neighbourhood, as good as can ever be expected to be within the means of the Society, is at our disposal.

4. The Council are of opinion, and have been professionally advised, that the rent asked is a moderate one, and is within the means of the Society. The proposed lease is for 999 years, which is equivalent to a freehold.

5. They are also of opinion that the provision of a good hall and offices would in itself attract a large number of new Fellows, and would in that respect help the subsequent acquisition of a garden.

It should be noted that it has been found necessary to take the decision of the Fellows without any delay, owing to the obligation of terminating certain leases at Lady Day.

The Council confidently appeal to the Fellows, of whom they hope to see a full attendance at the Drill Hall on the 21st, at 3 P.M., to support the policy briefly outlined in this memorandum. They trust the Fellows will not allow the Society to be placed in the undignified position of doing nothing to celebrate so memorable an occasion as its Centenary, which would be the probable result of the rejection of this proposal.

The Council hope to be in a position to place preliminary plans and estimates before the Fellows on the 21st.

Having regard to the unbroken continuance of large additions to the Fellowship roll, and to the ever-increasing interest taken throughout the Empire in every branch of horticulture, the Council feel that they will not appeal in vain for the funds necessary to provide a satisfactory hall and offices without serious encroachment on the invested funds of the Society.

W. Wilks, *Secretary.*

By Order of the Council, March 11, 1902.

The President moved the following Resolution :—

> "That the Fellows of the Royal Horticultural Society in General Meeting assembled accept the principle of building a New Hall in celebration of the Centenary of the Society, and hereby adopt the Report laid before them this day by the Council. They also desire to record their appreciation of Baron Schröder's public-spirited conduct in securing a site which they hereby adopt, and they authorise the Council to take the necessary steps to enable the building to be opened in the year 1904."

This was seconded by Sir William Thiselton-Dyer, F.R.S., K.C.M.G.

Mr. Shea moved as an amendment, and Mr. Bennett-Poë seconded—

> "That this Meeting stand adjourned to this day fortnight at the same place and time, if possible, and that in the meantime copies of the Report be sent to every Fellow of the Society."

Sir Alexander Arbuthnot and Mr. George Gordon supported the Amendment.

Sir Michael Foster, M.P., F.R.S., Dr. Masters, F.R.S., The Very Rev. the Dean of Rochester, Mr. A. W. Sutton, F.L.S., V.M.H., and Mr. R. W. Ker supported the Resolution.

On the Amendment being put eleven voted for it, and on the contrary being put there were cries of "All, all!" and practically the whole Meeting held up one hand.

The original Motion was then put; practically the whole Meeting voted for it, and on the contrary being put only three hands were held up against it.

The President declared the original motion carried, with three dissentients.

Nearly 300 Fellows were present.

GENERAL MEETING.

March 25, 1902.

Mr. A. H. Pearson in the Chair.

Fellows elected (47).—R. Allen, Mrs. H. Attlee, Octavius Q. Bates (U.S.A.), Mrs. F. Beadle, Mrs. A. Carpmael, Sir Edmund Hay Currie, Wallace Elliot, James Fortescue, A. N. Fowler, Mrs. Fraser-Mackintosh, George E. Fritche, John Gardner, Francis Gepp, Hon. Mrs. M. Glyn, Walter M. Gooch, James Good (Cape Town), George Goodsir, Arthur Grove, Frank Harris, Thomas F. Harrison, Daniel Heath, Cyril T. Horley, William James, Lady Edith Jessel, Miss G. H. Manning, J. L. Merivale, Sir George Meyrick, Bart., Sydney B. Michael, Mrs. Padwick, George H. Payne, Dowager Lady Pelly, Major N. Pochin, Lewes T. L. Pryse, W. Roberts, Major A. J. Saunders, W. Shuter, J. T. Simpson, Vincent Slade, F. J. Smith, E. N. Smith, John Stocker, Walter H. Stone, Mrs. S. Stuart, Mrs. J. D. Symon, Mrs. Green Thompson, W. Thompson, F. Woods.

Associates (2).—D. T. Poulsen (Denmark), Albert Waters.

Affiliated Societies (3).—Horticultural Society of Queensland (Australia), Lady Warwick Hostel, Reading and District Gardeners' Mutual Improvement Association.

A lecture on "Plant Communities" was given by Professor Carr (See p. 86.)

GENERAL MEETING.

April 8, 1902.

Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (39).—H. G. Alexander, William H. Bacon, W. H. Brownridge, E. A. Cannell, Hon. Mrs. Chichester, Lord Churchill, K.C.V.O., John W. Cole, Miss R. Cornelius-Wheeler, D. A. Cowan, W. T. Creswell, Mrs. F. G. Davidson, William Day, Edmund Dean, James Douglas, jun., Mrs. Elliott, R. J. Harvey Gibson, M.A., F.L.S., Miss Constance Gladstone, Eaton Hall, Alfred E. Hance, Sydney Harrison, James D. Hay, Mrs. E. F. Henley, Mrs. M. S. Howlett, Edward C. Jukes, Thomas Lester, M. P. Lucas, Col. Malcolm, C.B., Mrs. E. E. Marzetti, Jasper H. E. Nicolls, Miss Susan Onslow, Maurice Prichard, J. R. Randolph, James Russel, Lady Audrey Ryder, George Shawyer, James Smart, Richard Sparkes, William H. Wagstaff, Wilmot H. Yates.

Affiliated Societies (4).—Charlton and District Horticultural Society, Ryhope Amateur Gardeners' Association, Saltwood Cottage Garden Society, Woking, Chertsey, Addleston and District Horticultural Society.

A paper on "Plants for Pergolas and Verandahs," by Miss G. Jekyll, V.M.H., was read by the Secretary. (See p. 93.)

DEPUTATION TO TRURO.

April 15, 1902.

A small deputation was appointed by the Council, at the invitation of the Executive of the Cornwall Daffodil and Spring Flower-show Committee, to visit their exhibition at Truro.

The deputation consisted of—

The Right Hon. the Earl of Ilchester, Member of Council.

Rev. G. H. Engleheart, M.A., V.M.H., Member of the Narcissus Committee.

John T. Bennett-Poë, Esq., Member of the Narcissus Committee.

Alfred H. Pearson, Esq., Member of Council.

Rev. W. Wilks, M.A., Secretary R.H.S.

The Deputation assembled at the Town Hall, Truro, and were cordially welcomed by the Hon. John Boscawen and other members of the Executive, and after having made their awards they (together with the Judges of the Show) were most hospitably entertained by P. Nix, Esq., of Mount Pleasant, Truro.

The Deputation brought away with them the pleasantest remembrances of the kindly feeling manifested towards them by the representatives of the Horticulture of the West Country.

On the following day the members of the Deputation had the pleasure of visiting the beautiful gardens of Penjerrick, by the kind invitation of Robert Fox, Esq., and it is needless to say how delighted they were with the luxuriant growth of all the rare trees and plants they saw there.

Awards at Truro.

Silver-gilt Flora Medal.

To Messrs. R. Veitch, of Exeter, for a group of rare plants. (See below.)

To Messrs. Gauntlett, of Redruth, for a group of rare plants. (See below.)

To H. D. Shilson, Esq., of Tremough, for Rhododendrons. (See below.)

Silver-gilt Banksian Medal.

To Messrs. Barr & Son, Covent Garden, London, for a group of Daffodils.

Silver Knightian Medal.

To J. C. Daubuz, Esq., for thirty-three dishes of Dessert and Cooking Apples in magnificent condition.

Silver Flora Medal.

To Rev. G. H. Engleheart, V.M.H., for Seedling Daffodils.

To Robert Fox, Esq., of Penjerrick, for Rhododendrons.

To Messrs. Treseder, of Truro, for a group of rare plants.

Bronze Banksian Medal.

To Messrs. Curtis & Sandford, of Torquay, for Roses, &c.

First-class Certificate.

To *Rhododendron* 'Beauty of Tremough' (*R. Aucklandi* × *R. Thompsoni*) (votes, unanimous), from Henry D. Shilson, Esq., Tremough (gr. Mr. Richard Gill). A most glorious flower of a deep rosy or bright cherry pink on the margin of the flowers, passing gradually into a paler pink in the tube; the heads are very large, and the individual flowers, of which there are from nine to twelve in a head, are $4\frac{1}{2}$ inches in diameter. The cross was effected by Mr. Gill in 1888. The plant is of strong and vigorous growth.

Award of Merit.

To *Magnolia* 'Osaka' (votes, unanimous), from Messrs. Gauntlett, Redruth. The flowers are large and the petals purple-claret outside, and a sort of veined violet-purple on the inside.

To Daffodil 'Coronation Year' (votes, unanimous), from Rev. G. H. Engleheart, Appleshaw, Andover. The perianth, which measured fully four inches across, was of the palest possible sulphur, and the cup, fashioned after the style of 'Sir Watkin,' was very wide open and of a bright clear yellow.

To Daffodil 'Aurora' (votes, unanimous), from J. C. Williams, Esq., M.P., Caerhays Castle. Perianth cream-white, very flat and circular; cup broad, bright yellow, deeply edged and fringed with brilliant orange.

Amongst the rare and beautiful plants shown by Messrs. Robert Veitch, of Exeter, were the following:—

Magnolia Yulan
,, *Alexandrina*
,, *Lennëi*
,, *stellata*
,, *Soulangiana*
Rhododendron 'Countess of Haddington'
,, *exoniensis*
,, *multiflorum*
,, *Gibsonii*
,, *Veitchianum*
,, *arboreum* 'Crimson'
,, *Fosterianum*
,, 'Victoria Regina'
,, *Williamsii*
,, 'Chevalier Félix de Sauvage'
Weigelia hortensis nivea
,, 'Coquet'
Syringa 'Mdme. Lemoine'
,, 'Souvenir de Louise Spath'
,, 'Léon Simon'
,, 'Charles X.'
,, 'Marie Legraye'
Prunus triloba
,, *sinensis* fl. pl.
Amygdalus communis fl. pl.
,, (double scarlet)
Pyrus Malus floribunda
,, *spectabilis*
Cerasus Watereri
,, 'Jas. H. Veitch'
Andromeda japonica
,, *Polifolia*
,, ,, *angustifolia*
Acacia longifolia
,, *ulicina* (? *verticillata*)
,, *Riceana*
,, *cordata*
,, *Drummondii*
,, *armata*
Genista Everestiana
,, *variegata*
Azalea mollis and varieties
Eriostemon pulchellus
,, *linearifolius*
,, *scaber*
Eriostemon neriifolius
Boronia megastigma
,, *heterophylla*
Viburnum macrocephalum
,, *plicatum*
Correa cardinalis
,, *speciosa major*
,, *ventricosa*
Begonia 'Gloire de Lorraine'
Viola odorata sulphurea
,, 'Perle Rose'
Daphne Cneorum
Deutzia gracilis rosea
Aralia pulcher
,, *Sieboldii variegata*
Deutzia Sieboldi
Spiræa prunifolia
,, *arguta*
Philadelphus 'Boule d'Argent'
Arctotis aspera
Citrus japonica
Dimorphotheca Ecklonis
Chorozema in variety
Polygala acuminata
Ceanothus papillosus
,, *Veitchianus*
Toxicophlæa spectabilis
Statice intermedia
Hibbertia Readi
Erica Wilmoreana
,, *Cavendishiana*
,, *grandincsa*
Epacris in variety.
Rose 'Crimson Rambler'
Gerbera Jamesoni
Genetyllis fuchsioides
,, *tulipifera*
Diosma capitata
Pimelea in variety
Azalea obtusa alba
Aphelexis purpurea
Eupatorium ianthinum
Erica arborea
Tupa salicifolia
Coriaria japonica
Jasminum officinale variegatum

Senecio japonicus
Rhododendron Aucklandii
,, *kewense*
Calceolaria violacea
Desfontainea spinosa
Senecio Greyii
Lonicera Hildebrandiana
Acacia cultriformis
Olearia nitida
Cæsalpina japonica
Phormium tenax atropurpureum
Philesia buxifolia
Senecio Petasitis
Gunnera manicata
Photinia dentata
Ilex Perado
Aralia pentaphylla variegata
Polygonum filiforme aureum variegatum
Clethra arborea
Enkianthus japonicus
Rhamnus alaternus variegatus
Celmisia Munroi
Griselinia macrophylla
Widdringtonia Whytei
Olea fragrans
Musa Basjoo
Carpentaria californica
Eurya angustifolia
Myosotidium nobile
Moutan Pæonies, double and single in various colours
Diospyros Kaki
Azalea indica, in variety
Phyllostachys violescens
,, *Boryana*
Bambusa marmorea
,, *quadrangularis*
,, *fastuosa*
Arundinaria nitida
,, *anceps*
Cytisus schipkaensis
Senecio Heretieri
Rhodora canadensis
Staphylea colchica
Russelia Lemoinei multiflora
Erica codonodes = lusitanica
,, *australis*
Actinidia Kolomikta

Bulbs, Tubers, &c.

Lily of the Valley, Fortin's variety
Trillium grandiflorum
Anemone blanda
,, *fulgens græca*
,, *nemorosa rosea*
,, ,, *Robinsoniana*
Narcissus maximus
,, *cyclamineus*
Tulipa Kaufmanniana
,, ,, *rubra*
Tulipa Kaufmanniana aurea
,, *Greigi*
Fritillaria aurea
Ornithogalum nutans
Cyclamen libanoticum
Chionodoxa gigantea
Megasea ligulata
Helleborus orientalis atrorubens
Muscari botryoides album
,, ,, *conicum*

Hardy Cacti.

Opuntia camanchica major
,, ,, *salmonea* (salmon)
,, ,, *longispina* (light yellow)
,, ,, *albispina* (large yellow)
,, *phæacantha major* (yellow-shaded orange, crimson fruits)
spirocentra (yellow)
,, *Engelmanni* (yellow, reddish centre)
,, *xanthostema* (carmine)
Opuntia fragilis (deep yellow)
,, *arborescens* (purple, yellow fruits)
,, *xanthostema orbicularis* (3 in. across, bright carmine)
,, *rhodantha brevispina* (carmine)
Echinocactus spinosior (rosy red)
,, *Simpsoni* (rose)
Cereus phœniceus (blood-red)
,, ,, (orange scarlet)
,, *viridiflorus* (greenish)
Cactus viviparus (bright purple)

Herbaceous and Rock Plants.

Androsace arachnoidea
,, *Chumbyensis*
,, *Laggeri*
,, *villosa*
Androsace sarmentosa
,, *sempervivoides*
,, *Chamæjasme*
,, *carnea*

Bellidiastrum Michelli
Saxifraga Grisebachii
,, *squarrosa*
,, *valdensis*
,, *retusa*
Acantholimon libanoticum
,, *armenum*
Sedum spathulifolium
Draba olympica vera
,, *bruniæfolia*
Umbilicus spinosus
Celmisia Munroi
Meconopsis cambrica
Megasea ligulata
,, *petiolata*
Epimedium macranthum
Arabis alpina fl. pl.
Primula abyssinica
Campanula mirabilis
Corydalis cava
Sedum rubrum
Valeriana Phu aurea
Dianthus frigidus
Ramondia serbica
Erysimum Kotschyanum
Campanula Balchiniana
Aubretia Hendersoni
Morisia hypogæa
Nepeta Glechoma variegata
Sedum Nevii
Sarracenia Chelsoni
,, *purpurea*
,, *exoniensis*
Caltha palustris
Mertensia siberica
Iris pallida variegata
Cypripedium acaule
Primula cashmeriana
Nierembergia rivularis
Houstonia serpyllifolia
Gaultheria procumbens
Primula rosea
Gentiana bavarica
Omphalodes verna
Shortia galacifolia

Messrs. Gauntlett, of Redruth, showed the following in their beautiful group:—

Prunus 'Kelsey'
Grevillea sulphurea
,, *Preissii*
,, *rosmarinifolia*
Pyrus coronaria fl. pl.
,, *Parkmanni* fl. pl.
Prunus triloba
,, *spinosa* fl. pl.
,, *Watsoni*
Magnolia 'Osaka'
,, *Soulangeana nigra*
,, *conspicua*
,, ,, *Alexandrina*
,, *Lennéi*
,, *stellata*
,, *alba superba*
,, *amabilis*
,, *Soulangeana*
,, *obovata discolor*
,, *speciosa*
Aralia occidentalis
Acacia cultriformis
Rhododendron Hodgsoni
,, *ciliatum*
,, *Thompsoni*
,, *barbatum*
,, *Aucklandi*
,, *Aucklandi*, red
,, *arboreum*
,, *cinnamomeum*
Rhododendron Edgworthii
,, *Falconeri*
,, *grande*
,, *glaucum*
,, 'Impératrice Eugénie'
,, *arboreum* seedlings in 10 varieties
,, *caucasicum*
Illicium floridanum
Ribes speciosum
Camellia reticulata
Piptanthus nepalensis
Viburnum macrocephalum
Andromeda Rollisoni
,, *formosa*
,, *calyculata*
,, *japonica*
Pernettya ciliaris
,, *compacta*
Daphne Cneorum
,, *Genkwa*
,, *Blagayana*
Epigæa repens
Cerasus Wabihito, single white
,, 'Eva Gauntlett,' double pink
,, *lutea*, yellow
Cydonia coccinea, intense red
Syringa 'Madame Lemoine'
,, 'Marie Legraye'
Bridgesia spicata

Japanese Maples in 25 varieties
Hydrangea quercifolia
Gaultheria procumbens
Acacia cyanophylla
,, *verticillata*
Leucadendron argenteum
Feijoa Sellowiana
Gelsemium nitidum
Rhododendron Nuttalli
,, *eximium*
,, *Roylei*
Berberis congestiflora hakeoides
,, *Knightii*
,, *pruinosa*
Crinodendron Hookerianum
Gordonia Lasianthus
Ilex Tarajo
Pittosporum eugenioides var.
,, *crassifolium*
,, *Mayi*
,, *undulatum*
,, *Tobira*
,, *Tobira* var.
,, *macrophyllum*
Senecio rotundifolius
,, *Grayi*
Laurus Camphora
,, *glandulosus*
Olearia argophylla
Actinidia arguta
,, *Kolomikta*
Camellia Sasanqua
Corylopsis pauciflora
Embothrium coccineum
Stuartia Pseudo-camellia
,, *pentagyna*
,, *virginica*
Eucryphia pinnatifolia
Fremontia californica
Carpenteria californica
Banksia quercifolia
Elæagnus Frederici
Tetranthera californica
Laurus regalis
Gynerium argenteum aureo-lineatum
Cortaderia jubata
Styrax Obassia
Boldoa fragrans
Tristania nereifolia
Euonymus fimbriatus
Musa Basjoo
Cocos australis glauca
Chamærops humilis
,, *Fortunei*
Phœnix sylvestris
Phyllostachys aurea
,, *Boryana*
,, *Marliacea*
,, *heterocycla*
,, *Castillonis*
,, *Henonis*
,, *sulphurea*
Bambusa fastuosa
Arundinaria aristata
,, *anceps*

The following is a list of the names of the wonderful exhibit of Rhododendrons made by D. H. Shilson, Esq. (gardener Mr. Richard Gill), of Tremough :—

Rhododendron argenteum
,, *Falconeri*
,, *barbatum*
,, *Shilsonii*
,, *arboreum roseum*
,, ,, *album*
,, ,, *cinnamomeum*
,, ,, 'Wm. Shilson'
,, ,, 'Henry Shilson'
,, *Thompsoni* 'Tremough var.
,, ,, 'seedling'
,, *Yunnanense*
,, 'Beauty of Tremough'
,, *Edgworthii*
,, *Dalhousiæ*
Rhododendron Dalhousiæ, 'var. No. 2'
,, *Sesterianum*
,, 'Lady Alice Fitzwilliam'
,, *albescens*
,, *fragrantissimum*
,, *ciliatum*
,, *niveum*
,, 'Countess of Haddington'
,, *barbatum*, 'hybrid No. 1'
,, *barbatum*, 'hybrid No. 2'
,, *campanulatum*
,, ,, var.
,, *arboreum nepaulense*, with twelve varieties of *arboreum* seedlings unnamed.

GENERAL MEETING.

April 22, 1902.

Rev. W. Wilks, M.A., in the Chair.

Fellows elected (50).—Arthur L. Allen, F. E. Annison, Henry S. Atkins, Mrs. Johanna Blow, Charles Bourns, M.D., Miss C. M. Delves Broughton, Mrs. B. Case, J. P. Charles, Mrs. G. C. Conant, J. Davys Cradock, E. A. Davis, Lord Decies, Lady Drummond, Godfrey S. Evans, Albert Feaviour, W. Lumley Ferrier, F. G. Frisby, Miss N. A. Gates, Maurice Gray, Hugh Hamilton, G. T. Hawkins, Captain D. W. M. Home, Dr. W. R. Huggard (Switzerland), Sir William Johnston, Bart., Charles E. Jones, B.Sc., F.L.S., Hon. Mrs. E. Kenyon, Hon. Mrs. G. Kenyon, Sir Arthur J. Lawson, Rev. F. Leaver, Ernest J. Lewis, Rev. J. H. Champion McGill, Miss Mansel, The Right Hon. the Earl of Mount-Edgcumbe, William Nelson (South Africa), Campbell Newington, The Right Hon. Viscount Peel, John Poupart, C. W. Powell, Miss Purnell, Samuel A. M. Satow, Mrs. E. B. Sheppard, F. W. Smallpeice, S. Symington, J.P., H. A. Taylor, J. R. Turner, Alfred Unger (Japan), Miss C. M. Waring, Mrs. T. W. Williams, Sir Charles Wolseley, Bart., G. J. Woodman, J.P.

Associate (1).—C. H. Buck.

Affiliated Society (1).—Royal School of Pomology and Horticulture (Italy).

A lecture on "Campanulas" was given by Mr. Maurice Prichard, F.R.H.S. (See p. 98.)

GENERAL MEETING.

May 6, 1902.

Mr. George Bunyard, V.M.H., in the Chair.

Fellows elected (67).—Mrs. Arthur, Countess of Bective, Berry H. Berry, Hon. Mrs. Bevan, Mrs. Bingel, Miss Bingel, Hon. Lady Birkbeck, Dr. G. Mallack Bluett, A. Bullock, P. Burges, Mrs. F. F. Burghard, A. F. Calvert, Major C. A. Gordon Clark, A. Clutton-Brock, Percy A. Cragg, A. B. Crichton, Alfred Davey, Mrs. Davies, Baroness Deichmann, John Deverell, Mrs. Dobson, J. S. Dry, Mrs. Lionel Dugdale, Rev. Charles N. Edgington, Mrs. Charles Edwards, Miss Jessie B. Fildes, Coard Fulton, R. E. Gill, Lady Glyn, Mrs. J. K. Greive, John Grimes, T. Lindegren Harrison, Mrs. Hugh de Havilland, Ernest H. Hawker, George Hobday, Herbert James, F. W. Jeeves, Mrs. A. Jeffreys, F. Roy King, Mrs. Kirkwood, Mrs. Aubrey Lawrence, Right Hon. Lord Ludlow, Mrs. McGaw, Hon. Mrs. McLean, D. McLeod, Joseph Marriage, Ernest Noel, Rev. R. W. Powell, Mrs. Rate, Morley Reamsbottom, D'Arcy W. Reeve, Charles Richardson, John Richardson, William Robins, Reginald Ryley, S. H. Sands, Miss E. R. Saunders, Miss Schlüsser, Frederick F. Smallpeice, Mrs. Henry Stedall, Henry Sykes, W. H. Upjohn, K.C., Mrs. W. Vaughan, H. W. Wain, Edward Williams, George Wood, Miss Elizabeth Woodhouse.

Associate (1).—Edward Streeter.

A lecture on "The Classification of Plants by Evolution" was given by the Rev. Prof. G. Henslow, M.A., V.M.H. (See p. 132.)

GENERAL MEETING.

May 20, 1902.

Mr. George Gordon, V.M.H., in the Chair.

Fellows elected (67).—Miss Mary H. Anstey, Frederick Armstrong, Mrs. Bartlett, Mrs. Bowring, Mrs. Addison Bramwell, Benjamin Bridgman, Charles Butler, M.D., John B. Crichton, W. A. Cull, W. H. Cutbush, Hugh Dixon (Australia), Hugh V. Dobson, Miss Mary Duguid, Leonard S. Elwell, A. K. Gale, Mrs. Trench Gascoigne, Clarence Gilbert Wood, F.R.G.S., Charles Godfrey, C. M. Grullemans (Holland), Mrs. B. Hannen, jun., Arthur S. Hargreaves, Mrs. G. Harris, Robert Harrison, James Hill, Mrs. K. M. Hornby, A. P. Hoskyns, Mrs. A. B. W. Kennedy, Mrs. Knox, Joseph Lake, Miss Annie Leonard, Rev. Charles H. Lowry, Mrs. C. D. B. Marsham, Mrs. P. Martineau, Lady Stirling Maxwell, Sir John Stirling Maxwell, Bart., Mrs. T. G. Menzies, A. W. Metcalfe, Leonard Noble, George Norris, Mrs. W. E. Oates, F. G. Oliver, Mrs. Arch Parker, Thomas Pilkington, Carl Purdy (U.S.A.), Mrs. Ratcliff, Mrs. Robinson, Sir Albert Rollitt, M.P., A. Pearson Rose, Lady Ryder Miss Alice Salt, Miss Margaret Salt, Dr. Daniel Seaton, Lady Settrington, Mrs. W. N. Sprague, Mrs. Howard Startin, George Stimpson, jun., Darcy E. Taylor, Ralph Thrale, George Thudichum, The Lady Trevor, Walter Wales, Mrs. John R. Ward, W. Watney, Lieut.-Col. W. H. Wheeley, J.P., D.L., Mrs. Peter Williams, Peter Williams, Mrs. Arthur Wilson.

Associates (2).—Miss O. M. Robert, William J. Sims.

Affiliated Society (1).—Hindon and District Flower Show.

A lecture on "The English Tulip" was given by Mr. A. D. Hall. (See p. 142.)

THE TEMPLE SHOW, 1902.

MAY 28, 29, and 30.

JUDGES.

ORCHIDS.

Messrs. H. J. Chapman.
James Douglas, V.M.H.
J. Gurney Fowler.
Henry Little.

ROSES.

Messrs. John Jennings.
E. B. Lindsell.
E. Mawley.
Rev. J. H. Pemberton.

FRUIT AND VEGETABLES.

Messrs. T. Challis.
W. Crump, V.M.H.
G. Norman, V.M.H.
A. H. Pearson.

GROUPS IN OPEN AIR.

Messrs. J. McLeod.
H. B. May.
G. Nicholson, V.M.H.
James Smith, V.M.H.

HERBACEOUS ROCK PLANTS AND ALPINES.

Mr. E. Beckett.
Rev. G. Engleheart, V.M.H.
F. Page-Roberts.
Mr. Charles E. Shea.

FOLIAGE PLANTS.

Messrs. William Bain.
C. R. Fielder.
J. Hudson, V.M.H.
R. Wilson Ker.

FLOWERING PLANTS.

Messrs. R. Dean, V.M.H.
E. Hill.
W. Howe.
G. Paul, V.M.H.

MISCELLANEOUS.

Messrs. C. Dixon.
W. J. Jefferies.
E. Molyneux, V.M.H.
J. W. Odell.

ADVISORY COMMITTEE.

Messrs. John T. Bennett-Poë, V.M.H.
William Marshall.
Messrs. Henry B. May.
Owen Thomas, V.M.H.
Harry J. Veitch, F.L.S.

AWARDS GIVEN BY THE COUNCIL AFTER CONSULTATION WITH THE JUDGES.

The order in which the names are entered under the several medals and cups has no reference whatever to merit, but is purely accidental.

The awards given on the recommendation of the Fruit, Floral, and Orchid Committees will be found under their respective reports.

Gold Medal.

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. J. Hudson, V.M.H.), for fruit trees &c.

To Messrs. J. Veitch & Sons, Ltd., Chelsea, for Caladiums, Cacti, &c.

To Messrs. Barr & Sons, Covent Garden, for Alpines, herbaceous plants, &c.

To Messrs. Fisher, Son & Sibray, Handsworth, Sheffield, for hardy trees and shrubs.

To Messrs. Paul & Son, Cheshunt, for Roses &c.

To Messrs. Sander & Sons, St. Albans, for Orchids and Caladiums.

To Messrs. T. Rivers & Son, Sawbridgeworth, for fruit.

Sherwood Silver Cup.

To Messrs. Fisher, Son & Sibray, Sheffield, for hardy ornamental trees and shrubs.

Silver Cup.

To Lord Aldenham, Aldenham House, Elstree (gr. Mr. Edwin Beckett), for vegetables.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for Orchids.

To Pantia Ralli, Esq., Ashstead Park, Epsom (gr. Mr. G. J. Hunt), for fruit and Caladiums.

To Captain G. L. Holford, C.I.E., M.V.O., Westonbirt, Tetbury (gr. Mr. A. Chapman), for Hippeastrums.

To Jeremiah Colman, Esq., Gatton Park, Reigate (gr. Mr. W. P. Bound), for Orchids.

To Messrs. T. S. Ware, Ltd., Feltham, for Begonias, herbaceous and Alpine plants.

To Messrs. H. Cannell & Sons, Swanley, for Cannas and Begonias.

To Messrs. W. Balchin & Sons, Hassocks, for Boronias, Ericas, &c.

To Messrs. W. Cutbush & Sons, Highgate, for clipped trees, Carnations, &c.

To Messrs. R. & G. Cuthbert, Southgate, for Azaleas &c.

To Messrs. R. Wallace & Co., Colchester, for Lilies, Irises, &c.

To Mr. A. J. A. Bruce, Chorlton-cum-Hardy, for Sarracenias.

To Messrs. J. Charlesworth & Co., Bradford, for Orchids.

To Messrs. W. Paul & Son, Waltham Cross, for Roses.

To Mr. Charles Turner, Slough, for Roses &c.

To Mr. Amos Perry, Winchmore Hill, for herbaceous and Alpine plants.

To Mr. Maurice Prichard, Christchurch, Hants, for herbaceous and Alpine plants.

To Messrs. Geo. Bunyard & Co., Maidstone, for Apples and fruit trees.

To Messrs. T. Cripps & Son, Tunbridge Wells, for Japanese Maples and flowering shrubs.

To Messrs. J. Cheal & Sons, Crawley, for ornamental shrubs and Alpine plants.

Silver-gilt Flora Medal.

To Leopold de Rothschild, Esq., Ascott (gr. Mr. J. Jennings), for Carnations.

To Messrs. J. Carter & Co., High Holborn, W.C., for Calceolarias, Gloxinias, vegetables, &c.

To Messrs. J. Hill & Son, Lower Edmonton, for Ferns.

To Messrs. G. Jackman & Son, Woking, for Clematis and hardy plants.

To Mr. H. J. Jones, Lewisham, for Begonias, Tulips, &c.

To Messrs. H. Low & Co., Enfield, for Orchids and flowering plants.

To Messrs. Dobbie & Co., Rothesay, for Pansies and Violas.

To Messrs. R. Smith & Co., Worcester, for Clematis and Maples.

To Messrs. John Peed & Son, West Norwood, S.E., for Begonias and Caladiums.

To Messrs. W. Fromow & Sons, Chiswick, for Japanese Maples.

To Mr. George Mount, Canterbury, for Roses.

To Messrs. John Waterer & Son, Bagshot, for Rhododendrons.

To Messrs. Stanley Ashton & Co., Southgate, for Orchids.

To Mr. Jas. Cypher, Cheltenham, for Orchids.

To Messrs. J. Backhouse & Son, Ltd., York, for Ferns.

Silver-gilt Knightian.

To Mr. John Watkins, Withington, Hereford, for Apples.

To Mr. S. Mortimer, Farnham, Surrey, for Cucumbers and Tomatos.

FIG. 61.—MESSRS. REAMSBOTTOM'S ANEMONES. (*The Garden.*)

Silver-gilt Banksian.

To. W. P. Burkinshow, Esq., Hessle, near Hull, for Orchids.

To Messrs. B. S. Williams & Son, Holloway, N., for Orchids and hardy flowers.

To Mr. John Russell, Richmond, for ornamental trees and shrubs.

To Messrs. B. R. Davis & Sons, Yeovil, for Begonias.

To Messrs. Kelway & Son, Langport, for Pæonies.

To Mr. W. Iceton, Putney, for Lilies of the Valley.

To Messrs. Reamsbottom & Co., Geashill, King's Co., for Anemones. (Fig. 61.)

Silver Flora.

To J. Rutherford, Esq., M.P., Beardwood, Blackburn, for Orchids.

To Reg. J. Farrer, Esq., Ingleborough, Lancs., for Alpine plants.

To Mr. J. J. Upton, Irlam, near Manchester, for Gloxinias.

To Messrs. W. H. Rogers & Son, Southampton, for Rhododendrons.

To Mr. J. R. Box, West Wickham, for Begonias.

To Messrs. B. R. Cant & Sons, Colchester, for Roses.

To Mr. H. B. May, Upper Edmonton, for Zonal and Ivy Pelargoniums.

To Mr. S. Eida, Conduit Street, W., for Japanese dwarf trees.

To Messrs. J. Laing & Sons, Forest Hill, for Streptocarpus.

To Mr. Ch. Vuylsteke, Ghent, for Orchids.

To Messrs. Frank Cant & Co., Colchester, for Roses.

To Messrs. J. Cowan & Co., Gateacre, near Liverpool, for Orchids.

To Monsieur Lucien Linden, Brussels, for Orchids.

Silver Knightian.

To Lord Suffield, Gunton Park, Norwich (gr. Mr. W. Allan), for Strawberries.

To Alex. Henderson, Esq., M.P., Buscot Park, Faringdon (gr. Mr. W. L. Bastin), for fruit.

To Mr. Walter Godfrey, Colchester, for Asparagus.

Silver Banksian.

To the Hon. A. H. T. Montmorency, Carrick Mines, Co. Dublin, for Tulips.

To A. Meyers, Esq., Epsom, for Calceolarias.

To Mr. A. J. Harwood, Colchester, for Asparagus.

To Messrs. Jones & Son, Shrewsbury, for Sweet Peas.

To Messrs. Blackmore & Langdon, Tiverton, Bath, for Begonias and Carnations.

To Mr. T. Jannoch, Dersingham, Norfolk, for hardy flowers.

To the Misses Hopkins, Knutsford, for rock plants.

To Messrs. Storrie & Storrie, Dundee, for Auriculas.

To Mr. Leonard J. Ching, Enfield, for Ferns.

To Mr. R. C. Notcutt, Woodbridge, for cut flowers.

To Mr. W. J. Caparne, Guernsey, for Irises &c.

To Mr. K. Drost, for Lilies and Lilacs.

To Messrs. W. & J. Brown, Stamford, for Heliotropes and Petunias.

To Messrs. R. H. Bath, Limited, Wisbech, for Carnations and Tulips.

To Mr. R. Sydenham, Birmingham, for Sweet Peas.

To Mr. W. J. Godfrey, Exmouth, for Poppies.

GENERAL MEETING.

June 10, 1902.

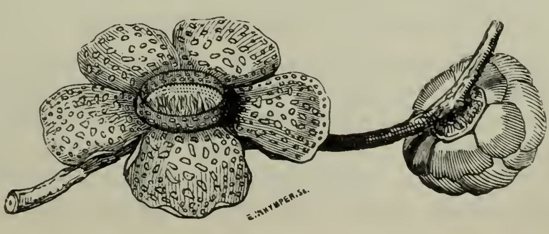
Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (158).—Mrs. A. Chivas Adam, Mrs. Allfrey, Arthur J. Allsop, Lady Ardilaun, Albert Armytage, H. B. Barkham, S. H. Barkham, William Bartholomew, Miss Marion Bedale, B. Bentley, John Bidgood, B.Sc., F.L.S., Miss F. I. Blencowe, Mrs. G. J. Blomfield, F. W. Bowater, Mrs. Ulick Browne, H. R. Browning, Rowland Burdon, A. R. Burkill,

C. Fitzpatrick Burroughes, Arthur Butt, H. Carrell, Miss E. S. Carter, Lady Gwendoline Cecil, Mrs. A. M. Chambers, Miss Christian, Charles H. Churchill, Dr. A. H. Clarke, Mrs. Codrington, Brenton R. Collins, John Cooper, Miss Cooper, Dr. Alfred Cox, Peter Cunliffe, H. W. Davies, Alfred Dickson, George Dickson, James Dickson, Miss Mary E. Dixon, The Dow. Countess of Donoughmore, Mrs. R. Dowling, Mrs. J. Drummond, Mr. Duncan (Cape Town), Charles Dunn, G. Ellis, Hamil Ferrier-Kerr, Henry H. Finch, Lady Frederic FitzRoy, Miss G. S. Foster, James Fraser, James Friend, Viscountess Galway, H. J. Garratt, Mrs. F. Ducane Godman, F. G. Godwin, John Goodfellow, Hamilton Gordon, Mrs. Grant, Samuel B. Green (U.S.A.) Walpole Greenwell, Charles E. Haig, J.P., Mrs. Hale, Mrs. Hanbury, R. Harkness, The Hon. Eleanor Hawke, H. N. Hawks, Mrs. T. C. H. Hedderwick, Otto Hiehle, G. R. Higgins, Mrs. G. R. Higgins, Mrs. W. H. Homewood, Clarence Hooper, F.R.G.S., F.S.A., Mrs. E. S. Hope, H. H. Hughes, Miss H. P. Humphery, C. Morton Humphreys, G. S. Hunt, Miss E. W. Ingham, Lady Jekyll, Mrs. Ernest E. Lake, John C. Lang, A. P. Langton, Mrs. Langton-Fetherston, Hon. Mrs. H. H. Lawrence, C. F. Leach, Katherine Lady Lechmere, Joseph Leete, Mrs. E. C. Leonard, Countess Lewenhaupt, Mrs. C. E. Lewis, Stephen Lynch, Mrs. Macnab, D. M. McCorquodale, Mrs. L. B. Marsham, G. J. Van Meeuven, George Middleton, Sir Guilford L. Molesworth, Capt. the Hon. R. Moreton, Hon. Mrs. R. Moreton, Edwin C. Mott, Matthew E. Muir, W. Newton, Miss E. Northey, Henry W. W. Nutting, Miss Macarthur Onslow, Rev. W. J. Packe, Miss E. A. Paget, Mrs. E. Cleeves Palmer, Miss E. O. Parr, M. G. Pawle, Sir Theophilus Peel, Bart., John E. Perkins, Walter R. Pierce, Alfred Platt, Mrs. K. Pottinger, Mrs. Heaton Rhodes, Francis Ricardo, T. Ridgewell, R. E. K. Rigbye, Countess Roberts, Col. Howland Roberts, Mrs. Rushton, Mrs. Samson, Mrs. C. P. Sandberg, John Sanderson, F. Schlusser, Rev. E. Maude Scott, W. M. Scott, S. Warren Searle, The Countess of Selborne, W. H. Simcoe, E. John Slinn, Stephen Soames, Dowager Lady Southampton, E. S. Spicer, Daniel W. Stable, Mrs. F. T. Stokes, Mrs. Stott, R. J. Tabor, F.L.S., Edgar Taylor, A. J. Thomas, Mrs. Yates Thompson, John Thomson, Mrs. B. A. Thornycroft, Mrs. Tighe, Miss Torrens, Lady Jane Trefusis, Edwin J. Trier, A. B. Urmstone, Mrs. Barclay Walker, Frederick J. Walker, J.P., D.L., J. Percival Ward, Mrs. Way, Mrs. K. Weber, Mrs. J. H. Western, Mrs. White, George G. Whitelegg, Dr. E. Woakes, Mrs. S. Woodhouse.

Associates (6).—T. L. Baker, Walter Carr, Joseph Frogley, Miss Cecil Harbord, George Jones, Miss H. Frederica Leaver.

A lecture on "Weeds" was given by the Hon. Mrs. Boyle. (See p. 163.)



SCIENTIFIC COMMITTEE.

January 14, 1902.

Dr. M. C. Cooke in the Chair, and thirteen members present.

Cyclamen Diseased.—Mr. A. J. Reid sent corms, the roots of which were clubbed, as happens in Cabbages. On examination the appearances were seen to be due to the presence of nematode worms (eel-worms).

Pelargonium Leaves.—From Mr. G. W. Murtrie came leaves of Pelargonium in various stages of decay. Dr. Cooke carefully examined the leaves, and reports :—

"The leaves of Pelargonium were disfigured by large brown indeterminate blotches of dead tissue, which did not reveal any fungus mycelium when submitted to the microscope, and there was nothing local to account for the spotting. The whole appearance suggested at once to members of the Committee practically acquainted with Pelargonium culture that the appearances were of the same character as are known to be caused by sour soil, and that the only remedy was to transplant into fresh soil at once. After twenty-four hours, the dead parts produced a plentiful crop of the common blue mould (*Penicillium glaucum*), which is a 'saprophyte,' and only occurs on dead matter as a consequence of decay, but is never itself productive of disease."

Arum Corms.—Some corms of *Richardia africana* were shown, with here and there a patch of decayed tissue like a bruise. Dr. Cooke examined the specimens and reported :—

"Both corms, otherwise of a healthy appearance, exhibited on one side an orbicular brown diseased spot, about $\frac{1}{4}$ inch in diameter, entering the corm to nearly the same depth, surrounded by a paler ring exhibiting the spreading of the spot. The decayed matter from the spot showed no trace of mycelium, but was almost entirely composed of elliptical colonies of nearly globose hyaline bodies, about three to four micromillimètres in diameter, reminding one of the colonies found in *Lamprocystis*. I am therefore inclined to the belief that the disease is some obscure form of bacteriosis, hitherto undescribed."

Iris unguicularis.—Mr. Bowles showed a ripe capsule of this species, which only occasionally ripens its seed-vessels.

Scientific Committee, January 28, 1902.

Mr. H. J. Veitch in the Chair, and twelve members present.

Richardia and Cyclamen Corms.—Mr. G. S. Saunders reported on the corms sent to the last meeting: "The Richardia corms are attacked by one of the 'bulb mites,' probably *Rhizoglyphus echinopus*; it is a very difficult pest to deal with. Water at a temperature of 115° Fahr. will kill them. I should add 4 oz. of sulphide of potassium to every quart of water, and allow the corms to remain in the mixture for ten minutes or a quarter of an hour. I do not imagine it would injure them in any way; the injury does not seem to have gone very far below the surface, so that it might be well to cut out the injured portion before putting them into the warm water. I should be very careful not to allow any of the earth in which these plants were grown to get upon the potting bench, or to be mixed with any uncontaminated soil.

"As to the Cyclamen, I was unable to find any eel-worms in the roots, but they are affected so exactly in the same manner as others in which I have found them that I have no doubt but that the 'root-knot eel-worm' (*Heterodera radicola*) is the cause. I cannot suggest any remedy, but to prevent the pest spreading the plants and the soil in which they are growing should be burnt, and on no account thrown on to a rubbish-heap, or any of the soil allowed to come in contact with non-infested soil."

Since the previous meeting, Mrs. Batten Pool sent specimens of the *Richardia* in growth to supplement the corms above alluded to. On examining the plants, the older roots were found to be decaying, but an attempt was being made to form new roots. The appearances were thought by the Committee to be due to a check caused by cold.

Pteris serrulata.—Fronds partially destroyed by some insect supposed to be black fly were sent. The condition is very common, but the cause is not perfectly ascertained. The senders were requested to forward specimens of the fly for determination.

Pelargonium Leaves.—With reference to the report on these leaves, Mr. Fraser writes:—"I should like to say a word in reply to the suggestions made: (1) As to faulty cultivation. I can plead that I have been an amateur plantsman for over forty years, during fifteen of which, in my younger days, I, single-handed, grew stove and greenhouse plants for exhibition with good success. I always use the best materials I can buy for compost, and have never yet put a plant into a dirty pot. (2) The wash I used was sulphide of potassium and soft-soap, applied both by spraying and liberal ablution, and, as fungus and sulphur do not agree, the former may have got the worst of it. (3) My greenhouse has the sun on it sixteen hours a day in the long days, and a fair share in the short ones. It is glazed with glass 16 ins. wide, between rafters 1 in. thick, and the glass is washed when necessary, so the plants enjoy all the light it is possible to give them in London. We have had little fog so far. In all my experience I have never seen Pelargonium leaves decay in the same way before, and to me the cause is still obscure. I now intend to try nitrate of soda, to induce leaf-growth, and later on will report the result."

Chrysanthemum and Cornflower Rust.—Dr. Cooke made the following communication:—"Recently, when I reported to the Committee upon these rusts, I applied a scientific name to the fungus doubtfully, and with a mental reservation that in each case they were the Uredo form of *Puccinia Hieracii*, and this was precisely what the book-makers led me to do.

"I am since informed that, in spite of all the efforts and experiments of the heterocismists, they are unable to claim the Uredo of the Chrysanthemum as the Uredo form of *Puccinia Hieracii*, or of any other *Puccinia*, which I believed in my own heart all along. Nowadays we are not permitted to trust our eyes, but must have faith in experiments. Hence the poor Chrysanthemum rust is an orphan, or worse, even illegitimate, and must remain as *Uredo Chrysanthemi.*

"As to the other rust, it awaits the result of experiment; but I am more disposed to call it the Uredo of *Puccinia Centaureæ*, which has been united or mixed up with *Puccinia Hieracii.* I may be permitted to observe that no fewer than fourteen of the old species of *Puccinia* date before the Reformation! and I know not how many species of Uredo are all bundled together into the latter-day species called *Puccinia Hieracii*, amongst these being the *Puccinia Centaureæ* of Martius, and still nearer to our tramping Uredo, the *Puccinia Cyani* of Passerini. Let us hope that this also will find rest at last. I should recommend horticulturists to call it *Uredo Centaureæ*, and they will not be very far from the truth."

Bulbiform Seed of Crinum.—Mr. Druery showed on behalf of Mr. Roupell a fine example of this curious condition. The seed was of the size of a small Apple, green and fleshy.

Red Spot on Leaves of Imantophyllum.—Mr. Saunders brought specimens showing red spots. It was stated that these spots sometimes followed on the attacks of the bulb-mite, and that they were connected with the presence of a yeast fungus (*Saccharomyces*).

Fasciation in Valeriana arizonica.—"In March last," writes Mr. Worthington Smith, "I received by post from Dr. Masters a specimen of *Valeriana arizonica* for illustration. The example was received in a flat and semi-dried state, and it had previously been received also by post from Mr. Henkel of Darmstadt, so the specimen may be truly said to have passed through some vicissitudes before I received it. I planted the damaged and cut root-stock in very poor earth in a pot, and placed it under glass without heat, with the result that the old root-stock has now produced two new growths, both twice the size of the original plant, with leaves twice the normal length, all the parts fasciated in a remarkable manner and with flowers from two to three months in advance of the parent. Fasciation is sometimes put down to over-rich living and comfortable surroundings, but in this instance it seems to have been brought about by serious difficulties."

Cucumber Leaves.—From Mrs. Batten Pool came specimens with the familiar signs of the presence of red-spider.

Grub in Roots of Pæony.—Mr. Carrington Ley, of Farleigh, sent Pæony-roots eaten by the larva of some moth, which was pronounced to be a Swift-moth, *Hepialus*.

Cypripedium insigne variety.—Mr. Tracy, Amyand Park Road, Twickenham, sent a specimen which may be described as a dwarf or stunted flower, in which all the parts are normal, but much reduced in size. The plant produced flowers of the same character last year also. No information was given as to whether the whole plant was dwarfed, or only the flower.

Cypripedium insigne variety.—In this specimen from Mr. Parr, Trent Park, New Barnet, there were two flowers, the topmost flower expanding first, the second flower developing from the axil of the bract, which was developed as a perfect leaf. The parts of the flower were normal.

Scientific Committee, February 11, 1902.

Mr. H. J. Veitch in the Chair, and thirteen members present.

Pæony Roots.—The identification of the Caterpillar affecting these roots as that of the Swift-moth (*Hepialus*) was confirmed.

Pelargoniums in the Transvaal.—A correspondent sent leaves of Pelargoniums, which were referred to Mr. Massee, who reports as follows:—

"The fungus on Pelargonium leaves is the African species of 'Geranium leaf-rust,' *Puccinia granularis*, K. and C. Diseased plants should be isolated, and the diseased leaves removed as quickly as the health of the plant will allow. Spraying with Condy's Fluid would prevent healthy plants from becoming infected. The fungus is not uncommon on wild species of *Pelargonium* in S. Africa, and has probably passed from such wild plants to the cultivated ones. The fungus is a very interesting species not previously known as attacking cultivated plants. Care will have to be taken that it is not imported into Europe."

Potato Disease.—Some specimens of diseased Potatos were sent from the Chippenham Horticultural Society. They presented in the interior of the tuber black spots, such as were investigated at Chiswick by Dr. Plowright and others several years ago, and figured in the *Gardeners' Chronicle* December 20, 1884.

Unhealthy Fern.—Mr. Gordon, V.M.H., showed fronds of a Fern in a sickly distorted condition, attributed by the Committee to defective cultivation.

"*Buddha's Fingers.*"—Mr. Holmes showed a specimen of a malformation in a Citron, consisting of a dissociation of the carpels, which thus resembled so many fingers.

Prolification of a Rose.—Mr. Worsdell showed a good illustration of this frequent malformation.

Anemone nemorosa.—Mr. Worsdell also showed specimens of this plant, in which the radical leaves were as long as the bracts of the involucre.

Diseased Begonias.—From Mr. A. Dewar came leaves of *Begonia* 'Gloire de Lorraine' in a diseased condition. The leaves were infested with thrip and mites. Fumigation or spraying with tobacco-water was recommended.

Air-canals in the leaf and in the flower-stalks of Nymphæas.—Dr. Masters showed impressions illustrative of the varying arrangements of the air-canals in the petioles and peduncles of several species and varieties of this genus—arrangements which are sufficiently varied and sufficiently distinct to allow of the grouping of the several species and varieties into certain well-defined groups. The subject had attracted the attention of the speaker many years ago, but the recent introduction of M. Latour Marliac's hybrids suggested a further examination, which was confirmatory of previous observations, and the results of which are detailed in the communication now laid before the Society (see vol. xxvi. p. 840). For the opportunity of examining numerous specimens, Dr. Masters expressed his great obligations to Mr. Hudson, the expert cultivator of these beautiful plants at Gunnersbury House.

Scientific Committee, February 25, 1902.

Mr. A. D. Michael in the Chair, with sixteen members present and Mr. Carruthers (visitor).

Diseased Leaves of Odontoglossum.—Mr. Chapman showed leaves showing discoloration and shrivelling of the leaf-tips, attributable to excessive moisture and unfavourable climatic conditions. There was no trace of fungus.

Alleged Hybrid between Pea and Dwarf Bean.—Dr. Masters showed a Pea-like seed raised, as was stated, between a dwarf Bean and one of the culinary Peas. The seeds of the Bean-parent were shown, in the form of small, flattened, kidney-shaped seeds, of a shining chestnut-brown colour. The supposed hybrid seed resembled a smooth round Pea in size, form, and colour. As there was only one seed available, no minute examination was made, but the seed was forwarded to Chiswick to be grown and reported on. [Chiswick. August 5, 1902.—The supposed hybrid seed grew freely exactly like the dwarf French Bean seeds which were sent as specimens of its parent. There is at this present time absolutely no difference in flower, or foliage, or growth, or fruit. All are in every respect identical with the one parent. We therefore conclude that the seed was a deformed albino Bean seed, and had no Pea whatever in it.—Ed.]

Narcissus poeticus ornatus.—Mr. Jenkins sent flowers of this variety to show the manner in which the coloured edge of the corona was eaten off by slugs, leaving the yellow cup untouched. Whether the slugs are attracted by the reddish colour or seductive flavour of the rim of the corona, or by some other inducement, is a matter for investigation.

Burr on Æsculus sp.—From the Botanic Garden, Bath, came a globular woody excrescence, crowded with buds and contracted shoots. The tree is reported to bear numerous similar burrs, varying in size from a hen's egg to two feet across, studded all over with small spur like growths two or three inches long, from some of which flowers protrude, so that their appearance is at that period very peculiar and attractive. It was suggested that these outgrowths might be the result of the irritation set up by mites or by fungus (*Exoascus*). There were originally six specimens in the gardens, but four of them have already been cut down on account of their ungainly tendency to burr. The trees were of *Æ. carnea* or *Æ. rubicunda*, and were all grafted on the common Chestnut, and it is only the scion, never the stock, which has been affected.

Burr on Allamanda.—A similar production on the branch of an Allamanda was shown from Mr. Bedford, Straffan Gardens, Kildare; but in this case there were no buds or shoots. It was suggested that the irritation occasioned by ants was competent to induce such growth.

Diseased Leaves.—Miss Dryden sent various leaves, as follows:—(1) Violet leaves. These were affected with red-spider and thrips, for which the application of tobacco-water and soft-soap as a wash was recommended. (2) Leaves of bulbous plant from Burmah. These were marked by red streaks, and ultimately by the decay and shrivelling of the tip of the leaf. The appearances were such as are occasioned by thrip, for which fumigation with tobacco or XL All is very effectual. (3) Pelargonium leaves discoloured and shrivelled. No insect or fungus could be found on these leaves, the condition of which was attributed to unfavourable conditions of light, or temperature, or moisture, or all combined.

Cyclamen Flowers, Synanthy in.—Mr. J. S. Davis sent flowers of Cyclamen more or less united one to another, and with leaves developed on the flower-stalk. Although the appearances are far from uncommon, it is not easy to assign a definite cause for their production.

Fasciated Holly.—Mrs. Morley, Southborough, sent a specimen of this malformation, due to excessive growth. It presented no special peculiarities.

The Wood Leopard Moth.—Mr. A. D. Webster sent specimens from Greenwich Park, to show how severely the trees were suffering from the effects of this tunnelling caterpillar, which seems to be peculiarly abundant in and around London.

Bacteriosis in Carnations.—Dr. Cooke reported as follows on some specimens exhibited at the last meeting :—" The Carnation-leaves are undoubtedly affected by the disease described as Bacteriosis. The appearance of the leaves is strikingly like that figured in the *Bulletin of the U.S.A. Experiment Station, Purdue University,* May 2, 1896, p. 549, and the minute organisms, whatever they may be, are similar. The name given to the parasite is *Bacterium dianthi.* The disease is said to enter the plants chiefly through the punctures made by aphides, and the suggestions made are that the plants may be kept essentially free from the disease by keeping the foliage dry and preventing the presence of aphides. Overhead spraying should only be done occasionally on bright days, with water containing a small amount of ammoniacal copper carbonate."

Germination of the Seeds of Crinum and other Amaryllids.—Mr. Worsley contributed the following note :—

On more than one recent occasion this subject has been discussed before the Scientific Committee of the R.H.S., and in the *Journal* of the Society [August 1901, vol. xxvi. p. 89] Dr. Rendle published an interesting paper, entitled " The Bulbiform Seeds of certain *Amaryllideæ.*" He maintained the accepted doctrine that the original process issuing from the seed and terminating in the bud (bulb) was the cotyledon. In my view it is impossible to so stretch the definition of the term " cotyledon " as to include this original process. It does not serve the same function, nor do we find any counterpart to it (that I am aware of) among dicotyledons. In my view it would be correct to call such plants " primarily monophyllous," but it would be incorrect to call them monocotyledonous, unless we may consider that in such cases the simple amorphous mass surrounding the embryo constitutes the cotyledon.

All writers dealing with the germination of these seeds have tacitly recognised that some difficulty existed in reconciling their organs and processes with those described in botanical works. Had no difficulty existed, it would evidently have been unnecessary to apply any special treatment or arguments to the case, and the fact that these writers have attempted to effect such a reconciliation is a proof that they, at least, recognised that a difficulty existed ; a something that required to be overcome or explained away.

Their arguments are in many cases carefully thought out, but they have failed to carry conviction upon some of the more important points; and I seek in this contribution to show why I have still cause to doubt the conclusions they arrived at.

The scientific world of to-day accepts the belief that all organic life had been evolved from one, or at least very few, ancestral types or stocks, and it is of great importance to trace back, correctly if possible, these primary distinctions in germination. This is as near the fountain-head as we may go, and from whence the most valuable deductions may be drawn.

We may take it that, in comparative anatomy, function is a safer guide than locality. That is to say that when we seek to trace the occurrence of one organ in many different complex organisms, we should not rely upon superficial appearance, mere locality or contiguity, but should search for the function performed in each case. The organ performing a similar function in each case is that which we seek.

In short, the corresponding organ in a number of widely differing complex organisms is not the one which happens to occur in the same relative position of contiguity, but it is the one which performs the corresponding function. This may be contiguous in one case and widely removed in another.

I am quite prepared to admit the existence of many apparent exceptions or contradictions to this rule. In simpler forms of life organs are few, and each organ serves a variety of functions. In more complex life organs are more numerous and more specialised, but are in most cases able to perform not only their special function, but also (to some extent at least) the more general functions they performed in the long-distant past.

I do not therefore wish to place too much importance upon any deduction I have drawn from the function of the original process emanating from the seed of certain Amaryllids, yet we must not altogether overlook it, for it would appear as though the problem presented to many authors dealing with seed germination had not been to discover the sequence of events in the process of germination, but rather, having decided beforehand that certain organs must exist, to find them.

To such persons it was impossible that any difficulty should arise. The contiguity of the cotyledons to the "lead" in the dicotyledonous orders pointed unmistakably to the contiguous process in the *Amaryllideæ* being in that case the cotyledon.

But when we consider the function served by the cotyledons in dicotyledonous plants and then seek for some organ performing a corresponding function in these Amaryllids, we shall certainly not find it in this original process issuing from the embryo.

The cotyledons, or seed-leaves, have, as their main function, the support of the embryo (and subsequently of the growing point) from the moment of parturition until the process of weaning is perfected.

During this, sometimes prolonged, period, the tissue of the cotyledon becomes gradually wasted or atrophied. Shortly after weaning the tissue of the cotyledon dies. Its function is completed, and the plant is now drawing sustenance from its own roots.

For purposes of experiment, or demonstration of the processes of germination among the dicotyledons, no genus offers greater facilities for observation than the common garden bean (*Phaseolus*).

Let us assume for the moment that the issues have been confused by the use of the terms monocotyledonous and dicotyledonous, and that the true division should have been between plants with a simple cotyledon and those with a sub-cleft cotyledon.

Consider the sub-cleft cotyledon of *Phaseolus*.

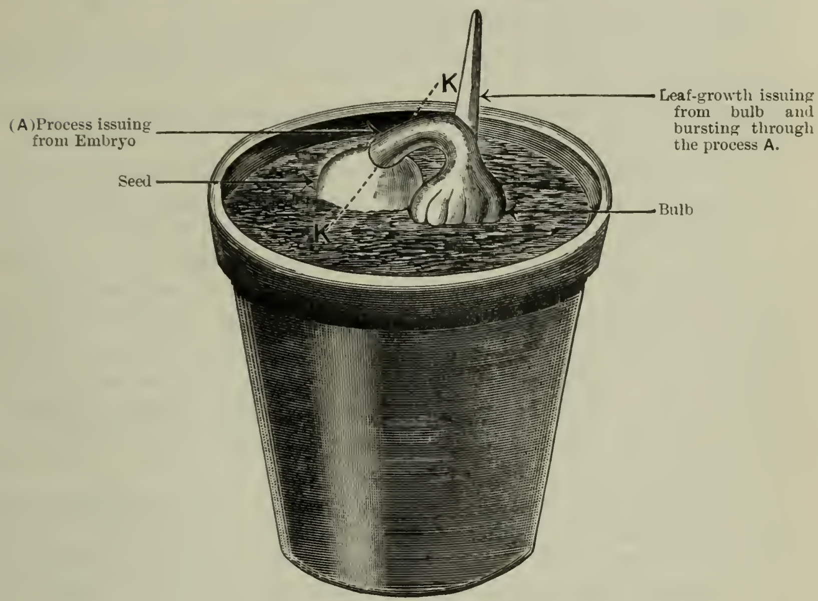


Fig. 62. a.—Sketch of growing plant.

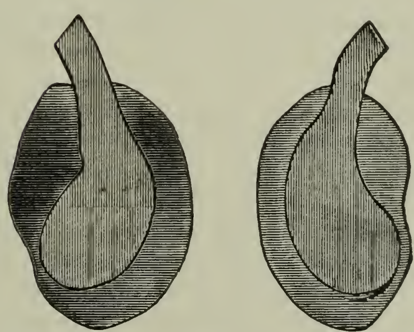


Fig. 62. b.—Full-size drawing of seed cut in half on section line K K in pot. These drawings were made from a living plant in Mr. Worsley's garden.

From the uncleft base of the cotyledon rises directly the main lead of the young plant, and in the opposite direction the roots descend. There is *no process connecting the embryo and the young plant.* It springs direct from the embryo and grows in both directions. The cotyledons are in fact leaves, and from the axils between the cotyledons and the lead of the young plant it is possible for bran ch growths to spring (*vide* decapitated specimen exhibited at the meeting of the Scientific Committee), just as such axillary growths may spring from the axils of any of the leaves of the growing plant.

Now turn to these drawings of the germinating seed of *Crinum Moorei* (Fig. 62), and suppose the amorphous mass surrounding the embryo to be the cotyledon. It is simple, not cleft. It entirely embraces the embryo. A process issues which has no counterpart in the *Phaseolus*; it bends to the ground and is terminated by a bulb or bud.

Can this process be the cotyledon, as asserted by some ?

For weeks or months it has no means of support (except such as it draws from the seed).

Can it be nourished out of nothing, grow larger and larger on nothing ? I cannot ask you to believe this.

No, it only grows at the expense of the amorphous mass and other parts of the seed. As it grows they decrease, suffer atrophy, and ultimately die just as the young bulb or bud becomes weaned. If this process was a cotyledon, it would perform the function of *supporting* the young plant during this period. Instead of doing this, it is itself nourished at the expense of the amorphous mass, and hence must be a part, not of the cotyledon, but of the young plant itself, or be a mere extension of the embryonic sac. In my view, therefore, this original process cannot be a cotyledon or part thereof. It is a process which, directly it begins to grow, does so at the expense of the seed. It has no counterpart in the *Phaseolus* we have before us.

It is possible, as I assumed for the purpose of this analogy, that the simple amorphous mass surrounding the embryo in the seed of *Crinum Moorei* is the cotyledon. At least it subserves the corresponding purpose.

Referring to alleged abnormal production of young bulbs within the fruit, it is possible for such germination to take place, for a young bulb to be formed, and for the seed to perish. This is a perfectly natural process, and it is not necessary, when we desire to account for it, to call to our aid such extraneous agencies as viviparous roots, abnormal development, and so forth.

To many persons Nature presents an indescribable anarchy unless they are allowed the exact names and definitions which they admire. Definitions, names, gradations of rank, help many minds to grasp problems. To others such restrictions make problems more difficult.

New Species of Hippeastrum.—Mr. Worsley showed a flower of a supposed new species, with the following note :—" *Hippeastrum Kromeri* is an unrecorded species introduced by Mr. Kromer, of the Roraima Nurseries, Croydon, who both presented me with a bulb and sent flowers of other bulbs not showing any divergence. It was gathered in the highlands of Minas Geraes, Brazil, on the banks of the Upper Rio São Francisco. It holds an intermediate position between the rutilum-reginæ group and the epiphytal group inhabiting the Organ Mountains. It seems nearest akin, geographically and generally, with *H. correiensis* [Bury. Hex. 9]."

Scientific Committee, March 11, 1902.

Mr. A. D. Michael in the Chair, and twelve members present.

Burr on Æsculus.—Mr. Odell reported that he had been unable to find any mites on the specimen exhibited at the last meeting.

Clematis glycinoides.—Mr. Odell exhibited a flowering specimen of this Australian species.

Unhealthy Palms.—Six pots of Kentias were sent for the opinion of the Committee. Mr. Odell reports that he finds no fungus on the living plants, and considers the malady to be constitutional. Some fungus spawn was found in the soil growing on the fragments of decayed wood.

Bi-coloured Cyclamen.—From the gardens, Sandhurst, Runfold, Farnham, came a plant of *Cyclamen persicum* (*latifolium*), with white and rosy flowers originating from the same tuber. Dr. Masters commented on the interest of the specimen, as showing an instance of variation uninfluenced by hybridisation.

Slime-fungus.—Dr. Cooke reported on the leaves of an unknown plant, submitted to the last meeting. The leaves were covered superficially with pink splashes of a chalky-looking nature, upon which, here and there, were small gyrose nodules, not larger than a Rape-seed, of pitch-brown colour. All this flaked off easily, and left the plant green and uninjured. The brown portion consisted of a mass of subglobose spores of a brownish-violet colour, evidently belonging to some slime-fungus or *Myxogaster.* Being unable to identify the species, he sent it to Mr. Geo. Massee, who has published a monograph of this group, and this is his reply :—" The substance is undoubtedly the plasmodium of some *Myxomycete*, but of what species I cannot say. It is quite superficial, and would do no harm to the plant it occurred upon."

Pœpalanthus sp.—Mr. E. M. Holmes showed a species of *Pœpalanthus* (nat. ord. *Eriocauleæ*), nearly allied to *P. elegans* and *P. niveus*, which is used in the district where it grows, on the banks of the Amazon, for decorative purposes. The white persistent dry bracts of the involucre give it the appearance of a *Helichrysum.* Its long, slender, pliable stalks render it useful for a variety of decorative purposes.

Jujube.—Mr. Holmes also exhibited specimens of a large variety of *Zizyphus Jujuba* cultivated in China, and preserved as a sweetmeat. The preserved fruits are about the size of Dates, but broader and flatter, and have a striated surface. According to Sir Thos. Hanbury the Chinese call them Meih-Tsau, or honey Jujube, and prepare them by making longitudinal incisions in the fruit with a knife, and then plunge the fruit into honey, subsequently drying it. It is prepared in Hang-chow, the district that yields the best green Tea. The preserved fruit forms an excellent article for dessert, and it is surprising that it has not hitherto been imported for that purpose into Great Britain. Bretschneider, in the *Botanicum Sinicum*, vol. ii., p. 119, No. 278, under Ta Tsao (great Jujube), quotes the following from the Chinese writer, Kno P'o :—" There is now in Ho-tung, in I-shi-hien (South-western Shansi), a kind of Tsao of the size of a hen's egg," and explains that this is probably the large Jujube now produced chiefly in Shan-tung, which the Chinese preserve with honey or sugar, and which is sold at Peking under the name of Meih-Tsau (honey Jujube).

Gall on the Root of the Logan Berry.—From Mr. Holland, Malvern, a hard rounded gall was shown on the roots of this plant, which is a hybrid between a Raspberry and a Blackberry. Mr. Saunders pointed out its resemblance to the root-gall of the Raspberry, attributed to eel-worms, but he has been unable to find any trace of eel-worm in the specimen exhibited.

Carnation Disease.—Dr. Cooke reported on various specimens recently sent, which he said exhibited the ravages of a parasite new to this country, and apparently before undescribed. It is of the kind known in the United States by the general name of Anthracnose, and is in all cases a destructive pest. The leaves are at first spotted with small purple roundish spots. These gradually enlarge and become confluent and indeterminate, and at length brownish in the centre. Meanwhile the leaves become sickly, and commence to die off at the tips. The pustules are not to be distinguished by the naked eye, and scarcely by the aid of a lens. Cells beneath the cuticle supply the place of definite receptacles, and in them a large number of elliptical hyaline sporules (ten to twelve by five μ) are produced, which escape through the fissured cuticle. At length the cuticle about the orifice turns pallid, and appears as a pale dot on the purple spots. No described species of *Glœosporium* has been found which answers to this diagnosis, and hence I called it—

Glœosporium Dianthi (Cooke).—Amphigenous spots at first small, roundish, dark purple, then confluent and indeterminate, sometimes turning brown at the centre. Pustules indistinct to the naked eye, but finally pale at the orifice. Sporules elliptical hyaline (ten to twelve by five μ). No remedies have been tried, but it would be advisable to apply diluted Bordeaux Mixture, so as to destroy the extruded sporules, and to pick off as many of the diseased leaves as possible.

Seed-vessels of Araujia sericifera (*Physianthus albens*).—Some follicles of this plant were sent by Mr. Pentland, Ashwick Hall, Gloucestershire. The plant is an Asclepiad, the fruits of which are illustrated in the *Gardeners' Chronicle*, 1893, vol. xiv., p. 436. The plant from which these specimens were taken bore scores of fruits, the result of fertilisation through the medium of insects.

Hazel Buds affected with Mites.—Mr. R. W. Dean sent specimens of buds distorted in the same manner as the buds of the Black Currant. The occurrence of these buds in the Hazel and Filbert was known long before the appearance of the Currant Bud-mite.

Œnanthe crocata poisonous to Cattle.—Mr. Holmes showed tubers of this plant thrown up on the sides of a ditch, where they had been eaten by cattle with fatal results, the symptoms being similar to those of poisoning by strychnine. (Fig. 63.)

Seedling Ailanthus bearing Flowers.—Dr. Masters showed specimens he had received from Mr. Dinter, German S.W. Africa, which were interesting as bearing flowers, while the cotyledons were still attached, and the whole plant was not more than 2 or 3 ins. in height. Dr. Masters recalled a similar production of flowers on a small shoot proceeding from a sucker of the same tree, and also the formation of perfect flowers on some seedling plants of *Philadelphus*, when only 2 to 3 ins. in height.

Pinus pindica (?).—Dr. Masters showed cones, received under this name, from Mr. Oscar Bierbach, of the Botanic Garden, Belgrade. The

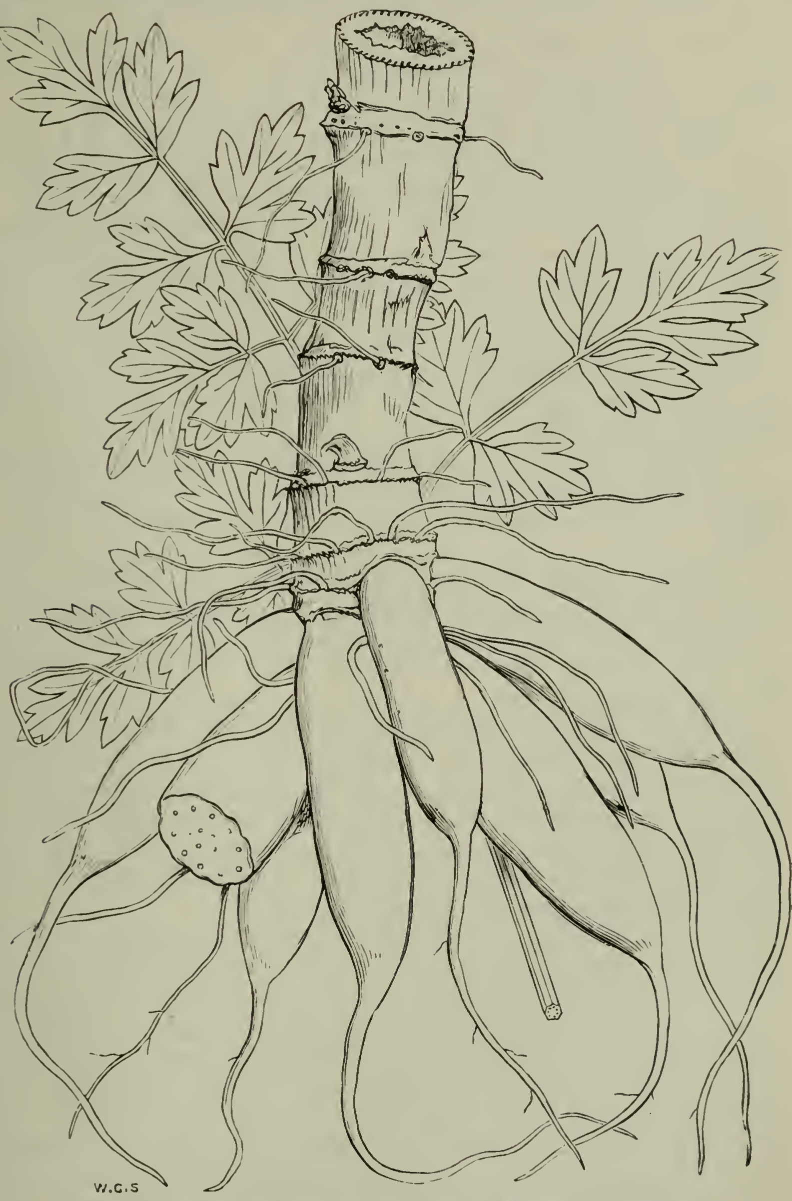


FIG. 63.—ROOTS OF ŒNANTHE CROCATA. (*Gardeners' Chronicle.*)

tree is reported to be a native of the mountains of Thessaly. No foliage was sent, but the cones have the appearance of those of a variety of *P. Laricio*, but much more tapering in form than is usually the case in that species.

Scientific Committee, March 25, 1902.

Mr. A. D. Michael in the Chair, and sixteen members present.

Narcissus Disease.—Rev. W. Wilks brought specimens in which the bulbs and roots appeared healthy, but the leaves were streaked with yellow, and appeared to be weak and flabby. The malady is widely diffused, but at present no light has been thrown upon its cause.

Hybrid Tropæolum, &c.—Mr. Worsley showed flowers of a hybrid between *T. Lobbianum* and one of the garden Tropæolums. A hexamerous flower of a *Tydæa* was also shown, in which the stigma was trifid. A zonal Pelargonium was exhibited in which the edge of the leaf was bordered with red, as happens in decaying leaves, whilst the flowers, usually white, were in this case suffused with salmon-pink in the centre.

Diseased Violets.—Some specimens from the Moor Hall Gardens, Harlow, in which the leaves were shrivelled, but in which the root-development was very satisfactory, were referred to Mr. Douglas for examination and report.

Proliferous Strawberry.—Mr. Hooper showed a coloured drawing of a Strawberry, in which small plants were developed on the receptacle in the place where the "achenia" ought to be (see *Vegetable Teratology*, p. 116).

Unhealthy Palms.—Mr. Odell showed further specimens of Kentias which confirmed the opinions expressed at the preceding meeting.

Mites on Begonias.—Mr. Shea adverted to this subject, and elicited the recommendation from the Chairman to burn the roots forthwith if they were attacked by mite.

Grub on Rose, &c., taken from a tunnel in a Rose Stem.—Mr. Chittenden sent a specimen for naming, and this on being submitted to Mr. Saunders has been determined to be the grub of some hymenopterous insect, such as causes galls on Roses, especially the form called Bedeguar, or Robin's Pincushion. Mr. Chittenden also sent the seed or pip of an Apple containing two embryo plants—the supplementary embryo having probably been developed from one of the synergidæ.

Peloria in Cattleya.—Dr. Masters showed an illustration of regular peloria in a *Cattleya* which he had received from Messrs. Veitch. In this flower there were three sepals of equal size and similar form; alternating with these were three regular flat petals, the lip being represented by a petal in size, shape, and colour like the lateral petals. This flower is probably a reversion to the earlier and simpler conformation from which the peculiar Orchid structure, as we now know it, has evolved. The column was in the normal condition. It is noteworthy that this flower was produced from the same seed-pod as the hybrid between *Cattleya Schroderæ* ♂ and *Brassavola Digbyana* ♀. Evidences of the cross were very obvious in the normal flower, whilst in the peloria the appearance was that of a degenerate *Cattleya*.

Cuscuta.—Dr. Bonavia sent a specimen of a shrub from the Riviera, encircled by a *Cuscuta*, but the species could not be determined.

Schizophyllum commune.—From Chiswick came a fungus found on the "Panama Pear." The fungus was determined by Dr. Cooke to be *Schizophyllum commune.*

Pitcher on Leaf of Pelargonium.—Mr. Cooper sent a specimen showing a funnel-shaped leafy cup in place of the inflorescence (see *Vegetable Teratology*, p. 313, for a similar production on the leaf of a Lettuce).

Scientific Commitee, April 8, 1902.

Dr. M. C. Cooke in the Chair, and sixteen members present.

Violet-leaf Disease.—Dr. Cooke reported as follows on some specimens sent by Col. Spragge :—

"Many of the leaves were in a bad state, the tissue being entirely bleached and dead, but not in interfoliary spots, as in *Phyllosticta* and *Septoria*, but marginal, extending inwards until the greater part or the whole of the leaf is involved. It was the opinion of some of the members of the committee that this bleaching was the result of external circumstances, and not from the attacks of any parasite. With this view I am disposed to agree. The mode of attack is not that of the American disease (*Alternaria*), of which I have failed to find a single spore.

"All the spots were occupied by tufts of a black mould, which at present I am inclined to think must be saprophytic, appearing subsequently on the dead tissue. They do not appear upon the leaves beginning to fade, only on the quite dead spots. These moulds are of two kinds, and both belong to genera of which the species are wholly saprophytic, it being the exception, in some few cases, for them to become parasitic.

"The fungus appears in small dark olive-coloured tufts scattered over the dead tissue, and in no case becoming confluent, and spreading in patches.

"The earliest form to appear is a *Cladosporium*, which certainly is not *Cladosporium herbarum*, nor does it appear to be *Cladosporium epiphyllum*. The threads are slender, unbranched, septate, and of a pale olive, not nodulose or torulose, and rather long for the genus (120 to 150 by 5 μ). The conidia, as usual, are at first continuous, afterwards uniseptate, then biseptate and triseptate ; so that in the same tuft one may find conidia with no septum, and others with one, two, or three, in all cases narrow, and but little thicker than the threads (18 to 30 by 6 to 7 μ).

"The other form, which appears mixed with the foregoing, is a *Macrosporium* of the type of *M. sarcinula*, with delicate deciduous threads and somewhat cubical conidia (30 to 35 by 25 to 30 μ), truncate at the ends, and but slightly constricted. The septa, longitudinal and transverse, divide the conidia into quadrangular cells, mostly in three irregular rows, and of a darker olive-brown than appears in the *Cladosporium*.

"Unfortunately, I have not seen a description of the Italian *Macrosporium Violæ*, which has the reputation of being a destructive parasite on Violets.

"It has been demonstrated that there is some close affinity, or relationship, between *Cladosporium* and *Macrosporium*. They are often found together, and in some cases have the reputation of being the micro-conidia and macroconidia of some species of *Pleospora*, bearing muriform sporidia contained in asci.

"I can only repeat that I do not think these moulds are the cause, but the consequence of the disease.

"N.B.—Since writing the above I have seen descriptions of the Italian pest, *Macrosporium Violæ* (Poll.), and it is certainly not the same as the one I have described; since, in that species, the spots are definitely orbicular and regular, and the conidia are clavate, and attenuated at the base (40 to 90 by 10 μ), not at all resembling those described above, which I must still, in default of better evidence, regard as a saprophyte." (For further remarks on Violet Diseases see vol. xxvi. pp. 491–4.)

Narcissus Disease.—Rev. W. Wilks showed further specimens with yellow stripes, both in the leaves and on the flower stems and in the flowers, as a preliminary to the shrivelling of the tips of the leaves. A similar condition has been seen in Iris. It was considered that the disease was due to the presence of bacteria. Mr. Nicholson remarked that *Narcissus* 'Sir Watkin' was much subject to this discoloration, but that when growing in the grass it was relatively free from it.

Peach-tree Disease.—Some conversation ensued with reference to a disease on Peach-trees in Essex, and it was desired that further specimens of the roots and foliage might be sent.

Peristeria pseudo-bulbs.—Mr. Gordon brought pseudo-bulbs affected with a black fungus, on which Dr. Cooke undertook to report.

Rootless bulbs of Hyacinths.—Mr. Gordon also brought specimens showing this not uncommon phenomenon, which was attributed in the first instance to the bulbs not having been matured, and in the next to some check to growth.

Plants exhibited.—Mr. Lynch brought from the Cambridge Botanic Garden specimens of the following plants:—

Kalanchoe somaliensis.—Figured in the April number of the *Botanical Magazine*, from Sir Edmund Loder, collected by himself, also introduced by the Cambridge Botanic Garden through Mrs. Lort Phillips.

K. coccinea, *K. crenata*, *K. Cassiopeia*, from Dammann of Naples. The last name is not in the *Kew Index*, and the plant therefore probably requires to be identified.

Gnidia simplex.—Probably referable to *G. carinata.*

Tecoma australis.—Remarkable for the sunken glands seen on the lower surface of the leaf, such as are met with in other genera of the order.

Aloe somaliensis, sp. n.—Introduced to Cambridge, also to Kew, but not yet figured.

Lopezia miniata.—Not commonly seen, but interesting on account of its mechanism for cross-pollination. The one perfect stamen is held in tension by a folded leafy or expanded staminode below. On this part the insect alights, as the best position from which to reach the two drops of honey that seem to rest upon the knee-shaped bend of the upper petals. The result is that the stamen is released and pollen is dusted upon the insect. Self-fertilisation is impossible on account of marked proterandry.

Osteomeles anthyllidifolia.—Roughly, a *Cratægus* or Hawthorn, with leaves of leguminous type, interesting further on account of its distribution in East Asia down to Pitcairn Island.

Petasites palmatus, A. Gr.—Native of West Asia and California, a rare but very distinct marsh plant.

Helleborus viridis.—From a wild locality near Huntingdon.

Poterium spinosum.—From Syria, interesting in comparison with other species.

Ribes speciosum.—The Fuchsia-flowered Gooseberry from California.

Kennedya nigricans.

Petasites japonicus giganteus.

Myrsiphyllum.—Mr. Saunders showed specimens of the foliage of this plant, in which the false leaves were withered at the tips. The appearances were considered as the result of defective cultivation.

Cypripedium.—Mr. Douglas brought a flower of a hybrid variety in which the lip, instead of forming a pouch, was divided into three portions, a basal portion concave and trough-like, green, marked with small purplish dots; an anterior portion, raised and humplike, striped with dark brownish-purple on an olive-coloured ground. On either side of this was a wide oblong projecting wing. The column was normal.

Various Plants.—Mr. Worsley showed specimens of *Hymenocallis Moritziana*, *Tulipa Greigi* with the bulbs attacked with mites, and *Triteleia uniflora*, with two flower-stalks fused together.

Lathyrus Seedlings.—Mr. Holmes brought specimens to show the sequence of the leaves from the cotyledons to the developed stipules which replace the leaves.

Inter-carpellary Prolification.—Mr. Holmes showed a specimen of this peculiarity in a Lemon.

Œnanthe crocata.—Mr. Holmes also showed roots similar to those which had recently occasioned the death of a boy near Hammersmith. The wildest statements were made at the inquest, but Mr. Holmes having obtained specimens from the locality, there was no doubt whatever as to the real cause of death. (Fig. 63.)

The "Sporting" peculiarities of the Persian Cyclamen.—Mr. Denman of Tremeirchion supplied the following note:—"The *Cyclamen persicum* (*latifolium*) is characterised by its own 'sporting' tendencies, to the investigation of which I have given much care and attention. The main points of interest are these:—(*a*) The Persian Cyclamen raised from seeds cannot, after the third or fourth year, be induced to retain its former characteristics, as regards the colour of the flowers, &c. (*b*) Although the flowers are liable to 'sport,' they cannot be regarded as specific characters, because they will not reproduce the same sporting tendencies when raised from their own seed. (*c*) The same plant frequently produces two flowers of distinctly opposite colours; or, on the other hand, a plant, say with pure white flowers, will produce a mixture of colours after an interval of three or four years. (*d*) The sporting peculiarities of the Cyclamen being such, what steps may be taken to ensure the retaining of the distinctive colours of the plants under consideration?

Let us briefly consider the first point:—"The 'Persian' Cyclamen, quite apart from the other species, cannot be induced to retain its seedling characteristic colour after an interval of three to four years. Now, why are these peculiarities so marked? The plants which were under trial were quite secure from the visits of insects to cross-fertilise the blooms; and further, even if the flowers were visited by insects, how comes it that the flowers produced on the old plants 'sport' from their original colour, whereas seedlings from the same plants do not exhibit signs of 'sporting,' but retain the original colour of the seed-bearing plant, unless, of course, the flowers were hybridised? I am convinced that the peculiarity is due to some changes which take place in the bulb previous to its flowering for the third year, and that it is not effected by the intervention of foreign agencies, such as insects, &c. It must be understood that these peculiarities are not exceptional, as some suppose, but rather the reverse; it is the rule. From about fifty plants grown, I do not notice one that has not 'sported'; the white flowers have been spotted with pink, and *vice versâ*; the red and purple have been distinctly darkened in colour, while the natural-spotted flowers have been changed either into pure white or red, as may be the case—some plants again, as before mentioned, bearing two flowers of opposite distinct colours. Let us now compare *Cyclamen persicum* with the hardy species: take any of them, for instance, the *C. europæum*, *C. repandum*, or any of the others; have they been known to sport? No! and yet these are daily visited by myriads of insects, without apparent results; this, then, proves that the suggestion which I have put forward is correct, and further that this peculiarity is confined to the Persian Cyclamen alone. As it is not due to the intervention of foreign agencies or external conditions, the sporting element must take place in the bulbous root of the plant.

"The plants of the order *Primulaceæ* are conspicuous in the vegetable kingdom for their sporting peculiarities; but of the whole order none can possibly excel the *Cyclamen* in this respect, and in addition to this the flowers are often malformed; for example, specimens have been seen which, instead of the usual single flower, bore three or four blooms, and a number of foliage leaves on the same stem.

"After a cursory glance over the former points, we come to the final one:—What steps may be taken to retain the original and distinctive colours of the flowers? I can see no way out of the difficulty, with the exception of growing none but young plants, and discarding them after they are three or four years old. Could we trace this deficiency to insects, &c., or if we could have any proof that the peculiarities are due to the flowers themselves, then we could possibly find a remedy. But, in spite of all these *lusus naturæ*, the point is one which appeals to the scientist more than to the horticulturist."

Vines.—From Mr. Yeatman came roots dying, it was conjectured, from over-saturation of the soil.

Eucalyptus cordata.—Dr. Masters showed a flowering specimen of this species growing in the island of Arran, which he had received from the Rev. Dr. Landsborough.

Scientific Committee, April 22, 1902.

Dr. M. C. Cooke in the Chair, and ten members present.

Plants sent to the last Meeting.—Dr. M. C. Cooke reported as follows :—

"*Daffodil Leaves.*—I failed to find any distinct evidence of bacteria in the etiolated spots, but still think that the theory of bacteriosis is probable.

"*Stem Tubers of Orchids.*—Externally they exhibited rounded blackish spots, beneath which the cellular tissue was blackened deeply into the tuber. It had all the appearance of fungoid disease. I examined it at once, but no trace of mycelium or spores could be found. Kept in a damp atmosphere for fourteen days, it was then examined again, with like result. I cannot account for the spots, and can find not the slightest evidence that they are of fungoid origin.

"*Tulip Bulbs.*—The outer scales were decayed, the inner ones only being sound. The decayed portions gave no indication of fungus growth, and no trace of mycelium, but contained numbers of nematode worms. There were also other evidences of insect depredations.

"*Japanese Maple.*—The peculiar globose pale little bodies which were clustered in the axils of branches proved to be agglomerations of minute fragments of woody tissue, apparently the exuviæ of some grub. I did not remove them to ascertain if there were any excavations beneath, but refer them back for entomologists to examine.

"*Orchid Leaves.*—There was an amorphous brown decayed matter in the cells, but no mycelium or fungous spores. I attribute the spots to some external cause.

"*Linum trigynum.*—There was nothing on the surface of the leaf, and no mycelium in the interior, and not the slightest trace of fungi. All I found in the white spots was that the cells were deficient in chlorophyll, just as in the Daffodil. There were just the abnormal cells, but no chlorophyll in them. I have often seen the same thing on leaves of the Honeysuckle, but could never comprehend it. There is doubtless some physiological cause for the manifestation of the disease, apparently a weakness in the plant, requiring some stimulus. Is it more heat, or more nitrogen in the soil? The fact of not flowering seems to indicate weakness. I can suggest nothing, only it is certain that there is no parasite at present."

"*Silver-leaf.*"—Mr. Worsley showed stems of Peaches with blackened wood, as seen in a cross-section, indicating some condition which apparently injures the whole tree, producing (or produced by) the "silver-leaf" affection, which is common also on Plum trees and Portugal Laurel, but it has never been accounted for.

Tulipa sylvestris.—Mr. Worsley showed this plant, regarded as a true native by Hooker in S. W. Yorks, Norfolk, Suffolk, and Somerset, being naturalised elsewhere. Professor Henslow observed that it grows abundantly in two valleys in Malta. Its distribution is from Holland southwards, so that in Somersetshire it may be a member of the British Mediterranean group. Mr. Worsley also showed specimens of *Bidens delphinifolia* with small yellow flowers, a Mexican annual, and also *Marica cærulea* from Eastern Brazil. It has a bell-shaped flower with no tube, and belongs to *Irideæ*. One species occurs in W. tropical Africa, the other eight in Eastern Brazil, indicating a probable former connection between the two continents.

Cephalotaxus, fruiting.—Rev. W. Wilks showed a bough, with fruit not usually seen in fruit in this country.

Pæony and the Swift Moth.—Mr. Holmes showed specimens of the stems injured. It is a plant not usually attacked by the caterpillar of this moth.

Nodules on Roots of Robinia, &c.—Mr. Rogers, Hexworthy, Launceston, Cornwall, sent some roots of *Robinia*, showing microbe-bearing tubercles which were terminal and globular, about one-eighth of an inch in diameter. They are also remarkably large on the roots of Laburnum, forming coral-like masses sometimes as large as a pigeon's egg.

Peach Blossoms.—Mr. G. A. Bunyard sent some blossoms of small-flowered varieties of Peach and Nectarine, illustrating a considerable difference in the degrees of protogeny. In some the pistil protruded to a great distance, the chance of self-fertilisation being very slight. In others it was much shorter. In all cases the stamens were inarching, so that self-fertilisation was easily secured. In a double-flowered variety there was a similar difference, so that they might be almost called "short-styled" and "long-styled," but always protogenous. Mr. Bunyard observes that in the large-flowered varieties the style is too long for the flower-bud, so that it is bent round. This is a common result in many self-fertilising flowers, as in *Salvia Verbenaca, Lamium amplexicaule*, &c., and it may be possibly so in this case; but it appears that the small-flowered varieties are the most prolific, hence insect agency perhaps comes into play. Neither the bitter nor sweet Almond has a protruding style. Our wild species of *Prunus*, as the Sloe and Bird Cherry, are all protogenous, the cause probably being the cold temperature of early spring. He also sent flowers of 'Tibbett's Pearmain' Apple, having unusually long styles. It is protogenous, and a scanty bearer.

Turnip Varieties.—The following interesting communication was received from Mr. Gould, of Sleaford:—"We have occasionally planted a single extra good stock-root to produce seed, and almost in every case the produce is mixed. When there are fifteen or twenty of the same type put in together the produce is always satisfactory. For instance, one perfect 'Enfield Market' Cabbage as a result gave us almost every variety of Borecole, garden and cattle Cabbage, Savoy, and Sprouts. One 'Altrincham' Carrot gave a number of white roots. One root of Mangold, in four instances in four different seasons, produced a mixed crop of roots. And we have a very curious instance this year: In a 20-acre field of 'Giant Bronzetop' Swede we found one root of 'Red Tankard' Turnip, the finest we ever saw. It was planted in a private garden miles from any Turnip or Swede seed, was covered with muslin to prevent any chance of inoculation, and the produce is wonderful. There are a few 'Short

Red Tankard,' 'Greentop,' and 'Greystone' Turnips, 'Purpletop' and 'Greentop' Swedes, as well as some intermediate forms. Can you suggest any cause for this state of things? In this case the 'Red Tankard' must have been a sport from the Swedes; but in those we first indicate, the Cabbage and the roots were from old stocks that had been well selected for years. We enclose particulars of the 'Red Tankard' produce; the others we did not notice at the time.

"Report of the produce of one handsome 'Red Tankard' Turnip picked up in a 20-acre field of 'Giant Bronzetop' Swede. Seeded in a private garden far away from any other Turnip or Swede seed. Covered with muslin to prevent inoculation. Forty-nine 'Purpletop' Swedes, seven 'Bronzetop' Swedes, 150 'Bronzetop' White Turnips, ten 'Greentop' ditto, one 'Whitetop' ditto, six 'Reddishtop' ditto, eight 'Shorttop Red Tankard,' and a score or two of small nondescripts." The opinion of the Committee was that in a large mass of any one kind of plant the general intercrossing which takes place tends to equalise the produce to a general average, the would-be varieties being swamped; but when a single plant is isolated it can give rise to variations intact.

Leucojum vernum forming Bulbs.—Mr. Bradley sent illustrations of this plant forming fresh bulbs above the one planted. He writes as follows:—"The border in which these bulbs grew had from time to time been topped up by the addition of soil, the effect being that the base of the bulbs, which had originally been planted much shallower, had gradually been covered with earth to a depth of 6 or 8 inches. *Nerine sarniensis* showed a similar production of new bulbs. They had been planted about five years ago. When planting, a trench was thrown out to a depth of some 18 inches, and about 3 inches of manure put in, then the trench was filled up with soil and the bulbs planted at a depth of about 3 inches to the base below the surface of the soil. The trench was subsequently refilled as the soil sank, so that the bulbs were ultimately about 8 inches below the surface. Under these conditions they developed the upper bulbs." The interpretation appears to be that bulbs normally require to be at certain depths, some deeper than others. If they be too near the surface they form contractile roots, which pull them down, but in the present case, the bulb being too deep, the difficulty was surmounted by the formation of another at the proper depth (see M. T. Masters's *Vegetable Teratology*, p. 84).

Scientific Committee, May 6, 1902.

Dr. M. C. Cooke in the Chair, and eleven members present.

Turnip Seedlings.—With reference to Mr. Gould's account at the last meeting of the great variation in the seedlings of a 'Red Tankard' Turnip, Mr. Arthur Sutton thought there must be some mistake, as it was contrary to all experience at Reading; but Rev. W. Wilks confirmed it in the case of Cabbages. Having an excellent variety, very useful late in the season, he saved two plants for seed, covering them when in bloom with a thin muslin net. In the following year they produced all sorts of the most mixed form of Cabbages, Coleworts, &c., but not one single plant at all like the parents. The Committee would be glad to hear of any similar cases. The physiological interpretation would seem to be that, from constant indiscriminate crosses, Cabbages, Turnips, &c., have a very mixed constitution. As long as any variety is grown in masses, the crossing keeps up an average form. When isolated, reversion to the various races takes place, the " blood " of which is in the individual. Mr. Sutton suggested experiments to be carried out at Kew or Chiswick to test these remarkable results.

Gooseberry Trees dying off.—Rev. W. Wilks showed branches withering and dying. Mr. Veitch observed that it was not uncommon after an excessively dry season like the last, and that some varieties are more liable to perish than others, the more vigorous ones withstanding it.

Primroses malformed.—Mr. Sutton brought specimens of umbellate, or, more strictly speaking, " capitate " forms, the flowers being sessile on the top of a peduncle. There were four flowers with linear bracts. The central flower was multifold, with seven or eight petals, &c.; the other flowers were either normal or with a sub-petaloid calyx. The petal lobes in some forms were unequal. They were from a wood near Reading. He also brought from the same wood double-flowered wild Anemones. The late Rev. Prof. J. S. Henslow collected similar double forms in Hitcham Wood, Suffolk, in 1845.

Tacca cristata.—Mr. Odell sent flowers of this anomalous plant, having one of the numerous filiform bracts broadening at the base, thus reverting towards the form of the larger outer series. The question as to the function of the filiform appendages was raised, for they are suggestive of some similar use to those in certain *Cypripedieæ.*

Gloxinia Flowers with Excrescences from the Outer Surface.—Mr. Odell also sent blossoms with this well-known peculiarity, the special feature being the fact that their abnormal character was now very constant for four years on the same plant.

Palm diseased.—Mr. Saunders reports as follows upon the Palm submitted to him at the last meeting:—" I have carefully examined the small Palm (*Kentia*) which I took away for that purpose. I forget the name of the grower, but we had some before us on March 11, which were reported on by Mr. Odell. At the roots of the Palm I found several specimens of snake millipedes (*Julus guttatus* and *J. londinensis*); of the latter I only found one specimen. These are well-known and most destructive pests. The only way of getting rid of them, short of repotting the plants and picking out the pests, is to bury small slices of Turnip, Carrot, or Potato in the soil just below the surface. The millipedes are very fond of these roots, and will probably be attracted to them. The traps should be examined every morning. If a small skewer of wood be stuck into each slice, it will show where the latter has been buried and render it easier to handle."

Lastrea (Nephrodium) Thelypteris, Marsh Buckler Fern.—Mr. Druery exhibited fronds of a very fine and thoroughly polydactylous variety of this species, found by Mrs. Puffer in Massachusetts, U.S.A.—a clump of 8 feet by 2 feet or 3 feet wide—a very old plant. It is the more interesting, as, although this species is indigenous to Great Britain, and is locally abundant in many marshy districts, it has never even afforded a subvariety in this country, despite its having been certainly assiduously hunted for half a century. In this case the pinnæ are foliosely multifid throughout.

Tulipa sylvestris.—Mr Chapman sent the following communication: "I notice that Mr. Worsley showed the above Tulip on April 22. Having several of the species in flower in the borders here, I mentioned the matter to Mr. Cookson (of Oakwood, Wylam-on-Tyne), and have ascertained the following particulars from him, which I thought might perhaps be of interest. The plants we have here were collected and brought by Mr. Cookson from a friend's wood, about eleven miles north of Newcastle-on-Tyne. Although they must have been growing in this particular spot for ages, Mr. Cookson was the first to notice the Tulip characteristics about the apparent "weed." I use the word "weed," for, from what Mr. Cookson tells me, they grow in hundreds of thousands, scarcely ever exceeding 3 inches in height, and never flowering where growing in the wild state. After collecting the plants, they were planted in the borders. It took three years before they produced flowers, when their identity was established. Since then, where the plants have not been moved, it is interesting to note that, in almost every instance, twin flower-scapes are produced, as in the enclosed specimen. It may also be of interest to note that it has a peculiar character of forming a long rhizome between each bulb, giving it such a roving nature in cultivated ground that although planted in a bed or patch it will be found the following year at a very different position from where it was planted. I notice S.W. Yorks being the furthest north given in the report; it might be interesting to know that it can be still found as a wild plant in Northumberland."

Scientific Committee, May 20, 1902.

Dr. M. C. Cooke in the Chair, with fourteen members present, and Professor Percival, Agricultural College, Wye, visitor.

Beech and Rose diseased.—Mr. Saunders reported as follows upon the specimens sent to the last meeting:—"As to the scale insects from Mr. Gregory, they are *Cryptococcus fagi*. The scale on the Rose is probably *Aspidiotus ostreæformis*—I say probably, because there is another species so closely resembling it that without boiling the little insect from under the scale in *liquor potassæ*, staining, and otherwise preparing it for examination under the microscope, so that certain parts of its anatomy can be clearly seen, it is impossible to be quite certain. The *Aspidiotus* and *Cryptococcus*, though both belonging to the same family, the *Coccidæ*, are very different insects, the former being a true scale insect, the other being nearly allied to the mealy bugs. I should recommend that all the shoots of the Rose that are attacked should be cut off and burnt, and the rest dressed or sprayed with paraffin emulsion. The Beech bark should be scrubbed with the same preparation, or with ½ lb. of soft soap dissolved in a gallon of water. It is best to boil the soft soap in a quart of water before adding it to the rest of the water."

Melon Leaves, decayed.—Mr. Purnell Purnell brought Melon leaves, and wished to know what the disease was they were suffering from, and whether he should pull the plants up and burn them. He also said it was spreading rapidly, and he was afraid it might extend to other plants in the same house as well as his Cucumbers. Dr. Cooke reported upon them as follows :—" I have examined carefully the Melon leaves sent me. They are certainly not affected with the new Melon disease, nor can I find any trace of mycelium in the tissues, or the least evidence of fungus attack. I am of opinion the mishap is due to some external cause, like a sudden chill, and there is nothing to be found which is capable of infecting other plants. In so far as the leaves sent to me are concerned, I find no evidence of internal disease, and cannot recommend the destruction of the plants ; only their complete isolation may be prudent, so as to prevent communication with other Melon or Cucumber frames. Close attention may reveal the cause, but I cannot see why it should spread so rapidly. As a precaution I should pick off and burn diseased leaves ; but, if it is really a disease of internal origin, although it does not at all resemble the bacteriosis of Cucurbits, the microscope fails to detect any mycelium or spores in the tissues, which confirms me that it is not an organic disease. I shall be interested to know if any discovery is made from external surroundings, but as these are unknown to me I cannot offer any suggestions."

Potato Tuber Disease (*Fusarium Solani*, Mart.).—Dr. Cooke also contributed the following :—" A circumstance has occurred within the past few days which convinces me that we have a disease to contend with in stored Potatos which has not hitherto been estimated at its true importance. Not long since, some tubers were sent to the Committee, which, when cut, showed black blotches, and at the time I was inclined to think they might be caused by the ordinary Potato mildew running down the stems into the tubers ; but the microscope failed to give satisfaction, and the inference remained in doubt. Since that time tubers have been sent, which, when cut, exhibited the same blackened blotches. In one instance this was supplemented by a great number of convex pinkish pustules on the outside of the tubers, mixed with tufts of white mould. These pustules were the external manifestations of a compact pink mould, which has long been known to develop itself upon Potato tubers, but the general impression has been that it was only a saprophyte, which flourished upon spots already decayed. Mr. Worthington Smith intimated in 1884 that *Fusisporium Solani*, as it was then called, was 'not peculiar to decaying Potatos,' but was a veritable disease of stored Potatos, and of this there can be no longer any doubt. The black internal blotches at length become permeated by mycelium, which produces the characteristic conidia wherever they reach the external air. The pustules are about the size of a split hemp-seed, and sometimes larger, with a tendency to form rings, or at least to grow in company, of a rather compact substance, of a pale pinkish colour, often mixed with tufts of white floccose mould. The conidia are profuse, of a spindle shape, curved, and narrowed towards each end, divided transversely by three septa into four cells (40–60 by 7–8 μ). When mature, they are apt to separate at the septa, and then the angular cells become rounded, and either germinate at once, or undergo a period of rest. It must be remembered that a very large number of conidia are produced on each pustule, and that one secondary spore germinates from each of the four cells, so that it possesses great powers of disseminating and reproducing the disease. Every such diseased tuber should be removed and destroyed at once, and if the disease appears amongst stored Potatos, the application of some fungicide would be advisable so as to kill any scattered conidia. Probably some slight wound or bruise may be necessary for the mould to obtain entrance into sound Potatos, but to be forewarned is to be forearmed."

Professor Percival observed that the disease was infectious amongst stored Potatos, so that care should be taken to remove any that were affected.

Lily Disease.—Dr. Cooke reported as follows upon some diseased bulbs :—" Bulbs and young shoots of *Lilium candidum* were sent to the last Committee for report. The two bulbs did not exhibit, either externally or internally, any trace of disease. The young shoot, about six inches long, at first appeared to be vigorous, but very soon all the young leaves began to turn brown and die at the tips, gradually passing downwards, until only the basal portion of the leaves remained green. No mycelium could be found within the tissues, and although the shoot has been kept in a moist atmosphere for a week, there has been no further development. I am inclined to suspect that, if any form of fungus disease is present, it is due to the parasite described by Professor Marshall Ward (' Diseases of Plants,' p. 117); but there is no direct evidence to be found in the specimens sent for examination, and it is possible that the failure may be due to external circumstances and surroundings."

Turnip Varieties.—Mr. Gould, of Sleaford, wrote to say that there was no possibility of a mistake in the case of the ' Red Tankard ' Turnip described at the last meeting. He adds :—" I am leaving all the plants to seed again, to see what the next generation will produce. We are also planting one Cabbage, one Carrot, and one Mangold, and will let you know the result in due course."

Raspberry Canes and Pear Leaves diseased.—Mr. Gaut, of the Yorkshire College, Leeds, sent some examples from various places in Yorkshire. They were referred to Dr. Cooke and Mr. Saunders for examination and report.

Anthurium Scherzerianum.—Mr. Chapman showed two spikes, one having two spathes, from a plant which has borne thirty-six spikes, all of which were double-spathed. The other specimen was a seedling from this plant, but single-spathed, with a pale rose-coloured stripe along the midrib.

Stipa viridula, injurious to cattle.—The seeds of a species of *Stipa*, probably *S. viridula*, Trinius, were shown by Mr. E. M. Holmes, and were stated to have caused considerable losses amongst cattle on the Canadian ranches. This particular species appears to possess some poisonous principle, which has not yet received a careful chemical examination. An account of its properties is given in the *British Medical Journal*, 1898, p. 1,059. Haeckel states that *S. inebrians*, Hance, and *S. sibirica*, possess similar toxic properties. Other species, likewise fatal to cattle, owe their danger to the seeds. Those of *S. aristiglumis*, F. von Mueller, being said by Maiden to cause the death of numbers of cattle and sheep by becoming attached to the wool and working through the skin, causing intense fever, and often penetrating into the vitals. The chief danger of this kind arises in the autumn, when the grass is in fruit. Many of the species form excellent fodder for cattle at other times, such as *S. spartea* (Trinius), which constituted the winter food of the buffalo, and is now the delight of horses in the winter season. This species grows on the dry prairie; but *S. viridula* grows around badger-holes and throughout the prairie region westward to the Pacific. In New Mexico, *S. viridula* is known as "Sleepy Grass."

Plants exhibited.—Mr. H. J. Elwes, Colesborne, Cheltenham, brought the following:—(1) *Eremurus.* "The leaves of this plant are damaged, as I believe, by long-continued cold, wet, frost, and hail; but Mr. Hoog (Van Tubergen) thought it was a fungus which caused the decay, and advised the cutting off the leaves to prevent its spreading, but I cannot find after ten days that there is any confirmation of this." Dr. Cooke thought that Mr. Elwes's view was correct, and that if any fungus was present it had followed on the previous decay, so that the plants should not be sacrificed. (2) *Eucharis grandiflora.* This is attacked by a snail, especially where the foliage is above the soil. Mr. Chapman suggested plunging the whole pot in warm water for twenty-four hours, at intervals of ten days, as this, without injuring the plant, was effective against mites. (3) *Hymenocallis* sp. These proved to be nearly allied to *H. littoralis* and *H. caribæa.* (4) *Zizania aquatica* seedlings. Mr. Elwes observed that though supposed to be an annual it had become a perennial. Mr. Bowles added that he had had it for four years, but it had never flowered with him.

Darwin Tulips.—Mr. Shea exhibited a plant bearing four blossoms on one stem. Professor Percival observed that such had occurred in Kent, especially on the Darwin and old English varieties. Also that many Tulips had seven or more perianth leaves, while the bracts were coloured. Lastly, "singles" had become "doubles" this year. Mr. Elwes attributed these abnormal conditions to the perfect season of 1901 for ripening the bulbs.

Scientific Committee, June 10, 1902.

Dr. M. C. Cooke in the Chair, and seven members present.

Pear Leaves.—Mr. Saunders reported that the leaves submitted to him were attacked by the Pear-mite, *Eriophyes pyri.*

Fusarium Solani.—A letter was read from Professor Percival in which he stated that he had proved experimentally that healthy Potatos could be affected by this fungus.

The Narcissus-fly.—Rev. W. Wilks showed specimens of the perfect insect, *Merodon equestris,* which he had reared from bulbs sent him from Cornwall. (See p. 181, fig. 60.)

Diseased Fig.—A specimen was exhibited, and referred to Dr. Cooke for report. No fungus was visible, and the appearance was consistent with some check to growth. The Doctor reported:—"The green fruit was externally blackened on the upper surface, with an exudation of gummy matter around the mouth of the syconus, having a roseate tint. Neither the exudation nor the blackened cuticle exhibited any trace of fungus, either mycelium or sporules. In section the fruit seemed to be in a perfectly healthy condition. The whole appearance was rather that of some sudden check, either from change of temperature or some external circumstances, unconnected with any organic disease."

Iris, overgrowth of.—Miss E. Cocker sent specimens of *Iris squalens* which had apparently grown too fast and too vigorously, and in which in consequence the stems had snapped across as from some injury.

Moth on Pear.—Mr. Berry sent specimens on which Mr. Saunders reported :—" The little Pears are attacked by the grubs of a small two-winged fly, the 'Pear Midge' (*Diplosis pyrivora*). The fly lays her eggs in the blossoms before they are really open by piercing the petals with her ovipositor, and depositing her eggs on the anthers; sometimes they pierce the calyx. The grubs are soon hatched and they make their way into the embryo fruit and feed there until they are full-grown. They then make their way out of the Pears and drop to the ground, or if the Pear has already fallen they merely crawl out; in either case they bury themselves in the ground about an inch below the surface and become chrysalides, from which the flies emerge in the spring. In the case of espalier or other low trees, the best remedy is to pick off the infested fruit, which can easily be known by its distorted appearance. With large trees, where this method is impossible, a good dressing of kainit should be given where the Pears or grubs are likely to fall; this should be put on at once. In the autumn the ground should be well dug, and the surface turned down so that the little grubs or chrysalides may be buried so deeply that the flies when they emerge from the chrysalides cannot reach the surface."

Mr. Alfred Gaut, of the Yorkshire College, Leeds, also wrote on the same subject :—" Enclosed are some young Pear fruits infested with the larvæ of the Pear Gnat Midge (*Diplosis pyrivora*, Riley). I have visited several orchards and gardens between Malton and York this season, and find the attack is very bad indeed in this district. In some places almost the whole crop is destroyed.

" The most effectual methods of combating the pest are :—(1) As the larvæ, when they leave the fruits, bury themselves in the soil close to its surface to change to pupæ, to clear away the soil round the trees during the autumn or winter months and bury it deeply in trenches bringing back some food soil to the trees; this will also act as a top dressing. (2) To catch the young fruits on cloths as they fall to the ground about this time of the year; many of the larvæ can be destroyed in this way. (3) In orchards with grass, kainit or quicklime might be tried both at this time of year and also in early spring when the imago emerges from the pupa in the soil to lay her eggs in the Pear blossoms."

Tomatos.—Mr. Berry also sent specimens of diseased Tomato-stems in which no fungus was visible.

Apple Leaves crippled.—Mr. Getting, of Ross, showed Apple leaves puckered, and of a deep green colour. No aphis or fungus was visible. They had already been submitted to Mr. Newstead, who said that he could not find any insect present and that he did not consider the injuries had been caused by insects at all. Dr. Cooke, having examined them for fungus, reported that "although the Apple leaves may suggest an appearance similar to that of Pear Blister and Peach Curl, yet they are certainly not suffering from either of those diseases, but *what* it is I am puzzled to say. The microscope reveals no mycelium and no trace of sporules. I can find no evidence of fungus. I am keeping the leaves in a damp atmosphere for a few days in the remote prospect of some development, but I imagine we must look for the cause somewhere else in local conditions. There is not the least trace of insects or fungi."

Dr. Cooke, having again examined them very carefully, on account of the suspicious appearance of the midrib, which some members of the Committee suggested might be of fungoid origin, said that microscopical examination showed the presence in the tissues (which were somewhat disorganised) of myriads of minute bodies, which might possibly have connection with some kind of *Bacterium*, but he would not like to express an opinion without stronger evidence.

Tomatos.—Mr. Lumsdaine sent specimens of some grubs found in the stem of a Tomato, which were handed to Mr. Saunders, who reported :—"I have examined the Tomato plants as well as I could, but they were so covered with the soil that had been packed with them that it was impossible to do so properly, and I was unable to find any of 'the lively white maggots,' though I looked very carefully for them and split the stems right down to the roots, but I could find no trace of them. It is quite possible that they had got among the soil and had been crushed out of all recognition ; this frequently happens when soil is packed loose in a box. If your correspondent would send a piece of a stem free from soil, I should be very pleased to examine it and could, no doubt, tell him what the maggot was."

Insect injurious to Apple Graft.—In reply to a question from Mr. Dunlop, of Armagh, the following letter was read from Mr. Saunders :—"The beetle you sent to me the other day, said to be the cause of injury to Apple grafts at Loughall, co. Armagh, belongs to the weevil family, and is known as the 'Brown leaf weevil' ; its scientific name is *Phyllobius oblongus*. It is a well-known pest, feeding on the leaves and buds of various fruit-trees ; but I can find no record of its feeding on the bark. It is said to be particularly fond of attacking grafts, and if it will feed on the buds I can see no reason why it should not also feed on the bark, particularly when it is young and tender. It is recommended that the grafts should be smeared with grafting wax or clay, to keep the insects away ; but I feel uncertain whether this would not be prejudicial to the graft. These beetles can fly very well, but on a dull morning they might be shaken from the trees on a white sheet. The eggs are laid below the surface of the ground, and the grubs feed on the roots of various plants, and undergo their transformation in the soil. The beetles emerge in the spring. It might be useful early in the spring to give a good dressing of kainit, nitrate of soda, or soot, which would be injurious to the beetle when it emerges in a tender state from its chrysalis, and tries to make its way to the surface."

The Raspberry Moth, Lampronia rubiella (fig. 64).—The life-history of this insect is rather unusual. The moth emerges from the chrysalis in the spring, and the females lay their eggs in the open flower, the egg being laid just below the surface of the receptacle (the core of the fruit).

Here it feeds until the fruit is ripe; it then leaves its quarters, and spins a small white cocoon in some place at the foot of the bush, frequently selecting the stool. It remains in this cocoon all the winter, and in the spring makes its way to the buds, piercing them and feeding within them in the manner which is so well known. The most effective remedy is to pick off the infested buds or shoots and burn them, taking care that the caterpillars do not escape during the operation. It has been suggested that it would be useful to throw dressings of ashes, or sand mixed with paraffin (a quart of oil to a bushel of sand), among the stools in the winter, but I should think it was very questionable if this was of any practical use. Raking away the earth and rubbish from round the stocks, and then earthing them up again, has been recommended.

Virescent Tulip.—Mr. Saunders showed a specimen in which the perianth-segments were partially virescent, and in one instance, from irregular growth, the segments had been torn. The coloured portion

Fig. 64.—Lampronia rubiella.

uplifted with the growing stem, whilst the green portion remained beneath.

Cytisus Adami.—Dr. Masters exhibited fine specimens of this curious hybrid, from Bournemouth, showing both parental forms, and various intermediates proceeding from the same branch.

Roses Dying.—Specimens were exhibited wherein the upper shoots and the stock were dead or dying. The appearances were considered to be due to an overdose of strong manure.

Melon Disease.—Further specimens were shown. Dr. Cooke remarked that the Melon leaves were disfigured by the bleached orbicular spots, already familiar on leaves of Cucumber and Melon. Upon these spots were developed the characteristic hyphæ and spores of *Cercospora melonis*, the destructive mould already found, in so many instances, upon the leaves of Cucumber and Melon. This mould evidently is widely diffused over the country, and, as far as we can discover, cannot be influenced by any application of fungicides, as the disease is deeply seated in the host plant long before it makes any external appearance. Even the picking off of diseased leaves has no effect, and the only alternative seems to be to burn the plants and thoroughly disinfect the pit. In such a case, even, it would be extremely hazardous to use the same pit for Melons or Cucumbers for a year or two. Moreover, an infected pit should at once be isolated, and pits in which the disease has not appeared should be watched and protected.

Supposed Wild Form of Lilium candidum.—Dr. Masters showed from Mr. Sprenger, of Naples, specimens from the mountains of Calabria. The segments were smaller, narrower, and less recurved than in the ordinary cultivated form.

Fruit of the Tea-plant.—Dr. Masters exhibited from Mr. Guttridge, the Botanic Garden, Liverpool, a specimen of *Thea Bohea* bearing a ripe capsule. Similar but larger fruits are not uncommon in Camellias, but are not so often met with on the Tea-plant.

Diseased Larch.—Mr. Elwes sent specimens for examination and report.

Diseased Vines.—Mr. Close sent specimens in which the roots were dying or dead. On examination, it was considered that the mischief was due to an over-rich soil, or to having been kept too long in a pot.

Plum Pockets.—Mr. Holmes sent some pieces of *Prunus spinosa* in which the fruits showed an extraordinary development. They were yellowish, oblong obovate, and hollow, showing no sign of stone, the ordinary fruits being small and dark green. He considered that this development of the abortive fruit must be due to a fungus, as they presented a peculiar " bloom " like " curled " Almond and Peach leaves. It is worthy of note that if the same disease were to attack the Plum trees it would make a considerable difference in the crop. The specimens sent were from wild bushes near Hope's Nose, Torquay, and near Churston (seven or eight miles apart), where the Sloe bushes were covered with these aborted and distorted fruits. The aborted fruits were from $\frac{1}{2}$ to $\frac{3}{4}$ inch long, and of a pale yellowish colour, which gave them a very striking appearance.

Dr. Cooke said that the specimens of *Prunus spinosa* with the hollow spurious fruits, covered with a glaucous bloom, are attacked by a parasitic fungus, which converts the fruits into " bladders," and of course wholly destroys their character as fruits. This disease is not uncommon on cultivated Plums, but is rarely seen in this country on the Sloe. The fungus is named *Exoascus pruni*, and is closely related to the fungus which causes the Peach-leaf curl. Trees infected with this disease should not be permitted to grow in the neighbourhood of Plum trees.

FRUIT AND VEGETABLE COMMITTEE.

JANUARY 14, 1902.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and twenty-two members present.

Awards Recommended :—

Silver Knightian Medal.

To Messrs. Veitch, Chelsea, for 20 dishes of Pears, 'Winter Nelis,'

FIG. 65.—PEAR 'WINTER NELIS.' (*Journal of Horticulture.*)

'Joséphine de Malines,' 'Glou Morceau,' and 'Duchesse de Bordeaux' being particularly fine.

To Messrs. Laing, Forest Hill, for 60 dishes of Apples and Pears.

Silver Banksian Medal.

To Frank Bibby, Esq., Hardwicke Grange, Taylor), for 8 dishes of excellent Pears.

To W. Shuter, Esq., Belsize Grove, Hampstead (gr. Mr. Armstrong) for 16 bunches of Grapes and a cluster of Oranges.

First-class Certificate.

To Pear 'Winter Nelis' (votes, unanimous), from Messrs. Veitch, Chelsea. This first-rate late dessert variety is so well known that any description is superfluous beyond stating that it should be planted in every collection, however small and select, and that it is well worthy of a wall. (Figs. 65 and 66.)

Commended.

The Patent Powder Distributing Bellows, from de Luzy Frères, 44A Harold Street, Camberwell. This apparatus is very simple in its

FIG. 66.—PEAR 'WINTER NELIS.' (*The Garden.*)

mechanism, and distributes powder or sulphur in a fine shower or spray with just sufficient force to make the powder adhere to foliage.

Other Exhibits.

The Earl of Ancaster, Normanton Park, Stamford (gr. Mr. J. Butler), sent Rhubarb 'The Sutton.'

Captain Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), sent Pears 'General Wauchope' and 'Anchor.'

Mr. John Basham, Bassaleg, Newport, Mon., sent Apple 'St. Basil,' a pretty and highly coloured flat Apple.

Dr. Bonavia, Westwood, Worthing, sent a sample of 'Roman

Colognata' made from Quinces and resembling Quince jelly pressed into the form of a flat cake. The flavour was very sweet and agreeable.

FRUIT AND VEGETABLE COMMITTEE, JANUARY 28, 1902.

MR. GEO. BUNYARD, V.H.M., in the Chair, and sixteen members present.

Awards Recommended:—

Silver Banksian Medal.

To Lt.-Col. Vivian, Rood Ashton, Trowbridge (gr. Mr. W. S. Strugnell), for a collection of Apples.

Cultural Commendation.

To Mr. C. Dixon, gr. to the Earl of Ilchester, Holland House, Kensington, for excellent fruits of Pear 'Beurre Rance.'

To Mr. W. Allan, gr. to Lord Suffield, Gunton Park, Norwich, for remarkably large and good fruits of Pear 'President Barabe.'

To Mr. J. Harris, Blackpill, Swansea, for Potato 'Sir John Llewellyn,' grown both on the farm and in the garden.

Other Exhibits.

Mr. J. Watkins, J.P., Pomona Farm, Hereford, sent Apple 'Pomona's Dessert,' a very handsome fruit from 'Cox's Orange' × 'King of the Pippins'; also Apple 'Gidley's Pearmain,' raised by Mr. John Gidley, of Exeter, from pips of 'Cornish Gilliflower.' Both varieties were past their best, and the Committee desired to see them again next December.

FRUIT AND VEGETABLE COMMITTEE, FEBRUARY 11, 1902.

MR. GEO. BUNYARD, V.M.H., in the Chair, and twenty-two members present.

Awards Recommended:—

Gold Medal.

To Messrs. Bunyard, Maidstone, for 100 dishes of superb Apples.

Silver Knightian Medal.

To Messrs. Cheal, Crawley, for 75 dishes of Apples.

Other Exhibits.

Messrs. J. Veitch, Chelsea, sent well-grown heads of Seakale 'Lily White,' 'Beddard's Seedling,' and the ordinary variety.

Messrs. Laing, Forest Hill, staged 25 dishes of Apples.

Messrs. Cannell, Swanley, sent a small collection of Onions, 'Cocoa Nut' being specially noticeable for its size and soundness.

Messrs. Cheal staged Apple 'Crawley Reinette.'

Messrs. Hartland, Cork, sent Apple 'Ballinora Pippin,' a bright-red fruit of good flavour.

The Duke of Northumberland, Syon House, Brentford (gr. Mr. G. Wythes, V.M.H.), sent beautifully blanched Asparagus cut from beds that had been forced for many years.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon), sent very good fruits of Pear 'Bergamotte Esperen.'

FRUIT AND VEGETABLE COMMITTEE, FEBRUARY 25, 1902.

Mr. A. H. PEARSON in the Chair, and seventeen members present.

Awards Recommended :—

Cultural Commendation.

To Mr. W. Poupart, Twickenham, for excellent Asparagus and Seakale.

To Mr. W. Kneller, Malshangar Park Gardens, Basingstoke, for large well-kept bulbs of Onion 'Cranston's Excelsior.'

Other Exhibits.

Messrs. Rowe, Worcester, sent Apple 'Edward VII.,' a large green shapely fruit raised from 'Blenheim Orange' × 'Golden Knob.'

Messrs. Wood, Wood Green, sent several Sprayers.

T. C. Roberts, Esq., Earl's Court Gardens, sent a new apparatus arranged in circular tiers, one above another, for growing Strawberries in.

Mr. W. Sanderson, Sleaford, Lincs., sent Apple 'Golden Russet Nonpareil' and Pear 'Winter Nelis.'

J. Vale, Esq., Orleton, Hereford, sent a pretty Apple past its best, which the Committee wished to see again next January under a name.

The Duke of Richmond and Gordon, Goodwood, Chichester (gr. Mr. R. Parker), sent Apple 'Long Keeper,' very similar in all respects to 'Reinette de Canada.'

FRUIT AND VEGETABLE COMMITTEE, MARCH 11, 1902.

Mr. J. CHEAL in the Chair, and thirteen members present.

Awards Recommended :—

Silver Knightian Medal.

To Mr. W. Taylor, Hampton, for 18 dishes of very fine Apples and Pears.

Silver Banksian Medal.

To Lady Wantage, Lockinge Park, Wantage (gr. Mr. W. Fyfe), for six varieties of admirably grown Onions.

Other Exhibits.

The Duke of Rutland, Belvoir Castle, Grantham (Mr. W. H. Divers), staged Pears 'Court Queen' and 'Ne Plus Meuris,' and also Apple 'Scarlet Nonpareil.'

W. Boyes, Esq., Duffield Road, Derby, sent Apple 'Kirk Langley Pippin,' a large green shapely fruit which the Committee desired to see again, with particulars as to the growth of the tree and its cropping qualities.

Mr. Ward, Shobdon, Herefordshire, sent a supposed hybrid between the Apple and Pear. The fruits were all of a distinct Pear shape, with a skin and flesh exactly like that of the Apple. The Committee asked for fruits, with wood and foliage, to be sent later on. (Fig. 67.)

FIG. 67.—APPLE AND PEAR HYBRID. (*The Garden.*)

Messrs. Rivers, Sawbridgeworth, sent jam made from fruits of Plum 'Late Orange,' of very excellent flavour.

FRUIT AND VEGETABLE COMMITTEE, MARCH 25, 1902.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and fourteen members present.

Awards Recommended:—

Gold Medal.

To Messrs. J. Veitch, Chelsea, for 88 dishes of Apples and Pears in excellent condition.

Silver Knightian Medal.

To R. M. Whiting, Esq., Credenhill, Hereford, for 24 dishes of Apples.

Cultural Commendation.

To Mr. E. Beckett, gr. to Lord Aldenham, Aldenham House, Elstree, for two baskets of very fine Mushrooms.

Other Exhibits.

Mr. A. Kay, Barrowgate Road, Chiswick, exhibited a dish of large 'Catillac' Pears.

Messrs. Cheal, Crawley, sent nine dishes of dessert Apples.

Mr. F. Lane, Berkhampstead, sent fruits of Apple 'Red Blenheim Orange,' a variety of high colour and very white flesh.

Fruit and Vegetable Committee, April 8, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and sixteen members present.

Awards Recommended :—

Silver Banksian Medal.

To A. Hargreaves Brown, Esq., M.P., Broome Hall, Dorking, for a box of very fine 'Royal Sovereign' Strawberries.

Other Exhibits.

Messrs. Rowe, Worcester, sent Apple 'Edward VII.,' in excellent condition. The Committee desired to see it again later.

Mr. J. H. Beach, Hazells, near Gravesend, sent a new Patent Weed Extractor which was referred to Chiswick for trial.

Fruit and Vegetable Committee, April 22, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and nineteen members present.

Awards Recommended :—

Silver Banksian Medal.

To R. W. Hudson, Esq., Danesfield, Marlow (gr. Mr. J. Gibson), for an exceedingly fine dish of 'Duke of Albany' Peas.

Cultural Commendation.

To Mr. John Russell, Richmond, for very large head of Seakale 'Solid Ivory.'

Other Exhibits.

Mr. J. Ward, Shobdon, Hereford, staged a large unnamed local Apple of no special merit.

Miss Edmonds, Wiscombe Park, Colyton (gr. Mr. W. G. Herrod), sent fruits of Apples 'Adams's Pearmain.' The fruit had been kept in a tin box, instead of on trays, in an ordinary fruit loft, and was perfectly fresh and sound. This is a very fine late dessert Apple, worth growing more extensively.

Fruit and Vegetable Committee, May 6, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and eighteen members present.

Awards Recommended :—

Silver Banksian Medal.

To the Horticultural College, Swanley, for baskets and one box of Strawberry 'Royal Sovereign.'

Cultural Commendation.

To Mr. W. Clarke (gr. to Lady Plowden), Aston Rowant House, Oxon, for very fine Lemons.

Other Exhibits.

Messrs. Rowe, Worcester, sent Apple 'Edward VII.'

Messrs. R. Veitch, Exeter, sent three varieties of Radish, viz. 'Great Northern,' 'Great Western,' and 'Great Eastern.'

Messrs. Carter, High Holborn, sent Radish 'Icicle.'

The above Radishes were grown from seeds sent to Chiswick for trial.

FRUIT AND VEGETABLE COMMITTEE, MAY 20, 1902.

Mr. J. CHEAL in the Chair, and twelve members present.

Awards Recommended :—

Award of Merit.

To Peach 'Duke of York' (votes, unanimous), from Messrs. Rivers, Sawbridgeworth. Fruit large, deep, round, with a deep suture, and

FIG. 68.—PEACH 'DUKE OF YORK.' (*Journal of Horticulture.*)

prominent nipple; skin pale and nearly covered with a light red colour; flesh very melting and of delicious flavour, almost like the flavour of 'Noblesse' Peach. (Fig. 68.)

Cultural Commendation.

To Mr. J. Hudson, V.M.H. (gr. to Mr. Leopold de Rothschild, Esq.), Gunnersbury House, Acton, for a box of remarkably high-coloured 'Cardinal' Nectarines.

To Messrs. Rivers, for a box of exceptionally large fruits of 'Cardinal' Nectarines.

To Mr. G. Kelf, gr. to Miss Adamson, South Villa, Regent's Park, for a box of 'Royal Sovereign' Strawberries.

Other Exhibits.

Messrs. Thomas, Rodmersham, Sittingbourne, sent Apple 'Diamond Jubilee,' in excellent condition.

TEMPLE GARDENS.

Fruit and Vegetable Committee, May 28, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and twenty-five members present.

The list of cups and medals will be found on page xxvii.

Awards Recommended:—

Award of Merit.

To Cucumber 'British King' (votes, unanimous), from Mr. S. Mortimer, Rowledge, Farnham. A dark-spined variety of good shape, short neck, and slightly ribbed, of moderate length and a rich dark green colour. Raised from 'Sensation' × 'Famous.'

Other Exhibits.

Mr. J. J. Upton, Irlam, Manchester, staged Cucumber 'Commonwealth.'

Honble. A. H. T. de Montmorency, The Grange, Carrick Mines, Dublin, sent Potato 'The Scout.'

Lord Aldenham, Elstree, Herts (gr. Mr. E. Beckett), sent Vegetable Marrow 'Sutton's Perfection.'

Fruit and Vegetable Committee, June 10, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and thirteen Members present.

Awards Recommended:—

Silver Knightian Medal.

To J. Hodges, Esq., Fay Gate (gr. Mr. T. Le Pelley), for baskets and stands of Grapes.

Silver Banksain Medal.

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. J. Hudson, V.M.H.), for highly coloured and large fruits of Nectarines and Plums.

Award of Merit.

To Melon 'The President' (votes, unanimous), from Mr. W. J. Ingram, gr. to R. Burrell, Esq., Westley Hall, Bury St. Edmunds. Fruit large, roundish oval; skin green and deeply netted; flesh scarlet, thick, melting, and of excellent flavour. Raised from 'Royal Favourite' × 'Westley Hall.'

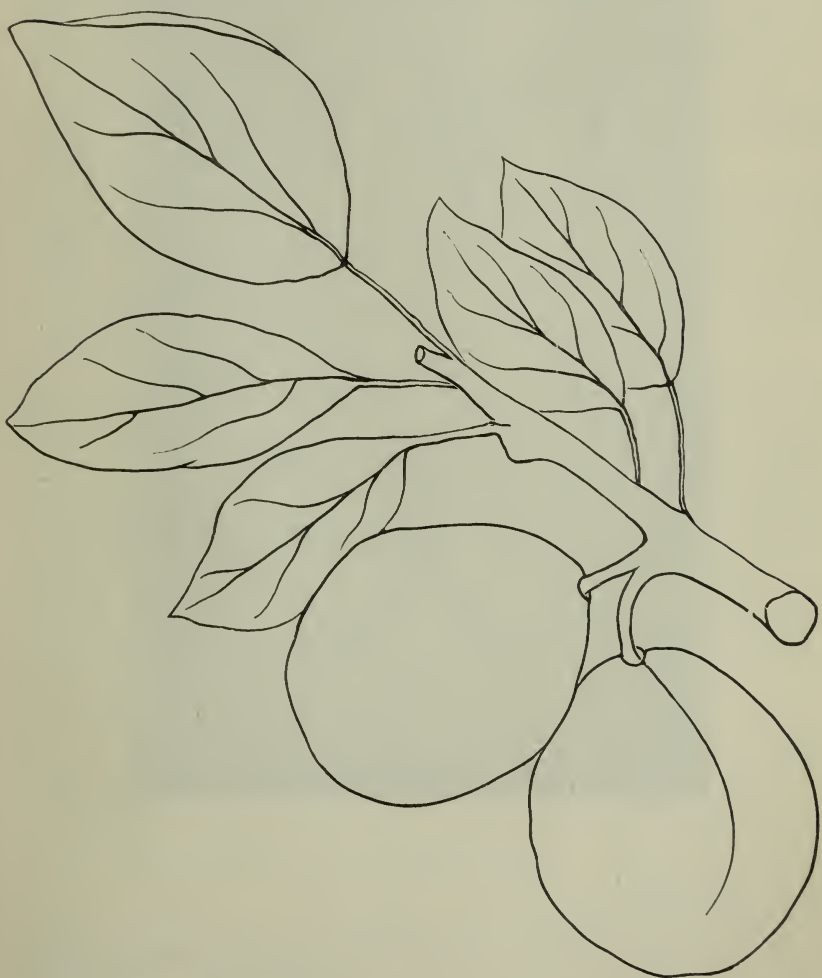
Commended.

To Mr. T. Le Pelley, for his system of packing Grapes in boxes and cross-handled baskets.

Other Exhibits.

Lord Braybrooke, Audley End, Saffron Walden (gr. Mr. J. Vert), sent Melon 'Golden Wedding,' overripe.

Messrs. Rowe, Worcester, sent Apple 'Edward VII.'



FLORAL COMMITTEE.

JANUARY 14, 1902.

Mr. W. MARSHALL in the Chair, and twenty-four members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Leopold de Rothschild, Esq., Ascott, Leighton Buzzard (gr. Mr. J. Jennings), for a remarkably fine group of *Begonia socotrana.*

FIG. 69.—MOSCHOSMA RIPARIUM. (*The Garden.*)

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for *Coleus thyrsoideus* and *Moschosma riparium*, both excellent plants for winter conservatory use. (Fig. 69.)

To Mr. Rochford, Broxbourne, for winter-flowering Begonias.

To Messrs. Cannell, Swanley, for flowering plants.

Silver Banksian Medal.

To Messrs. Low, Enfield, for Cyclamen.

To Mr. Godfrey, Exmouth, for a decorative arrangement of Chrysanthemums.

To Mr. Drost, Richmond, for forced Lilacs.

Award of Merit.

To *Amaryllis* (*Hippeastrum*) 'Impératrice du Brésil' (votes, unanimous), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). The plant exhibited was imported from Brazil last year, and is remarkable for its long stout neck or stem, similar to a robust Crinum, while its handsome flowers are suggestive of *Hippeastrum procerum*, also introduced from South America, but unfortunately not generally cultivated in this country. The plant in question is very vigorous, with broad, smooth, strap-shaped, drooping glaucous leaves, nearly 3 feet long by $2\frac{1}{2}$ inches broad, and carried five large fully expanded, exceedingly beautiful funnel-shaped flowers, arranged almost horizontally at the apex of the tall stout spike, the colour being very pale blue or delicate lilac, with a lighter centre and faintly speckled with lilac near the base of the throat. The segments are distinctly undulated along the margins.

To *Asparagus japonicus* (votes, unanimous), from Messrs. Elliott, Hurstpierpoint, Sussex. This seems to be a free-growing species, well adapted for the decoration of a cool or intermediate greenhouse and likely to prove a good pillar plant. Its growths are long and wiry, and the flat, deep green, ovate, lanceolate, opposite leaves, about a half-inch long, are arranged on slender branchlets.

To *Exacum Forbesii* (votes, 15 for), from Messrs. Jas. Veitch, Chelsea. Coming into blossom at mid-winter this free-flowering evergreen perennial, indigenous to the island of Socotra, is a useful and ornamental plant for the warm greenhouse. The specimens exhibited ranged from a foot to 16 inches high, similar in habit to but perhaps a trifle more bushy than *E. affine*, with erect shoots, clothed with deep glossy green opposite ovate leaves and small Solanum-like violet-blue flowers, half an inch or so across, borne in terminal cymes. The central cluster of golden yellow stamens gives it additional beauty. It was stated that up to the present time plants have failed to produce seed in this country, and propagation has to be carried on by means of cuttings, which root readily in sandy soil placed in a warm, close propagating case. (Fig. 70.)

To *Iris Tauri* (votes, unanimous), from Messrs. Wallace, Colchester. This recently introduced species is perfectly hardy and one of the most pleasing of early-flowering bulbous Irises, reminding one more of *I. Heldreichi* than any other, from which it differs principally by reason of its brighter and more intense shade of colour. It is a grand addition to the dwarf early-flowering group, is sturdy and free in growth, with short, lanceolate, glaucous leaves and fragrant violet-purple flowers. The dark blue falls are variegated with white and striped down the centre with golden yellow.

Other Exhibits.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon),

Fig. 70.—Exacum Forbesii. (*Gardeners' Chronicle.*)

sent flowering branches of *Hamamelis arborea*, a beautiful and rather curious hardy small-growing deciduous tree introduced from Japan exactly forty years ago.

Messrs. Cutbush, Highgate, sent a group of indoor flowering plants.

From Mr. Towndrow, Malvern Link, came a new zonal Pelargonium named 'Beauty.'

Messrs. Ware, Feltham, contributed spring flowers.

Mr. Lasson, Bermondsey Street, London, sent an example of patent lead glazing for plant houses.

Chrysanthemums were exhibited by—

1. Mrs. Evans, Forde Abbey, Chard (gr. Mr. J. Crook).
2. Mr. Springbett, Cheshunt.
3. Mr. Dyer, Frimley.

Floral Committee, January 28, 1902.

Mr. C. E. Shea in the Chair, and twenty-two members present.

Awards Recommended:—

Silver Flora Medal.

To Messrs. Hill, Lower Edmonton, for Ferns.

To Messrs. Sutton, Reading, for Primulas.

Bronze Flora Medal.

To Messrs. Barr, Covent Garden, for spring flowers.

Bronze Banksian Medal.

To Messrs. Wallace, Colchester, for bulbous Irises.

First-class Certificate.

To *Hæmanthus imperialis* (votes, unanimous), from M. Lucien Linden, Brussels. During the past few years several beautiful species, and apparently natural hybrid Hæmanthuses, have been introduced from the Belgian Congo State of Tropical Africa. The species in question is one of the finest of the genus, certainly much superior to the one named *H. mirabilis*, certificated March 26, 1901, and shown for comparison on the present occasion. The superiority of *H. imperialis* over the last-named species is that its flowers are larger and more enduring, as well as of a brighter and more pleasing shade of colour. The flowers are borne in large globular heads at the apex of a stout spike, nearly 18 inches high, and of a lovely shade of bright salmon orange. The leaves are large and deep green.

Award of Merit.

To *Primula sinensis* 'The Duchess' (votes, unanimous), from Messrs. Sutton, Reading. A remarkably pretty and distinct Chinese single Primula, with large delicate pink flowers with a broad well-defined rose-coloured zone near the prominent greenish-yellow centre. The edges of the petals are nearly white and beautifully fimbriated. (Fig. 71.)

To *Begonia alba grandiflora* (votes 10 for, 7 against), from Mr.

Lange, Hampton. Evidently a sport from the well-known hybrid *Begonia* 'Gloire de Lorraine,' and a welcome improvement on the variety named 'Caledonia,' also a sport from the same hybrid. The flowers are large and substantial, and borne on strong stems very much stiffer than those of 'Caledonia,' and thrown well above the foliage. The plant is robust and very floriferous, the flowers white, faintly suffused

Fig. 71.—Primula sinensis 'The Duchess.' (*Journal of Horticulture.*)

with pink when first expanded, but not nearly so pronounced as in the variety 'Turnford Hall,' certificated October 29, 1901.

Other Exhibits.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon), sent a plant of *Loropetalum chinense* bearing an abundance of small white flowers.

Sir Lawrence Alma Tadema, 34 Grove End Road, N.W. (gr. Mr. C. Willingham), sent *Begonia manicata variegata.*

Mr. C. Martin, gr. to the Isle of Wight C.C., Holyrood Street, Newport, I.W., sent flowers of *Primula sinensis* 'Island Gem.'

From Messrs. Ware, Feltham, came a small collection of spring flowers.

Messrs. Jas. Veitch, Chelsea, sent *Coleus thyrsoideus.*

FLORAL COMMITTEE, FEBRUARY 11, 1902.

Mr. C. E. SHEA in the Chair, and twenty-three members present.

Awards Recommended:—

Silver Flora Medal.

To Messrs. W. Paul, Waltham Cross, for *Clematis indivisa lobata.*

To Messrs. Cannell, Swanley, for Primulas.

Bronze Banksian Medal.

To Messrs. Jackman, Woking, for spring flowers.

To Messrs. Barr, Covent Garden, for spring flowers.

Other Exhibits.

Messrs. Jas. Veitch, Chelsea, sent hardy flowering shrubs, amongst them the beautiful *Halesia tetraptera.* (Fig. 72.)

Messrs. Cutbush, Highgate, sent Rhododendrons.

Mr. Caparne, Rohais, Guernsey, sent a small collection of unnamed early-flowering hybrid Irises.

Messrs. Low, Enfield, sent Cyclamen.

Messrs. Laing, Forest Hill, sent a group of foliage and flowering plants.

FLORAL COMMITTEE, FEBRUARY 25, 1902.

Mr. C. E. SHEA, in the Chair, and twenty-one members present.

Awards Recommended.

Silver-gilt Flora Medal.

To Messrs. W. Paul, Waltham Cross, for Camellias.

To Messrs, Cuthbert, Southgate, for forced shrubs.

Silver Flora Medal.

To Messrs. Cannell, Swanley, for Primulas and *Cotyledon (Echeveria) retusa.*

To Messrs. Low, Enfield, for flowering plants.

Silver Banksian Medal.

To Mr. Mount, Canterbury, for Roses.

To Messrs. Jas. Veitch, Chelsea, for *Amygdalus Persica magnifica* and *Cupressus Lawsoniana Stewartii.*

To Messrs Cutbush, Highgate, for flowering plants.

To Messrs. Jackman, Woking, for spring flowers.

To Messrs. Barr, Covent Garden, for hardy flowers.
To Messrs. Ware, Feltham, for hardy flowers.

Bronze Banksian Medal.

To Messrs. Peed, West Norwood, for *Primula obconica.*

FIG. 72.—HALESIA TETRAPTERA. (*Journal of Horticulture.*)

First-class Certificate.

To *Acacia cultriformis* (votes, unanimous), from Mrs. Denison, Little Gaddesden, Berkhampsted (gr. Mr. Gentle). It is remarkable that such a delightful species of Acacia as *cultriformis,* introduced from Southern

Australia so long ago as 1820 and submitted to the Floral Committee upon this occasion as *A. harpophylla*, should be so seldom seen, notwithstanding its beauty at flowering time and general utility for greenhouse decoration. It is free in growth with long arching shoots, clothed with short flat glaucous phyllodia (leaves), and in early spring bears great quantities of small canary-yellow flowers in terminal and axillary racemes, each raceme bearing from eight to fifteen small round heads of flowers.

Cultural Commendation.

To Mr. John N. May, Summit, New Jersey, U.S.A., for excellent flowers of Rose 'Mrs. Oliver Ames.' The Committee expressed a wish to see flowers from plants grown in this country.

Other Exhibits.

Mr. A. Chandler, Haslemere, sent an interesting collection of seedling Lachenalias.

Messrs. Low, Enfield, sent forced Lilac 'M. Buchner.' The Committee asked to see flowers from the open ground.

From Mr. H. T. Weeks, Garden Road, Bromley, came an invention for protecting Crocuses &c. from birds.

Messrs. Blampied & Taudevin, La Fosse, St. Martin's, Guernsey, and Mr. A. J. Guilbert, 15 Pollet Street, Guernsey, sent plants and sprays of an Asparagus named *plumosus Blampiedii* and *plumosus sarniensis* respectively. These proved to be identical, and the Committee adopted the name of *plumosus Blampiedii*, given by the first-named exhibitor.

Floral Committee, March 11, 1902.

Mr. W. Marshall in the Chair, and twenty-five members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Messrs. W. Paul, Waltham Cross), for forced shrubs.

Silver-gilt Banksian Medal.

To Messrs. Barr, Covent Garden, for hardy plants.

Silver Flora Medal.

To Colonel Rogers, Franklands, Burgess Hill, Sussex (gr. Mr. Murrell), for Cyclamen.

To Messrs. Low, Enfield, for Palms and flowering plants.

To Messrs. Jas. Veitch, Chelsea, for Clivias and *Loropetalum chinense.*

To Messrs. Cannell, Swanley, for Cinerarias, Primulas, and Cyclamen.

To Messrs. Cutbush, Highgate, for forced shrubs and Hepaticas.

Silver Banksian Medal.

To Messrs. Paul Cheshunt, for Lachenalias and Camellias.

To Messrs. Jackman, Woking, for Alpines.

To Messrs. Cuthbert, Southgate, for forced shrubs.

To Messrs. Wallace, Colchester, for bulbous and other plants.

Bronze Banksian Medal.

To Messrs. John Waterer, Bagshot, for *Pieris* (*Andromeda*) *japonica* and Conifers.

To Messrs. Ware, Feltham, for hardy flowers.

Award of Merit.

To *Lachenalia* 'W. E. Gumbleton' (votes 15 for, 2 against), from F. W. Moore, Esq., V.M.H., Glasnevin, Dublin. A very handsome variety resembling *L. chrysantha* with large deep golden yellow flowers, the unopened buds heavily shaded with orange-red.

Other Exhibits.

Lady Ancaster, Normanton, Stamford (gr. Mr. Butler), sent Violets.

Lady Wantage, Lockinge Park, Wantage (gr. Mr. Fyfe), sent beautiful flowers of Rose 'Fortune's Yellow.'

F. A. Bevan, Esq., Trent Park, New Barnet (gr. Mr. Parr), sent seedling Hippeastrums and *Primula stellata.*

From F. W. Moore, Esq., V.M.H., Glasnevin, Dublin, came seedling Lachenalias.

M. Arthur, Esq., Fullarton House, Troon, Ayrshire (gr. Mr. Henderson), sent Violets.

Mr. Norman, Chudleigh, Devon, sent a small Conifer stated to be a sport from *Biota orientalis.* It was very similar to *Retinospora ericoides.*

Mr. Fabius, Emsworth, Hants, sent *Pteris Wimsettii cristata.*

From Messrs. Laing, Forest Hill, came a group of foliage and flowering plants.

Floral Committee, March 25, 1902.

Mr. W. Marshall in the Chair, and nineteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Cuthbert, Southgate, for hardy Azaleas.

Silver-gilt Banksian Medal.

To Messrs. Jackman, Woking, for Alpines.

To Messrs. Cutbush, Highgate, for forced shrubs.

To Mr. Mount, Canterbury, for Roses.

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for Hyacinths, Clivias, and hardy shrubs.

Silver Banksian Medal.

To Messrs. Cannell, Swanley, for Cinerarias.

To Messrs. Low, Enfield, for forced shrubs.

To Messrs. Wallace, Colchester, for hardy bulbous plants.

Bronze Banksian Medal.

To Messrs. Laing, Forest Hill, for foliage and flowering plants.

First-class Certificate.

To *Iris warleyensis* (vote, unanimous), from Miss Willmott, V.M.H., Warley, Essex. This species recently introduced from Bokhara, appears

FIG. 73.—IRIS WARLEYENSIS. (*Journal of Horticulture.*)

to be rather slender in growth with glossy green lanceolate recurving leaves 10 inches long by an inch broad, slightly margined with white. In shape the faintly violet-scented flowers remind one of *I. orchioides*—a member of the Juno group—and stand well above the foliage, are pale blue with a conspicuous golden yellow blotch in the centre of the rich purple falls. (Fig. 73.)

Award of Merit.

To *Fritillaria askhabadensis* (votes, 15 for), from Miss Willmott, V.M.H., Warley. A new 'Crown Imperial' discovered in Kasakala, close

Fig. 74.—Fritillaria askabadensis. (*Journal of Horticulture.*)

to Askhabad, in the Trans-Caspian province of Russia, and similar in growth to *F. Imperialis.* It belongs to the sub-genus *Petilium,* and bears pale yellow drooping bell-shaped flowers, about 2 inches across, with prominent yellow stamens. (Fig. 74.)

To *Hippeastrum* 'Sir Christopher Wren' (votes, 11 for, 4 against), from Captain Holford, C.I.E., Weston Birt, Tetbury, Gloucester (gr. Mr.

A. Chapman). Flowers large and of splendid shape, colour rich rosy-crimson with deeper shadings towards the centre of the stout segments.

Other Exhibits.

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain), sent splendid flowers of *Lapageria rosea*, 'The Knoll' variety.

From the Dowager Lady Williams Wynn, Llangedwyn, Oswestry (gr. Mr. G. Squibbs), came plants and flowers of a new Violet named 'The Dowager Lady Williams Wynn,' a sport from 'Comte de Brazza.' It is free in growth and bears large fragrant perfectly double flowers.

Captain Holford, C.I.E., Weston Birt, Tetbury, Gloucestershire (gr. Mr. A. Chapman), sent a small group of choice seedling Hippeastrums.

F. W. Moore, Esq., V.M.H., Glasnevin, Dublin, sent flowers of *Lachenalia* 'W. Watson,' a grand variety raised between *L. reflexa aurea* and *L. Nelsoni.*

From Dr. Bonavia, Worthing, came flowers of Hyacinths which had been allowed to occupy the same ground undisturbed for four years.

Messrs. Barr, Covent Garden, sent a small collection of hardy flowers.

Messrs. Cripps, Tunbridge Wells, sent hardy shrubs and well-flowered plants of *Rogiera* (*Rondeletia*) *cordata.*

Mr. Brown, Brentwood, Essex, sent a collection of Hyacinths.

Messrs. Ware, Feltham, sent hardy flowers.

Mr. Wade, Colchester, sent hardy bulbous and other flowering plants.

From Messrs. Waterer, Bagshot, came a group of *Pieris* (*Andromeda*) *floribunda* bearing an abundance of small drooping white flowers.

Mr. Hockey, Bridgport, sent excellent flowers of Violet 'La France.'

From Messrs. Linden, Brussels, came *Hæmanthus maximus*, a handsome stove plant with bright salmon-coloured flowers.

Floral Committee, April 8, 1902.

Mr. G. Paul, V.M.H., in the Chair, and twenty-one members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To St. George's Nursery Company, Hanwell, for Cyclamen.

Silver Flora Medal.

To Messrs. W. Paul, Waltham Cross, for Roses and hardy shrubs.

To Messrs. Cannell, Swanley, for zonal Pelargoniums and Cinerarias.

To Messrs. Jackman, Woking, for hardy flowers.

Silver Banksian Medal.

To H. Little, Esq., Baronshalt, The Barons, East Twickenham (gr. Mr. Watts), for Clivias.

To Sir Francis T. Barry, Bart., M.P., St. Leonard's Hill, Windsor (gr. Mr. Brown), for Camellias.

To Messrs. Cutbush, Highgate, for forced shrubs.

Bronze Flora Medal.

To Messrs. Low, Enfield, for Roses and *Schizanthus wisetonensis.*

To Messrs. Wallace, Colchester, for hardy flowers.

To Mr. Perry, Winchmore Hill, for hardy flowers.

Bronze Banksian Medal.

To Messrs. Paul, Cheshunt, for Roses and Amaryllis.

To Messrs. Ware, Feltham, for hardy flowers.

FIG. 75.—PRIMULA VISCOSA HYBRID 'SPRING BEAUTY.' (*Gardeners' Chronicle.*)

First-class Certificate.

To *Iris bucharica* (votes, unanimous), from Miss Willmott, V.M.H., Warley, Essex. An exceedingly pretty dwarf new species introduced from Bokhara, with pure white flowers except for the broad lip or fall, which is canary yellow slightly speckled with brown.

Award of Merit.

To *Primula viscosa* 'Spring Beauty' (votes, 8 for), from E. A.

Hambro, Esq., Hayes, Kent (gr. Mr. Beale). This is a cross between *Primula viscosa* and Auricula C. J. Perry, and likely to prove a welcome addition to spring flowers, being quite distinct from either of its parents. Its Auricula-like leaves are broad, deep green with crenated margins, and its substantial purple flowers with conspicuous cream-white eye are borne on stiff stalks. (Fig. 75.)

To *Hippeastrum Sylvanus* (votes, 10 for, 5 against), from Messrs. Jas. Veitch, Chelsea. The bold flowers with reflexed overlapping segments are scarlet mottled and edged with white.

To *Hippeastrum Nysa* (votes, 11 for, 2 against), from Messrs. Jas. Veitch. A medium-sized deep crimson self-coloured flower of great substance.

To Show Auricula 'Mrs. Henwood' (votes, 17 for), from Mr. Jas. Douglas, V.M.H., Edenside, Great Bookham. A very fine broad green-edged variety with large flat flowers having a black zone near the clear white eye.

To Alpine Auricula 'Rosy Morn' (votes, 13 for, 1 against), from Mr. Jas. Douglas, V.M.H. Flowers large with a deep yellow eye, narrow purplish zone and a broad deep brownish red margin.

To Alpine Auricula 'Firefly' (votes, 17 for), from Mr. Jas. Douglas, V.M.H. A distinct and handsome variety with bold rosy red flowers and well-defined bright yellow eye.

Other Exhibits.

Miss Willmott, V.M.H., Warley, Essex, sent a small group of Muscarias.

From the Marquis of Londonderry, K.G., Wynyard Park, Stockton-on-Tees (gr. Mr. Gribble), came a small plant in flower of *Hæmanthus diadema.*

Captain Holford, C.I.E., Weston Birt, Tetbury (gr. Mr. Chapman), sent four very fine seedling Hippeastrums.

The Earl of Latham, Latham House, Ormskirk (gr. Mr. Ashton), sent some very fine bracts of *Euphorbia* (*Poinsettia*) *pulcherrima* from plants cut back at the beginning of January. Treated in this fashion they are very useful for Easter decorations.

From the Curator, Botanic Gardens, Cambridge, came flowering shoots of *Bignonia Tweediana* and *Cantua dependens.*

W. Carshaw, Esq., The Manor House, Thrumpton, Derby, sent Carnations.

Messrs. Paul, Cheshunt, sent China Rose 'Jean Bach Sisley.' The Committee asked to see flowers from the open ground.

Mr. Ching, Enfield, sent new zonal Pelargoniums.

From Messrs. Jas. Veitch, Chelsea, came *Kalanchoë Kirkii,* Cinerarias, Hippeastrums, and blue Primroses.

Mr. Wade, Colchester, sent hardy flowers.

Messrs. Laing, Forest Hill, staged a group of hardy ornamental foliage and flowering shrubs.

Mr. Turner, Slough, sent three varieties of Deutzias.

Messrs. Williams, Upper Holloway, sent foliage and flowering plants.

FLORAL COMMITTEE, APRIL 22, 1902.

Mr. W. MARSHALL in the Chair, and thirty-one members present.

Awards Recommended:—

Gold Medal.

To Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. Bain), for Anthuriums.

Silver-gilt Flora Medal.

To Messrs. Cuthbert, Southgate, for forced shrubs.

Silver-gilt Banksian Medal.

To Mr. Mount, Canterbury, for Roses.
To Messrs. Frank Cant, Colchester, for Roses.

Silver Flora Medal.

To Messrs. Carter, High Holborn, for Cinerarias.
To Mr. Mortimer, Rowledge, Farnham, for Polyanthus.
To Mr. Perry, Winchmore Hill, for herbaceous and Alpine plants.

Silver Banksian Medal.

To Messrs. Cutbush, Highgate, for hardy shrubs and greenhouse flowering plants.
To Messrs. Wallace, Colchester, for hardy plants.
To Messrs. Balchin, Hassocks, Sussex, for hard-wooded plants.
To Messrs. Cannell, Swanley, for zonal Pelargoniums.

Bronze Flora Medal.

To Messrs. Paul, Cheshunt, for Roses.

Bronze Banksian Medal.

To Messrs. Ware, Feltham, for hardy flowers.
To Messrs. Low, Enfield, for *Schizanthus Wisetonensis.*
To Messrs. Jackman, Woking, for hardy flowers.

Award of Merit.

To Border Auricula 'Alexandra' (votes, 16 for), from the Misses Hopkins, Mere Cottage, Knutsford. A very deep green-leaved variety, having fine trusses of large well-shaped lemon yellow flowers with a deeper centre.

To *Hippeastrum* 'Mrs. Bilney' (votes, unanimous), from Messrs. Jas. Veitch, Chelsea. A remarkably handsome flower, with broad stout reflexed scarlet segments, feathered, and margined with white.

To *Hippeastrum* 'Queen Alexandra' (votes, 15 for, 4 against), from Messrs. Jas. Veitch. Flowers much after the fashion of the last-named, but rather bigger, brighter in colour, more distinctly edged with white, and shaded with green in the throat.

To *Hippeastrum* 'General Buller' (votes, 13 for, 5 against), from Messrs. Jas. Veitch. This produces a very stout spike of large scarlet flowers, touched with green in the centre.

To *Pteris Wimsettii multiceps* (votes, 22 for), from Messrs. Hill, Lower Edmonton. This differs from the ordinary *P. Wimsettii* on account of its beautifully slender and much-crested tips, as well as being of a paler green. The plant is of very dense habit and free in growth.

To *Dimorphanthus mandschuricus folius argenteus marginatus* (votes, 17 for), from Mr. J. Russell, Richmond. An ornamental, vigorous, hardy, deciduous shrub or small tree of erect habit, with very large, flat, much-divided pale green leaves, irregularly margined with cream white. It delights in a sunny sheltered spot, and is useful for sub-tropical gardening.

Cultural Commendation.

To Mr. W. Howe, gr. to Lady Tate, Park Hill, Streatham Common, for a large plant of *Rhododendron Nuttallii*, a tender Himalayan species, bearing twenty-one flower trusses.

To Messrs. Balchin, Hassocks, Sussex, for hard-wooded plants.

Other Exhibits.

F. D. Godman, Esq., F.R.S., South Godstone (gr. Mr. Moody), sent Camellias and hybrid Rhododendrons.

Mrs. Collyer Bristow, Beddington Place, Croydon, sent a plant for name. It proved to be *Rohdea japonica*, an uncommon greenhouse plant, introduced from Japan in 1783, and formerly known as *Orontium japonicum*.

G. C. Maynard, Esq., Wymondham, Norfolk, sent a few small flowers of an unnamed Rose. The Committee asked to see a plant.

Mr. H. B. May, Upper Edmonton, sent a small group of new Ferns and *Dracæna Mayi*.

Mr. R. Forster, Nunhead Cemetery, S.E., sent flowers of Chrysanthemum 'Golden Shower.'

Mr. A. Wade, Colchester, sent hardy plants.

From Messrs. Jas. Veitch, Chelsea, came a group of *Prunus* (*Cerasus*) *pseudo-cerasus* 'James H. Veitch' and Cinerarias.

Mr. Pollen, Cranbrook, Kent, sent hardy flowering and ornamental foliage shrubs.

Messrs. Barr, Covent Garden, sent Aubrietias.

Messrs. W. Paul, Waltham Cross, sent forced shrubs.

Messrs. Cheal, Crawley, sent sprays of hardy flowering trees and shrubs.

Floral Committee, May 6, 1902.

Mr. W. Marshall in the Chair, and twenty-five members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Reamsbottom, Alderborough, King's County, Ireland, for a most beautiful display of the Alderborough strain of St. Brigid Anemones.

To Messrs. Frank Cant, Colchester, for Roses.

Silver-gilt Banksian Medal.

To Messrs. Jackman, Woking, for hardy flowers.

To Messrs. Storrie & Storrie, Dundee, for Auriculas and Polyanthuses.

Silver Flora Medal.

To Messrs. John Waterer, Bagshot, for Japanese Maples.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Messrs. Cheal, Crawley, for sprays of hardy flowering and ornamental-leaved trees and shrubs.

To Messrs. Jas. Veitch, Chelsea, for a group of *Primula japonica* and other spring-flowering plants.

To Mr. Russell, Richmond, for Japanese Maples.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

Silver Banksian Medal.

To Messrs. Carter, High Holborn, for *Cineraria stellata.*

To Mr. H. B. May, Upper Edmonton, for British Ferns and zonal Pelargoniums.

To Messrs. B. R. Cant, Colchester, for Roses.

To Messrs. Cutbush, Highgate, for Azaleas, Tree Pæonies, and Carnations.

To Mr. Walker, Thame, for 'Maréchal Niel' Roses.

To Mr. Turner, Slough, for *Primula Sieboldii* varieties and Auriculas.

To Messrs. Ware, Feltham, for hardy flowers.

Bronze Flora Medal.

To Mr. Caparne, Rohais, Guernsey, for Irises.

To Messrs. Wallace, Colchester, for hardy flowers.

Award of Merit.

To the Alderborough strain of St. Brigid Anemones (votes, unanimous), from Messrs. Reamsbottom, Alderborough, Geashill, King's co., Ireland. This strain is remarkable for the unusually large double and semi-double flowers in rich and varied colours from white through shades of pink, rose, scarlet, and crimson to purple and violet.

To *Saxifraga* 'Guildford Seedling' (votes, 13 for, 1 against), from the Guildford Hardy Plant Co., Millmead, Guildford. A mossy Saxifrage described as a cross between *S. Rhei* and *S. muscoides atropurpurea*, resembling in a great measure that of the first-named parent. The soft green leaves are forked at the tips, and the rosy-crimson flowers with a greenish-yellow centre are borne freely on slender stems six inches high.

To Ivy-leaved Pelargonium 'Col. Baden-Powell' (votes, 16 for), from Mr. Turner, Slough. This is a splendid variety, and considered an improvement upon 'Mrs. W. H. Martin,' certificated June 4, 1901. The semi-double flowers are large, pale pink streaked with crimson on the upper petals, and are borne in good-sized trusses.

Other Exhibits.

Frank Lloyd, Esq., Coombe House, Croydon, sent a small group of exceedingly well-grown *Primula obconica* in mauve and pure white flowered varieties.

Lady Susan Byng, Bayman Manor, Chesham, Bucks, sent a small group of *Schizanthus* and Mignonette.

G. Yeld, Esq., Clifton Cottage, York, sent *Anthericum* 'Arethusa,' the result of a cross between *A. algeriense* and *A. Liliastrum.* Its flowers are very much larger than those of the first-named parent, and in growth less stiff and more graceful.

H. E. Gordon, Esq., Aikenhead House, Catchcart, N.B. (gr. Mr. J. Boucher), sent a large truss *Rhododendron Nuttallii.*

From A. Fitter, Esq., Miramar, Streatham Hill (gr. Mr. W. Hurst), came a plant in flower of *Clianthus Dampieri*, the 'Glory Pea' of South Australia.

Mrs. S. A. Leathes, Charmouth, Dorset, sent flowers of an unnamed Rose. They had suffered greatly on the journey, so that no reliable opinion could be formed.

Mr. Ching, Forty Hill, Enfield, sent a group of zonal Pelargoniums.

Messrs. Laing, Forest Hill, sent a small group of hardy flowering shrubs.

Messrs. Gilbert, Dyke, Bourne, Lincs., sent single and double Anemones.

From Messrs. Barr, Covent Garden, came hardy flowers.

Messrs. Low, Enfield, sent Malmaison Carnations.

Floral Committee, May 20, 1902.

Mr. W. Marshall in the Chair, and nineteen members present.

Awards Recommended :—

Silver-gilt Banksian Medal.

To Messrs. James, Farnham Royal, Slough, for Calceolarias.

Silver Flora Medal.

To Messrs. B. R. Cant, Colchester, for Roses.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

Silver Banksian Medal.

To Messrs. Cutbush, Highgate, for Richardias, Liliums, and hardy Azaleas.

Bronze Flora Medal.

To Messrs. Cheal, Crawley, for sprays of hardy flowering and ornamental-leaved trees and shrubs.

Bronze Banksian Medal.

To Mr. Russell, Richmond, for stove and greenhouse plants.

To Messrs. W. Paul, Waltham Cross, for Roses.

To Messrs. Ware, Feltham, for hardy flowers.

Award of Merit.

To Malmaison Carnation 'Duchess of Westminster' (votes, unanimous), from his Grace the Duke of Westminster, Eaton Hall, Chester (gr. Mr. N. F. Barnes). A deliciously scented large and shapely salmon pink flower passing to silvery pink. The plant is vigorous and the leaves broad and glaucous.

To *Rosa Wichuriana* 'Dorothy Perkins' (votes, unanimous), from Mr. Potten, Cranbrook, Kent. This is the result of crossing H.P. 'Madame Gabriel Luizet' with *Rosa Wichuriana.* The progeny is of climbing habit with small bright green leaves and bears great clusters of fragrant double and semi-double warm pink flowers almost as big as a crown piece. A splendid Rose for rafters and pergolas.

To *Iris Barnumæ* (votes, 18 for), from Messrs. Ware, Feltham. This belongs to the Oncocyclus group, and is indigenous to Persia. It is quite hardy, free in growth, and bears large slightly fragrant flowers on stout stems. The broad incurving standards are bronzy purple with violet veins and the falls maroon purple.

Other Exhibits :—

A. K. Bulley, Esq., Ness, Neston, Cheshire, sent a small flowering plant of *Rehmannia glutinosa*, a very uncommon species from Northern China, introduced to British gardens in 1835, and flowered for the first time in this country in the Society's Gardens at Chiswick.

Miss E. Armitage, Dadnor, Ross, Hereford, sent flowers of an unnamed Iris. It proved to be *I. pumila tristis.*

Mr. R. Dean, V.M.H., Ranelagh Road, Ealing, sent a white-centred Alpine Auricula named 'Tillie.'

Messrs. Stark, Great Ryburgh, Norfolk, sent *Viola* 'Royal Sovereign.' The Committee requested that plants might be sent to Chiswick.

From Messrs. Cuthbert, Southgate, came a new Malmaison Carnation.

Mr. Potten, Cranbrook, Kent, sent Auriculas, Trollius, and Spiræas.

TEMPLE GARDENS.

Floral Committee, May 28, 1902.

Mr. W. Marshall in the Chair, and twenty-seven members present.

(The list of Cups and Medals will be found on page xxvii).

Awards Recommended :—

First class Certificate.

To *Nymphæa stellata* 'W. Stone' (votes, unanimous), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A distinct and beautiful hardy Water-lily with long pointed deep violet-blue petals and a central cluster of yellow stamens.

To *Darlingtonia californica rubra* (votes, 12 for), from Mr. A. Bruce, Edge Lane, Chorlton-cum-Hardy. This is perhaps best described as a brownish-red form of the well-known Californian pitcher plant.

Award of Merit.

To *Primula imperialis* (votes 11 for, 3 against), from Messrs. Jas. Veitch, Chelsea. An uncommon species from Java resembling *P. japonica* in growth, but with narrower leaves. Its golden yellow flowers are borne in whorls on stout stems 15 inches high.

To *Phyllocactus* 'Ernita' (votes, unanimous), from Messrs. Jas. Veitch, Chelsea. Beautifully shaped rich rose-pink flowers.

To *Papaver orientale* 'A. W. Chillery' (votes, 11 for, 4 against), from Mr. W. J. Godfrey, Exmouth. A big salmon-pink flower with a large black blotch on the lower portion of each petal.

To *Rhododendron* (*Azalea*) *rustica fl. pl. ramona* (votes, 12 for), from Messrs. Cuthbert, Southgate. A very pretty free-flowering, hardy, deciduous Azalea with large clusters of double and semi-double creamy white flowers suffused with blush pink.

To tree Pæony 'Queen Alexandra' (votes, unanimous), from Messrs. Kelway, Langport. A handsome saucer-shaped flower about 10 inches across, satin-white, with a prominent cluster of yellow stamens.

Fig. 76.—Iris sofarana magnifica. (*The Garden.*)

To *Freesia aurea* (votes, unanimous), from Messrs. Wallace, Colchester. A slender-growing South African reputedly hardy plant with canary-yellow tube-shaped scentless flowers, similar in shape and size to those of *F. refracta alba*, the edges of the lower segments stained with deeper yellow.

To *Iris sofarana magnifica* (votes, unanimous), from Messrs. Wallace, Colchester, and Messrs. Barr, Covent Garden. A grand Iris, reminding one of *I. susiana* and *I. atrofusca*, with large substantial flowers. The standards and falls are dark brown suffused with purplish crimson and beautifully netted. (Fig. 76.)

To Darwin Tulip 'Pride of Haarlem' (votes, unanimous), from Messrs. Barr, Covent Garden. A bold cup-shaped flower with stout rosy-scarlet petals. The centre or base is deep indigo-blue.

To *Thalictrum orientale* (votes, unanimous), from Mr. Amos Perry, Winchmore Hill. A pleasing border plant between two and three feet high, with glaucous much-divided, Maidenhair Fern-like leaves, and white ball-like flowers borne in great profusion well above the foliage.

Other Exhibits.

Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.), sent a hybrid Water-lily named 'Mrs. Ward.' The Committee asked to see this again.

R. I. Farrer, Esq., King Edward Street, Oxford, sent *Cineraria longifolia* and *Tiarella superba.*

Col. Rous, Worstead, Norfolk (gr. Mr. W. Chettleburgh), sent long flowering growths of *Bougainvillaea glabra* 'Maud Chettleburgh.'

The Hon. Mrs. Evelyn Cecil, Lytchett Heath, Poole (gr. Mr. Cox), sent flowers of *Gloriosa superba lutea.*

Messrs. Cripps, Tunbridge Wells, sent some new Japanese Maples.

Mr. E. Coppitters, Ghent, sent *Dracæna indivisa* 'King Edward VII.,' a variety with narrow leaves margined with cream-white.

Messrs. Hill, Lower Edmonton, sent new Ferns.

Messrs. Cutbush, Highgate, sent seven varieties of bedding Begonias. It was requested that plants might be sent to Chiswick for trial.

Mr. J. J. Upton, Irlam, Manchester, sent a new Fern.

Mr. B. Ruys, Moerheim, Dedemsvaart, Holland, sent *Aubrietia Moerheimi.*

From Mr. W. J. Godfrey, Exmouth, came a small group of Oriental Poppies.

Mr. James Pike, Park Road, Acton, sent Carnation 'Queen Alexandra,' a sport from the well-known 'Uriah Pike.'

Floral Committee, June 10, 1902.

Mr. W. Marshall in the Chair, and twenty-four members present.

Awards Recommended :—

Gold Medal.

To Messrs. Jas. Veitch, Chelsea, for Gloxinias, Eremurus, Pæonies, and Primulas.

Silver-gilt Flora Medal.

To Messrs. Cutbush, Highgate for Eremurus, Carnations, and Pyrethrums.

Silver-gilt Banksian Medal.

To Mr. Turner, Slough, for Carnations.

Silver Flora Medal.

To Messrs. Wallace, Colchester, for hardy flowers.
To Mr. Prichard, Christchurch, for hardy flowers.
To Messrs. Ware, Feltham, for hardy flowers.
To Messrs. Cannell, Swanley, for Begonias.
To Messrs. Kelway, Langport, for Pyrethrums and Pæonies.
To Mr. Perry, Winchmore Hill, for hardy flowers.

Silver Banksian Medal.

To Messrs. Barr, Covent Garden, for hardy flowers.

Bronze Flora Medal.

To Percy R. Dunn, Esq., Caisteal Tuath, Brockley Park, Forest Hill, for Calceolarias.

First-class Certificate.

To *Corydalis thalictrifolia* (votes, unanimous), from Messrs. Jas. Veitch, Chelsea. A new species from China bearing great quantities of short, slender, tube-shaped, yellow flowers in racemes—5 to 7 inches long—which stand clear of the much cut bright green Thalictrum-like leaves. Unfortunately it is not perfectly hardy, but can be well recommended for cool house and conservatory decoration, and when grown in pots will yield a display of flowers for several months together. It is easily raised from seed.

Award of Merit.

To *Iris* 'Sarpendon' (votes, unanimous), from G. Yeld, Esq., Clifton Cottage, York. This is the result of crossing *I. asiatica* with *I. pallida dalmatica.* The flowers retain the fragrance of the last-named parent and the size and colour of *I. asiatica*, the bold, upright standards are deep azure blue and the large drooping falls violet-purple, white on the basal portion, with pale purple venations and a yellow crest.

To Border Carnation 'Lady Hermione' (votes, unanimous), from Martin R. Smith, Esq., The Warren, Hayes, Kent (gr. Mr. C. Blick). A grand self-coloured, salmon-pink, sweet-scented flower with broad smooth petals. The plant is strong in growth.

To *Fuchsia triphylla hybrida* (votes, unanimous), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.) and J. T. Bennett-Poë, Esq., Holmewood, Cheshunt (gr. Mr. Downes). An exceedingly handsome free-flowering variety, similar in leaf and habit to *F. triphylla*, while the influence of *F. fulgens* is shown in the size of the flower. The colour is coral red and crimson.

To Double Begonia 'Exquisite' (votes, unanimous), from Messrs. Cannell, Swanley. A medium-sized, beautifully shaped, bright salmon flower, passing to silvery pink in the raised centre. The petals are broad with frilled margins.

To *Chrysanthemum frutescens* (Marguerite), 'Coronation' (votes, unanimous), from Messrs. Ward, Enfield Road, Southgate. In habit of growth this is identical with the well-known white-flowered Marguerite, but the flowers have a distinct raised anemone centre or disc. The florets or guard petals are broad and pure white.

To *Heuchera brizoides gracillima* (votes, unanimous), from Messrs. Wallace, Colchester. A graceful hardy plant with long wiry, branching flower spikes bearing a profusion of tiny rose-pink flowers. A useful plant for forcing for greenhouse embellishment in spring.

To *Fagus sylvatica* 'Paul's Gold-margined' (? *aurea marginata*) (votes, 20 for), from Messrs. Paul, Cheshunt. A free-growing attractive Beech with pale green leaves irregularly margined with yellow. A useful tree for decorative planting.

Other Exhibits.

Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.), sent long flowering shoots of *Rosa rugosa germanica* 'Conrad F. Meyer.' It is an exceedingly floriferous variety, and received an award of merit, June 4, 1901.

The Hon. Mrs. Lawrence, Minchinhampton, sent a plant of *Bryophyllum calycinum* with a very fine spike of bloom.

From H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. W. Noble), came a group of Gloxinias.

C. J. Lucas, Esq., Warnham Court, Horsham, sent Richardias.

Mr. Andrews, Campsea Ashe, Wickham Market, sent flowers of *Asclepias fruticosa* grown from seed gathered in South Africa.

From the Horticultural College, Swanley, came flowers of *Aristolochia elegans*.

Messrs. Cooper Taber, Southwark Street, S.E., sent Petunia 'Silver Star.'

Messrs. Laxton, Bedford, sent Pyrethrum 'Pink Pearl.'

Mr. H. J. Jones, Lewisham, sent six Spiræas.

From Messrs. Jackman, Woking, came a small collection of rare Alpines.

Messrs. Dobbie, Rothesay, sent Aquilegias and Pansies.

Messrs. Paul, Cheshunt, sent a group of hybrid Rhododendron plants and sprays of hardy foliage and flowering trees and shrubs.

Mr. E. Potten, Cranbrook, Kent, sent herbaceous flowers and Lilacs.

Messrs. Laing, Forest Hill, sent foliage and flowering plants.

Messrs. Peed, West Norwood, sent hardy flowers.

Messrs. Carter, High Holborn, sent Gloxinias.

Messrs. Ward, Enfield Road, Southgate, sent a group of *Chrysanthemum frutescens* (Marguerite) 'Coronation.'

Messrs. Cheal, Crawley, sent sprays of hardy ornamental trees and shrubs.

From Mr. R. Greenfield, jun., Bath Street, Leamington Spa, came plants of an Asparagus named *A. Greenfieldi*, probably a variety of *A. retrofractus*.

Messrs. James Green & Nephew, Queen Victoria Street, E.C., sent Munstead flower vases.

Mr. W. Miller, Berkswell, Coventry, submitted garden plans.

Carnations were exhibited by—

1. R. Heywood Thompson, Esq., Nunwick Hall, Penrith (gr. Mr. Jas. Kennan).
2. Martin R. Smith, Esq., The Warren, Hayes (gr. Mr. C. Blick).
3. Mrs. Ernest Hills, Redleaf, Penshurst.
4. Sydney Morris, Esq., Wretham Hall, Thetford (gr. Mr. G. Henley).
5. Messrs. Low, Enfield.

ORCHID COMMITTEE.

January 14, 1902.

Mr. Henry Little in the Chair, and sixteen members present.

Awards Recommended :—

Silver Flora Medal.

To Baron Sir H. Schröder, for a fine collection of cut spikes of extremely rare spotted *Odontoglossum crispum* and hybrids, and a fine selection of Cypripediums.

To Messrs. Williams, Holloway, for a group of Orchids.

Silver Banksian Medal.

To W. Shuter, Esq., Belsize Grove, Hampstead, for a group of *Cypripedium insigne, Saccolabium giganteum,* &c., grown within three miles of Charing Cross.

First-class Certificate.

To *Lælia anceps Chamberlainiana* (votes, unanimous), from De B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. Stables). The largest and best of the coloured forms of *Lælia anceps* of the *grandiflora* section. It originated in the gardens of the Right Honble. Joseph Chamberlain, M.P.

To *Odontoglossum* × *Wattianum* 'Hardy's variety' (votes, unanimous), from Baron Sir H. Schröder, The Dell, Egham (gr. Mr. H. Ballantine). A natural hybrid of *O. Harryanum.* Inflorescence very strong. Flowers as large as those of *O. Harryanum.* Sepals and petals pale yellow, with dark purple-brown markings. Lip white, with purple lines at the base.

To *Cypripedium* × *Leander* 'Cambridge Lodge variety' (*Leeanum* × *villosum*) (votes, unanimous), from R. I. Measures, Esq., Cambridge Lodge, Camberwell (gr. Mr. H. J. Chapman). Flowers large; dorsal sepal white, with small green base and purple lines. Petals and lip yellow, with a glossy red-brown tint.

To *Cypripedium* × 'Miss Fanny Wilson' (*Argus* × *Sanderianum*) (votes, unanimous), from Drewett O. Drewett, Esq., Riding Mill-on-Tyne. Upper sepal green, changing to white upwards, and bearing a dozen purple lines. Petals six inches long, whitish, tinged, and spotted with purple. Margin ciliate; lip reddish-rose; staminode reddish-yellow.

To *Cypripedium* × 'Mrs. Wm. Mostyn' ('Calypso' × ?) (votes, unanimous), from Francis Wellesley, Esq., Westfield, Woking (gr. Mr. J. Gilbert). A fine hybrid. Upper sepal green at the base, blotched with blackish purple. Central area suffused with rose purple; margin white. Petals and lip pale yellow and with a shining surface tinged with purple. (Fig. 77.)

To *Cattleya Trianæi* 'Mrs. Edward Sondheim' (votes, unanimous), from Messrs. Low, Bush Hill Park. Flower large and finely formed; pure white, with pale yellow disc to the lip.

Award of Merit.

To *Odontoglossum* × *Duvivierianum Burfordiense* (votes, unanimous), from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). A natural hybrid of *O. nebulosum.* Sepals greenish white, spotted with brown. Petals white, with red-brown spots on the inner halves; lip white, with brown spots.

To *Lælia anceps Hilliana Rosefieldiensis* (votes, unanimous), from De B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. Stables). Flower

Fig. 77.—Cypripedium × 'Mrs. W. Mostyn.' (*Journal of Horticulture.*)

white, with a slight blush tint and a clear pink colour on the side lobes and front of the lip.

To *Lælio-Cattleya* × 'Orpheus' (*L. glauca* × *C. Trianæi alba*) (votes, unanimous), from Messrs. Jas. Veitch, Chelsea. Flower of good form, fragrant, white, with sulphur yellow disc to the lip.

To *Cypripedium* × *Stevensii* ('Calypso' Oakwood variety × 'Albert Hye') (votes, unanimous), from W. Thompson, Esq., Walton Grange (gr.

Mr. W. Stevens). Upper sepal white, marked with purple on the lower part. Petals and lip greenish yellow, with a purple tinge.

Botanical Certificate.

To *Gomesa planifolia*, from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). Flowers in dense racemes; greenish yellow.

To *Ornithidium Sophronitis*, from R. I. Measures, Esq. (gr. Mr. H. J. Chapman). Plant dwarf, densely tufted; flowers scarlet.

Fig. 78.—Cypripedium × Venus, 'Oakwood Variety.' (*Journal of Horticulture.*)

Other Exhibits.

Messrs. Jas. Veitch, Chelsea, staged a group of hybrid Lælias, Lælio-Cattleyas, &c.

De B. Crawshay, Esq. (gr. Mr. Stables), showed cut examples of *Lælia anceps* and *Odontoglossum Leeanum Crawshayanum.*

Francis Wellesley, Esq. (gr. Mr. J. Gilbert), showed two distinct varieties of *Cypripedium insigne.*

M. Claes, Rue des Champs, Brussels, showed *Odontoglossum* × *Adrianæ* 'Romulus' and other Odontoglossums.

H. F. Simonds, Esq. (gr. Mr. Geo. E. Day), sent *Cypripedium insigne* 'H. F. Simonds.'

Arthur Sutton, Esq. (gr. Mr. Alex. Wright), showed two hybrid Cypripediums.

ORCHID COMMITTEE, JANUARY 28, 1902.

Mr. HARRY J. VEITCH in the Chair, and twenty members present.

Awards Recommended :—

Silver Flora Medal.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr W. H. Young), for a group of *Phalænopsis* and other Orchids.

FIG. 79.—LÆLIA ANCEPS HOLLIDAYANA CRAWSHAYANA. (*Gardeners' Chronicle.*)

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Dendrobiums, *Lælia anceps*, Calanthes, and Odontoglossums.

Silver Banksian Medal.

To Messrs. Charlesworth, Heaton, Bradford, for a collection of hybrid Orchids.

First-class Certificate.

To *Cypripedium* × *Venus* 'Oakwood variety' (*C. niveum* × *C. insigne Sanderæ*) (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. Wm. Murray). Flowers large, yellowish white, the dorsal sepal and petals spotted with small purple markings. (Fig. 78.)

To *Lælia anceps Hollidayana Crawshayana* (votes, unanimous), from De B. Crawshay, Esq., Rosefield, Sevenoaks (gr. Mr. Stables). A fine white flower with chocolate purple lines on the insides of the side lobes of the lip, and a pencilling of rose colour on the front lobe. (Fig. 79.)

Award of Merit.

To *Cypripedium × rubescens* 'Ranjitsinghi' (*C. œnanthum superbum × Boxallii*) (votes, unanimous), from Francis Wellesley, Esq., Westfield,

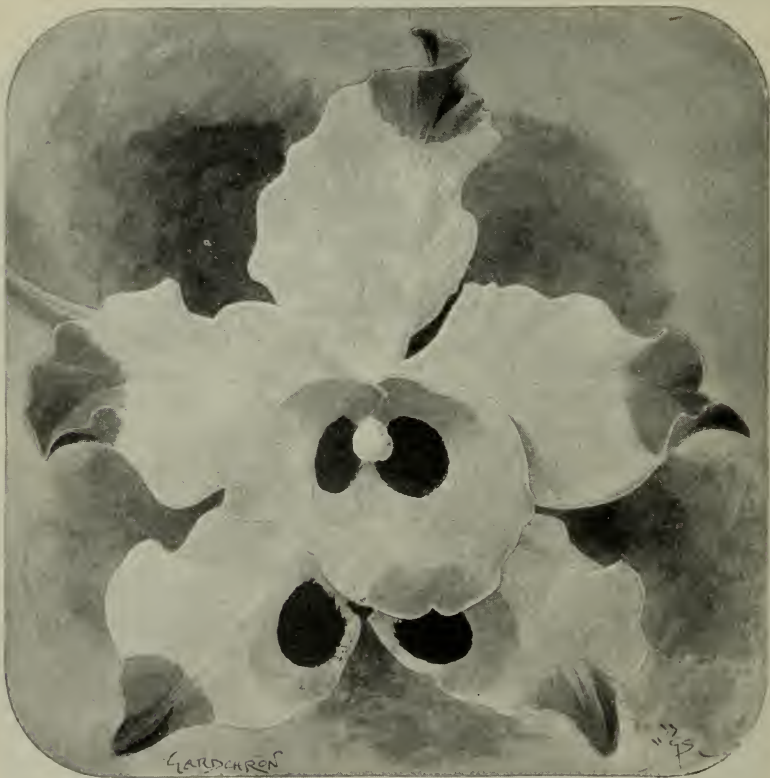


FIG. 80.—DENDROBIUM WARDIANUM FOWLERI. (*Gardeners' Chronicle.*)

Woking (gr. Mr. J. Gilbert). Upper sepal nearly black, with a white margin and a heavy purplish tint on the reverse side. Petals and lip Indian yellow with a chocolate-purple tinge.

To *Cypripedium × insigne Fowlerianum* (votes, 10 for, 8 against), from J. Gurney Fowler, Esq., Glebelands, South Woodford (gr. Mr. J. Davis). A finely formed flower of medium size and with large brown blotches equally distributed over the greater part of the dorsal sepal.

To *Dendrobium Wardianum Fowlerianum* (votes, 10 for, 6 against), from J. Gurney Fowler, Esq. All the flowers exhibited that form of peloria known as trilabellia, the lateral sepals being coloured with orange, and with a purple blotch as on the labellum. (Fig. 80.)

FIG. 81.—LÆLIO-CATTLEYA × 'QUEEN ALEXANDRA.' (*Journal of Horticulture.*)

(*To face page* xcix.)

To *Lælio-Cattleya* × *Cappei* (*L. cinnabarina* × *C. Warscewiczii*) (votes, unanimous), from Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young). Sepals and petals copper-yellow, lip crimson with purple veining.

To *Lycaste Skinneri* 'Lady Gladys' (votes, unanimous), from Messrs. Charlesworth, Heaton, Bradford. A fine pure white flower with a delicate freckling of rose on the petals.

Botanical Certificate.

To *Odontoglossum pardinum*, from H. T. Pitt, Esq., Rosslyn, Stamford Hill. Floral segments narrow, yellow, spotted with brown.

Cultural Commendation.

To Mr. Quartermain, gr. to A. Seth Smith, Esq., Silvermere, Cobham, for a fine specimen of *Angræcum sesquipedale* with ten flowers.

To Mr. Stables, gr. to De B. Crawshay, Esq., Rosefield, Sevenoaks, for *Odontoglossum Pescatorei Rosefieldiense*, with a branched spike of thirty-six flowers.

Other Exhibits.

F. Wellesley, Esq., Westfield (gr. Mr. J. Gilbert), showed hybrid Cypripediums.

De B. Crawshay, Esq. (gr. Mr. Stables), showed *Lælia* × 'Nemesis' (*L. anceps* × *L. superbiens*), with flowers resembling those of *L. superbiens*.

Messrs. Low showed three varieties of *Cattleya Trianæi*.

W. P. Burkinshaw, Esq., Hessle, Hull, sent *Lælio-Cattleya* × *Luminosa* (*L. tenebrosa* × *C. Dowiana aurea*).

H. T. Pitt, Esq. (gr. Mr. Thurgood), showed *Odontoglossum* × *loochristyense*.

Frau Ida Brandt, Zurich (gr. Mr. Schlecht), sent flowers of *Lycaste* and *Maxillaria*.

ORCHID COMMITTEE, FEBRUARY 11, 1902.

Mr. HARRY J. VEITCH in the Chair, and sixteen members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Dendrobiums, &c.

To Messrs. Charlesworth, Bradford, for a group of Orchids.

First-class Certificate.

To *Lælio-Cattleya* × 'Queen Alexandra' (*C. Trianæi* × *L.-C.* × 'Bella') (votes, unanimous), from Messrs. J. Veitch, Chelsea. A very showy flower. Sepals and petals light rosy lilac. Front of lip ruby red; disc orange colour; base white with purple lines. (Fig. 81.)

Award of Merit.

To *Cymbidium* × *Lowio-grandiflorum* (*C. Lowianum* × *C. grandiflorum*) (votes, unanimous), from Messrs. J. Veitch. Flowers nearly as large as those of *C. grandiflorum*, and with similar emerald-green sepals and petals; lip of the general appearance of *C. Lowianum*, but with a downy crest; whitish with red markings.

To *Cymbidium* × *Lowio-Mastersii* (*C. Lowianum* × *C. Mastersii*) (votes, unanimous), from Messrs. Charlesworth, Heaton, Bradford. Habit and flowers similar to *C.* × *Lowio-eburneum*, but smaller. Sepals and petals greenish-white; lip white with purple markings. In this the Cyperorchis section, to which *C. Mastersii* belongs, merges into typical *Cymbidium.*

To *Odontoglossum* × *Hallio-crispum heatonense* (*O. Hallii* × *O crispum*) (votes, unanimous), from Messrs. Charlesworth, Bradford. Sepals yellow with red-brown blotches, the tips being yellow; petals fringed, yellow, with red-brown blotches on the inner halves; lip pale yellow with a few reddish spots.

Cultural Commendation.

To Mr. Downes, gr. to J. T. Bennett-Poë, Holmewood, Cheshunt, for a fine plant of *Ipsea speciosa*, with six spikes of large bright yellow flowers. This and several other species are referred to *Pachystoma senile* by some authorities.

Other Exhibits.

H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood), showed *Cirrhopetalum appendiculatum.*

Leopold de Rothschild, Esq. (gr. Mr. J. Hudson), showed *Cattleya Trianæi* var. *Mariæ*, a fine and richly coloured form.

The Rev. F. Paynter (gr. Mr. Cooke) sent a hybrid Cypripedium near to *C.* × *tessellatum porphyreum.*

Messrs. Low showed *Dendrobium nobile virginale* 'Low's variety,' and *Cypripedium* × *insigne* × *bellatulum.*

E. C. Bliss, Esq., Tulse Hill (gr. Mr. Parker), showed a fine specimen of *Cœlogyne cristata.*

W. M. Low, Esq., Wellesbourne, Warwick (gr. Mr. H. Liney), showed *Odontoglossum* × *loochristyense* 'Wellesbourne House variety.'

Messrs. Dowel, Ravenscourt Avenue, Hammersmith, showed a varied assortment of Orchid pots, pans, and potting materials.

ORCHID COMMITTEE, FEBRUARY 25, 1902.

Mr. NORMAN C. COOKSON in the Chair, and fourteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Messrs. Sander, St. Albans, for a group of Orchids.

Silver Flora Medal.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To Mr. Cypher, Cheltenham, for a group of Dendrobiums.

Silver Banksian Medal.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White), for a group of rare Masdevallias, hybrid Cypripediums, and other Orchids.

To Captain Holford, C.I.E., Westonbirt (gr. Mr. Alexander), for a group of *Cattleya Trianæi*, Odontoglossums, &c.

First-class Certificate.

To *Zygo-Colax* × *Wiganianus superbus* (*Z. intermedium* × *C. jugosus*) (votes, unanimous), from Messrs. Sander, St. Albans. A fine improvement on the original. Sepals and petals pale green, marked with chocolate purple; lip white, with heavy violet-coloured markings. (Fig. 82.)

Award of Merit.

To *Cypripedium* × 'A. Dimmock' (*Godseffianum* × *Drurii*) (votes, unanimous). from Messrs. Sander, St. Albans. Upper sepal green, at the

Fig. 82.—Zygo-Colax × Wiganianus superbus. (*Journal of Horticulture.*)

base spotted with purple; middle area rose; upper part white, a broad blackish band running up the middle. Petals and lip yellow, marked with purple-brown. (Fig. 83.)

To *Lælio-Cattleya* × *Chôletiana* (*L. superbiens* × *C. Mossiæ*) (votes, unanimous), from Messrs. Sander, St. Albans, and Messrs. Low, Bush Hill Park. Habit of *L. superbiens*, but dwarfer. Flowers several on a spike, in form and colour resembling *L. superbiens*, but as large as *C. Mossiæ*. Sepals and petals light rosy lilac. Lip dark rose with yellow disc. (Fig. 84.)

To *Odontoglossum* × *loochristyense enfieldense* (votes, 7 for, 1 against) from Messrs. Low, Bush Hill Park. Flowers broad and finely formed canary yellow, with a few large reddish-brown blotches.

To *Phaio-Calanthe* × 'Ruby' (*P. Sanderianus* × C. × 'Oakwood Ruby') (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. Wm. Murray). Flowers rosy lilac, with claret-purple lip.

To *Odontoglossum crispum* 'Mabel Whateley' (votes, 8 for, 4 against), from H. Whateley, Esq., Kenilworth (gr. Mr. Cook). A good form. Sepals heavily blotched with purple at the back, and with corresponding blotches on the face. Petals white with a large irregular red-brown blotch extending across each; lip white with yellow crest and a few brown blotches.

To *Cypripedium* × 'Felicity' (? *callosum* × *tonsum*) (votes, 8 for, 3 against), from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). A

Fig. 83.—Cypripedium × 'A. Dimmock.' (*Gardeners' Chronicle.*)

delicately tinted flower with a pale whitish-green ground colour, slightly tinged with rose-pink, the upper part of the dorsal sepal being white.

To *Cypripedium* × *Dowlerianum* (*C. insigne punctatum violaceum* × *C. Godefroyæ leucochilum*) (votes, unanimous), from W. M. Appleton, Esq., Weston-super-Mare. Resembling an enlarged *C. Godefroyæ*. Flowers yellowish, finely marked with dark purple.

Cultural Commendation.

To Mr. Duncan, gr. to C. J. Lucas, Esq., Horsham, for well-flowered plants of *Odontoglossum coronarium brevifolium.*

To Mr. Seaman, gr. to G. Taylor, Esq., Reigate, for *Dendrobium speciosum* with ten spikes.

Other Exhibits.

Messrs. Charlesworth, Bradford, staged a group of hybrid Orchids.

FIG. 84.—LÆLIO-CATTLEYA × CHÔLETIANA. (*Journal of Horticulture.*

H. F. Simonds, Esq. (gr. Mr. Geo. Day), showed *Odontoglossum* × *Adrianæ* 'Mrs. Simonds.'

Geo. Singer, Esq., Coventry (gr. Mr. Collier), showed *Cypripedium* × *Coundoniense* (× *Leeanum ?*).

W. C. Walker, Esq. (gr. Mr. Geo. Cragge), sent *Odontoglossum crispum* 'Avice.'

Fred. Hardy, Esq. (gr. Mr. T. Stafford), sent flowers of three hybrid Cypripediums.

R. G. Thwaites, Esq., Streatham (gr. Mr. Black), sent *Dendrobium* × *Wiganianum album.*

D. M. Grimsdale, Esq., Uxbridge (gr. Mr. Hooker), showed *Cypripedium villosum.*

Malcolm S. Cooke, Esq., Kingston Hill (gr. Mr. Buckell), sent *Odontoglossum Rossii majus.*

R. I. Measures, Esq., Camberwell (gr. Mr. H. J. Chapman), showed *Cypripedium × Argo-Arthurianum.*

ORCHID COMMITTEE, MARCH 11, 1902.

Mr. HARRY J. VEITCH in the Chair, and nineteen members present.

Awards Recommended :—

Silver Flora Medal.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White), for a group of fine Dendrobiums, Masdevallias, &c.

To Frank A. Rehder, Esq. (gr. Mr. Norris), for a group of Cypripediums and Dendrobiums.

To Messrs. Jas. Veitch for a group of hybrid Lælias, &c.

To Messrs. Sander for a group of hybrid *Phaius*, &c.

To Mr. Cypher, Cheltenham, for a collection of finely flowered Dendrobiums.

To Messrs. Stanley, Ashton, for a group of Orchids.

First-class Certificate.

To *Lælia × Digbyano-purpurata* 'Edward VII.' (*L. Digbyana × L. purpurata*) (votes, unanimous), from Messrs. Jas. Veitch, Chelsea. A very remarkable improvement on the original variety in every respect. Sepals and petals white veined with purple. Lip very large, in form resembling that of *L. Digbyana* but extraordinarily developed. Base primrose colour, fronted by a white band from which radiates rose purple veining extending into the light rosy lilac fringed front lobe. (Fig. 85.)

Award of Merit.

To *Lælio-Cattleya × purpurato-Schilleriana Whateleyæ* (*L. purpurata × C. Schilleriana*) (votes, unanimous), from H. Whateley, Esq., Priory Lawn, Kenilworth. Plant and flower inclining to *C. Schilleriana.* Sepals and petals tinged with light purple; lip front glowing ruby red; disc yellow with dark red lines; side lobes white with purple veining.

To *Dendrobium* × 'Euryalus Apollo album' (*nobile pulcherrimum × splendidissimum grandiflorum*) (votes, unanimous), from Mr. Cypher, Cheltenham. A beautiful variety with finely formed white flowers with claret purple disc to the lip.

Botanical Certificate.

To *Masdevallia minuta*, Lindl., from R. I. Measures, Esq., Camberwell (gr. Mr. H. J. Chapman). A dwarf tufted species from Guiana with numerous white flowers.

Cultural Commendation.

To Mr. W. Stevens, gr. to W. Thompson, Esq., Stone, for a fine plant of *Odontoglossum pulchellum majus* with sixteen spikes.

Fig. 85.—Lælio Digbyano-purpurata, var. 'King Edward VII.' (*Journal of Horticulture.*)

(*To face page* civ.)

To Mr. Scutcher, gr. to J. Ebner, Esq., for a fine specimen of *Odontoglossum mirandum*, Rchb. f.

Other Exhibits.

Geo. Singer, Esq., Cormdon Court, Coventry (gr. Mr. J. Collier), showed varieties of *Cattleya Trianæi*, *Cypripedium* × 'Olivia' and cut spikes of hybrid *Phalænopsis*.

H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood), showed Odontoglossums.

Baron Sir H. Schröder (gr. Mr. H. Ballantine), sent *Odontoglossum crispum Truffautianum.*

A. Warburton, Esq., Haslingden, sent *Odontoglossum crispum Lindeni.*

J. Ebner, Esq. (gr. Mr. Scutcher), showed *Cypripedium* × *Lathamianum* × *villosum.*

Mrs. Haywood, Reigate (gr. Mr. C. J. Salter), sent two hybrid Dendrobiums.

Fred Hardy, Esq. (gr. Mr. Stafford), showed three hybrid Cypripediums.

F. Wellesley, Esq. (gr. Mr. Gilbert) showed *Lælio-Cattleya* × *Gottoiana* 'Westfield variety.'

Messrs. Low sent *Lælia-Cattleya* × *Lucasiana.*

Orchid Committee, March 25, 1902.

Mr. Harry J. Veitch in the Chair, and twenty-one members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Jas. Veitch for a group of Lælio-Cattleyas and other Orchids.

To Messrs. Sander, St. Albans, for a group of Orchids.

To Messrs. Charlesworth, Bradford, for a group of Orchids.

To H. T. Pitt, Esq. (gr. Mr. Thurgood), for a group of Odontoglossums &c.

Silver Banksian Medal.

To W. P. Burkinshaw, Esq., Hessle (gr. Mr. Barker), for a collection of Dendrobiums.

To Messrs. Stanley, Ashton, Southgate, for a group of *Lælia Jongheana.*

To J. Colman, Esq., Gatton Park (gr. Mr. Bound), for a group of Odontoglossums, Cymbidiums, &c.

First-class Certificate.

To *Odontoglossum* × *Adrianæ* 'Mrs. Robert Benson' (votes, 18 for, 3 against), from Captain Holford, C.I.E. (gr. Mr. Alexander). This plant received an Award of Merit, Feb. 26, 1901, but has improved. Flowers large, cream white, spotted with red brown. (Fig. 86.)

To *Lælio-Cattleya* × 'Rosalind Prince of Wales' (*L.-C.* × *Dominiana* × *C. Trianæi*) (votes, unanimous), from Messrs. Jas. Veitch. Sepals rosy lilac; petals purplish crimson; lip ruby purple with yellow disc.

To *Lælio-Cattleya* × *Digbyano-Schröderæ* (*L. Digbyana* × *C. Schröderæ*) (votes, unanimous), from Messrs. Jas. Veitch. Flowers white slightly tinged with rose; lip fringed.

To *Cattleya guttata Prinzii Sanderæ* (votes, unanimous), from Messrs. Sander, St. Albans. An albino of the species more commonly known as *C. amethystoglossa.*

Award of Merit.

To *Cattleya* × 'Parthenia' *vernalis* (*C. calumnata fimbriata* × *C.*

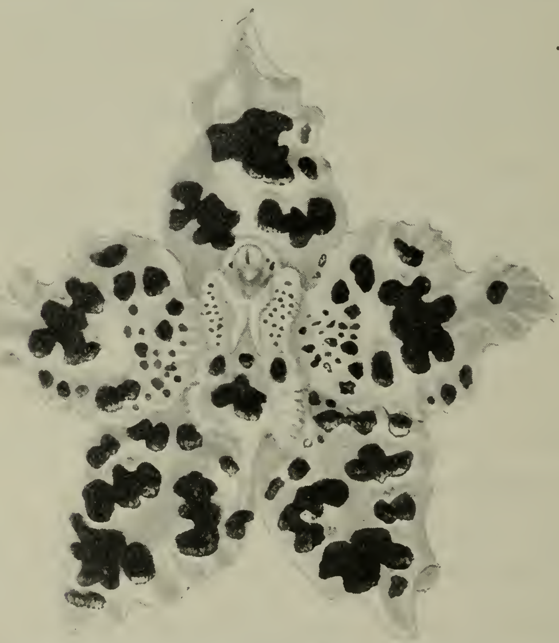


Fig. 86.—Odontoglossum Adrianæ, var. 'Mrs. R. Benson.' (*Journal of Horticulture.*)

Mossiæ) (votes, unanimous), from the Right Honble. Lord Rothschild (gr. Mr. E. Hill). Flowers white with rose-pink marking on the lip.

To *Odontoglossum* × *loochristyense* 'Lady Victoria Grenfell' (votes, unanimous), from Captain Holford, C.I.E. A very fine variety resembling *O.* × *l. Rochfordianum.* Flowers bright yellow heavily blotched with red brown.

To *Sophro-Lælia* × *læta Orpetiana* (*S. grandiflora* × *L. Dayana*) (votes, unanimous), from Capt. Holford. Plant dwarf, flowers rose-tinted scarlet.

To *Odontoglossum Andersonianum Pittianum* (votes, unanimous), from H. T. Pitt, Esq. (gr. Mr. Thurgood). A large darkly blotched variety of the *O.* × *Ruckerianum* section.

To *Cypripedium* × 'William Pitt' (votes, unanimous) (parentage unrecorded), from H. T. Pitt, Esq. (gr. Mr. Thurgood). Flowers white with rose tint and small dark spots on the petals and upper sepal.

To *Lælio-Cattleya* × 'Myra Princess of Wales' (*C. Trianæi* × *L. flava*) (votes, unanimous), from Messrs. Jas. Veitch. Sepals and petals light orange; lip claret-crimson.

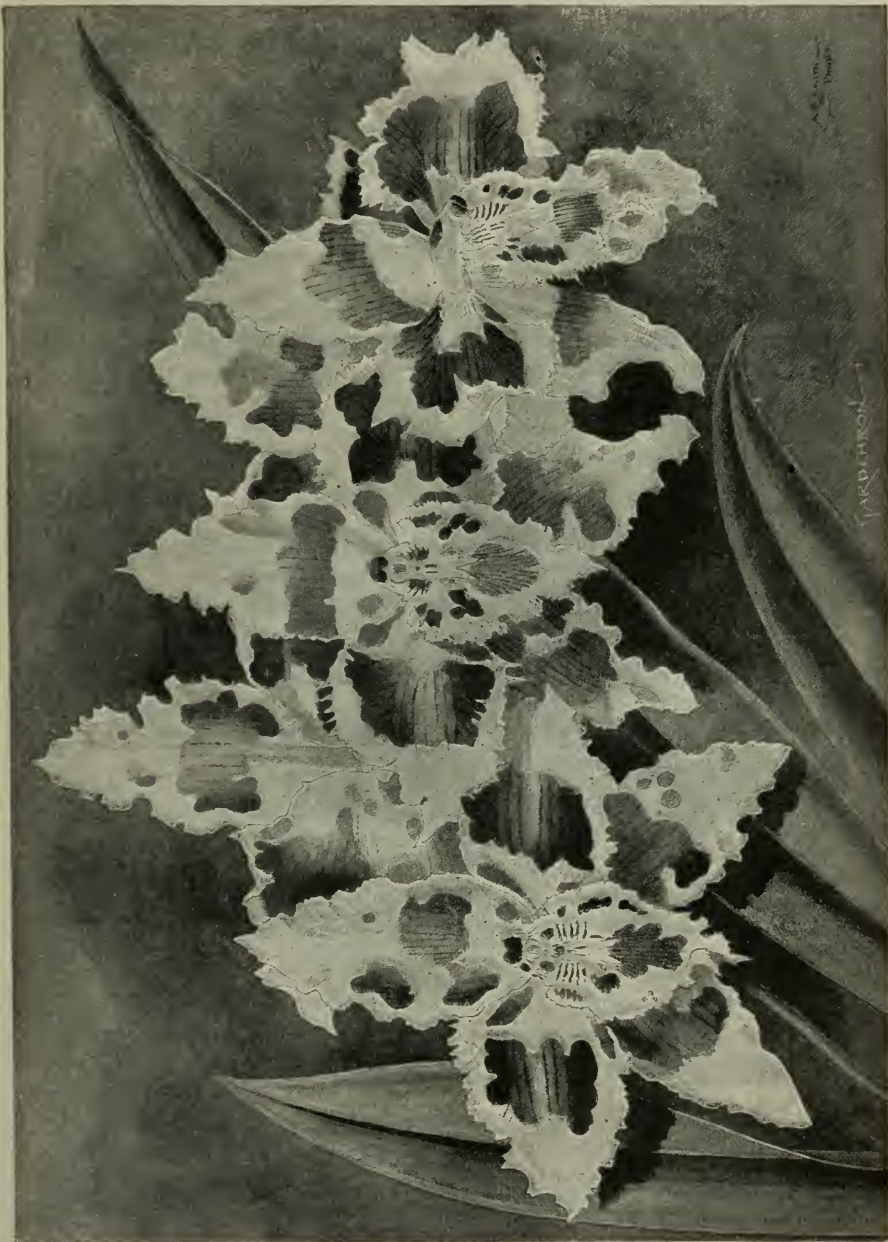


Fig. 87.—Odontoglossum crispum 'Miss Lucienne Linden.' (*Gardeners' Chronicle.*)

To *Dendrobium* × *Rolfeæ roseum* (votes, unanimous), from W. P. Burkinshaw, Esq. (gr. Mr. Barker). Flowers resembling *D. nobile*, but without the dark blotch on the lip.

To *Odontoglossum crispum* 'Miss Lucienne Linden' (votes, 19 for, 1 against), from Messrs. Linden, Brussels. (Fig. 87.)

Other Exhibits.

Messrs. Linden, Brussels, showed a collection of Odontoglossums.

M. Claes, Brussels, showed varieties of *Odontoglossum* × *Adrianæ.*

Messrs. Low sent *Lycaste* × *Balliæ* and other Orchids.

F. W. Moore, Esq., V.M.H., Glasnevin, sent *Gongora Charontis.*

Captain Holford, C.I.E., showed *Dendrobium* × 'Sibyl' *magnificum* with a many-flowered pseudo-bulb over three feet in length.

G. F. Moore, Esq., Bourton-on-the-Water (gr. Mr. Morris), showed as *Phaio-Cymbidium* × *Chardwarensis* a supposed hybrid between *Phaius grandifolius* and *Cymbidium giganteum.* The flowers resembled *Phaius* × *maculato-grandifolius.*

W. B. Latham, Esq., Botanic Gardens, Birmingham, showed *Cypripedium* × *edgbastonense* (*nitens* × *Chamberlainianum*).

Mrs. Haywood, Reigate (gr. Mr. Salter), showed *Dendrobium* × *Wardiano-Hildebrandii.*

Orchid Committee, April 8, 1902.

Mr. Harry J. Veitch, in the Chair, and seventeen members present.

Awards Recommended :—

Silver Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a group of Odontoglossums and other Orchids.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Orchids.

Silver Banksian Medal.

To Baron Sir H. Schröder, The Dell, Egham (gr. Mr. H. Ballantine), for a collection of rare Odontoglossums.

To Messrs. Sander, St. Albans, for a group of hybrid *Phaius* &c.

To J. Gurney Fowler, Esq., Glebelands, South Woodford (gr. Mr. J. Davis), for three finely grown and well-flowered *Dendrobium devonianum.*

Bronze Banksian Medal.

To Messrs. Charlesworth, Heaton, Bradford, for a group of Odontoglossums and hydrid Orchids.

First-class Certificate.

To *Odontoglossum* × *Adrianæ* 'Memoria Victoriæ Reginæ' (votes, 11 for, 2 against), from Baron Sir H. Schröder, The Dell, Egham (gr. Mr. H. Ballantine). A very fine variety with fringed petals and lip, white, closely blotched with dark purple. (Fig. 88.)

Award of Merit.

To *Lælia* × *Flavina* (*pumila* × *flava*) (votes, unanimous), from Messrs. Jas. Veitch. Flower primrose yellow with orange disc.

To *Masdevallia* × 'Circe' (*tovarensis* × *Chimæra*) (votes, 10 for, 2 against), from Messrs Jas. Veitch The first hybrid of *M. Chimæra*. Flowers on slender stems, ascending, yellow, with red papillæ and three red lines in each segment continued to the slender dark red tails.

To *Lælio-Cattleya* × 'Dora' (*L.-C.* × 'Hippolyta Phœbe' × *C. Schröderæ*) (votes, unanimous), from Messrs. Charlesworth, Heaton, Bradford. Flower equal in size and form to a small *C. labiata*; in colour a salmon-tinted yellow with darker blotch on the lip.

To *Zygopetalum* × *Perrenoudii* 'Cecil Rhodes' (*intermedium* × *maxillare Gautieri*) (votes, 11 for, 2 against), from H. T. Pitt, Esq., Stamford Hill. Larger than the original form; sepals and petals greenish with purple blotches; lip white, suffused and veined with blue.

Other Exhibits.

Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H.

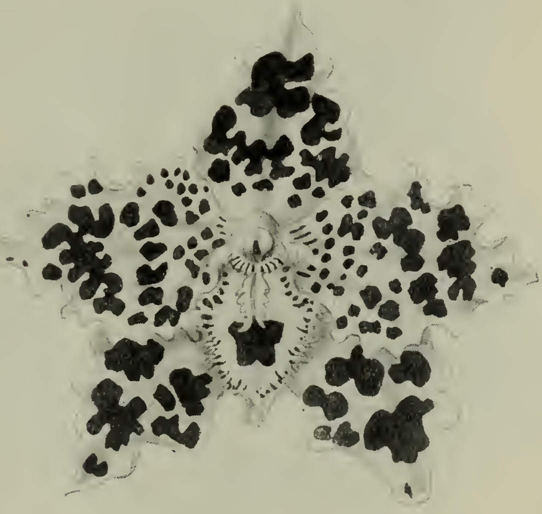


FIG. 88.—ODONTOGLOSSUM × ADRIANÆ 'MEMORIA VICTORIÆ REGINÆ.' (*Journal of Horticulture.*)

Young), sent *Miltonia* × *Bleuana* and *M. vexillaria* 'Memoria G. D. Owen.'

Messrs. Low, Bush Hill Park, showed *Cattleya Schröderæ alba* and other varieties.

Captain Holford, C.I.E., Westonbirt (gr. Mr. Alexander), sent *Odontoglossum* × *elegans* 'Westonbirt variety,' with a very large spike with five branches. Flowers larger and lighter in colour than the original.

Norman C. Cookson, Esq., Oakwood (gr. Mr. H. J. Chapman), sent *Cypripedium* × 'Wm. Lloyd' *superbum*.

Messrs. Williams showed a number of Orchids in flower.

F. Wellesley, Esq., Westfield (gr. Mr. Gilbert), showed *Cypripedium* × 'W. E. Dickson' (*Rothschildianum* × ?) and *C.* × *Chapmanii* 'Westfield variety.'

T. Carruthers, Esq., Reigate (gr. M. G. Collip), sent *Odontoglossum* × *Wilckeanum Carruthersii.*

J. Richardson, Esq., Hale (gr. Mr. Jenkins), showed a fine spike of *Dendrobium Dalhousieanum* and three Odontoglossums.

Walter Cobb, Esq., Tunbridge Wells (gr. Mr. J. Howes), showed *Odontoglossum triumphans Cobbiæ* and *Cypripedium* × 'Mary Beatrice.'

Orchid Committee, April 22, 1902.

Mr. Harry J. Veitch, in the Chair, and seventeen members present.

Awards Recommended :—

Silver Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a group of Orchids.

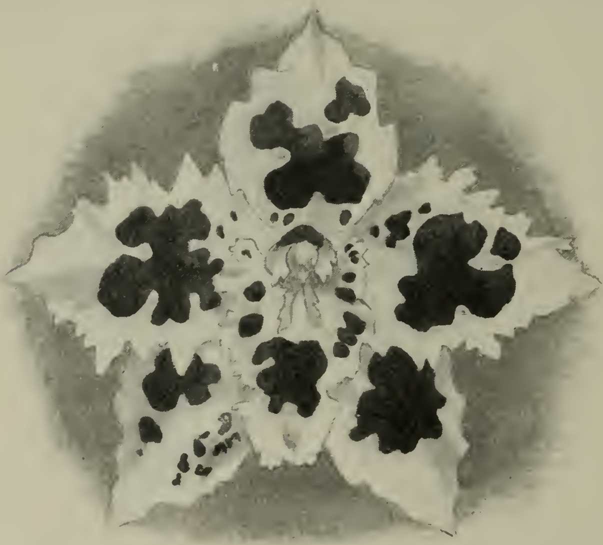


Fig. 89.—Odontoglossum crispum, var. 'Robert McVittie.' (*Journal of Horticulture.*)

To W. A. Bilney, Esq., Weybridge (gr. Mr. Whitlock), for a group of Dendrobiums.

To Messrs. Jas. Veitch for a collection of hybrid and other Orchids.

To Messrs. Sander for a group of Orchids.

To Mr. Cypher for a group of Orchids.

Silver Banksian Medal.

To Messrs. Low for a group of Orchids.

First-class Certificate.

To *Odontoglossum crispum* 'Robert McVittie' (votes, 18 for, 1 against), from W. Thompson, Esq., Walton Grange, Stone, Stafford (gr. Mr. Stevens). A handsomely blotched flower of the *O. c. apiatum* class. (Fig. 89.)

Award of Merit.

To *Odontoglossum* × *Rolfeæ* 'Oakwood variety' (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. H. J. Chapman). Flower, large. Sepals and petals, cream-white barred with

Fig. 90.—Cypripedium × 'Emperor of India.'
(*Journal of Horticulture.*)

purple; lip white, with yellow crest, in front of which are small purple spots.

To *Cypripedium* × 'Emperor of India' (votes, unanimous), from Messrs. Sander. A very large flower, the dorsal sepal of which partakes much of *C. Lawrenceanum*, being white suffused with rose and bearing dark chocolate lines. Petals and lip shaded with rose, the petals also having small dark spots on the inner halves. Parentage unrecorded. (Fig. 90.)

To *Odontoglossum* × *Adrianæ Fairieanum* (votes, unanimous), from H. T. Pitt, Esq. (gr. Mr. Thurgood). Flower white, with dark purplish brown bars and spotting.

To *Cypripedium* × *Vipanii* 'Hessle variety' (votes, unanimous), from W. P. Burkinshaw, Esq., Hessle, Hull (gr. Mr. Barker). A fine hybrid between *C. niveum* and *C. philippinense*. Flowers, pure white with dotted purple lines on the dorsal sepal and petals.

To *Cypripedium* × *Edithæ* (*bellatulum* × *Chamberlainianum*) (votes, 13 for, 2 against), from Messrs. Charlesworth, Heaton, Bradford. Sepals and petals yellowish nearly covered with dark purple markings. Lip rose colour with small darker rose spots.

To *Cattleya* × 'Niobe' (*Aclandiæ* × *Mendelii*) (votes, unanimous), from Messrs. Jas. Veitch. Sepals and petals tinged with rose and sparsely spotted with purple; base of lip white, front dark rose.

To *Dendrobium* × *Ainsworthii* 'Hazlebourne variety' (votes 13 for, 3 against), from W. A. Bilney, Esq. (gr. Mr. Whitlock). Flowers white with maroon disc to the lip.

Other Exhibits.

Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), staged an effective group of Orchids.

Baron Sir H. Schröder (gr. Mr. H. Ballantine) showed cut spikes of rare Odontoglossums, including the beautiful *O.* × *Adrianæ* 'Memoria Victoriæ Reginæ.'

M. Maron, Brunoy, France, sent *Lælio-Cattleya* × 'Mrs. J. Leemann' (*C. aurea* × *L. Digbyana*) *C.* × 'Adonis,' and *L.-C.* × *Digbyano-Mendelii.*

W. J. Cowper, Esq., Hayward's Heath (gr. Mr. Reynolds), showed a group of *Dendrobium atro-violaceum.*

Elijah Ashworth, Esq., sent a spike of *Cypripedium caudatum Ashworthianum.*

Sir R. G. Harvey (gr. Mr. Gillies) showed a large specimen of *Cattleya Lawrenceana.*

Messrs. Linden, Brussels, sent rare Odontoglossums.

The Hon. Walter Rothschild, M.P., showed a good *Eulophiella Elisabethæ.*

Orchid Committee, May 6, 1902.

Mr. Harry J. Veitch, in the Chair, and twenty-one members present.

Awards Recommended:—

Gold Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for an exceptionally fine group of Odontoglossums &c.

Silver Flora Medal.

To Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young), for a group of Orchids.

To Messrs. Jas. Veitch, Chelsea, for a selection of hybrid and other Orchids.

Silver Banksian Medal.

To Baron Sir H. Schröder (gr. Mr. H. Ballantine) for rare Odontoglossums.

FIG. 91.—DISA × 'LUNA.' (*Journal of Horticulture.*)

To Messrs. Low for a group of Orchids.

To Messrs. Williams for a group of Orchids.

First-class Certificate.

To *Odontoglossum crispum Pittiæ* (votes, unanimous), from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). A finely blotched variety of the *O. c.* 'Franz Masereel' class.

Award of Merit.

To *Odontoglossum Hallii* 'Queen Alexandra' (votes, 11 for, 5 against), from H. T. Pitt, Esq., of the *O. H. xanthoglossum* section. Sepals chocolate brown tipped with yellow. Petals and lip pale yellow, blotched with red brown.

To *Odontoglossum crispum* 'Fairy Footsteps' (votes, unanimous), from H. T. Pitt, Esq. Flowers white, tinged with pink and bearing a few purple markings on the petals.

To *Odontoglossum luteo-purpureum secundum nulli* (votes, unanimous), from H. T. Pitt, Esq. Flowers pale yellow marked with brown; lip white with reddish blotches.

To *Odontoglossum triumphans latisepalum* (votes, unanimous), from Baron Sir H. Schröder (gr. Mr. H. Ballantine). A fine flower with equally broad sepals and petals. Flowers yellowish, heavily blotched with brown.

To *Odontoglossum* × *crispo-Harryanum* 'Duchess of York' (votes, unanimous), from Baron Sir H. Schröder. A pretty variety, with cream-white flowers tinted with rose and marked with purple.

To *Dendrobium* × 'Ethel' (*moniliforme* (*japonicum*) × *Rolfeæ*) (votes, unanimous), from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). A neat and profuse bloomer. Flowers white tipped with pink.

To *Cattleya Mossiæ Arnoldii* Westfield variety (votes, 15 for, 3 against), from F. Wellesley, Esq., Westfield, Woking (gr. Mr. Gilbert). A grand white *Cattleya* with a faint tint of pink on the tips of the petals and marbling of purple on the lip.

To *Disa* × 'Luna' (racemosa ♀ × Veitchii ♂) (votes, unanimous), from Messrs. Jas. Veitch. Flowers of a uniform rosy lilac colour. (Fig. 91.)

To *Odontoglossum citrosmum punctatum* (votes, 9 for, 4 against), from Sir F. Wigan, Bart. Flowers white spotted with rose, and with rose-coloured lip.

Botanical Certificate.

To *Maxillaria fractiflexa*, from Sir Trevor Lawrence, Bart. An extraordinary species with long narrow yellow sepals tinged with brown curled white petals and small white lip spotted with purple.

Other Exhibits.

The Hon. Walter Rothschild, M.P., showed *Lælia* × *cinnabrosa* 'Tring Park variety.'

Norman C. Cookson, Esq., sent *Cattleya* × 'Jupiter' (*Warscewiczii* × *Lawrenceana*).

Mr. Otto Beyrodt, Berlin, sent spikes of two blotched Odontoglossums.

H. L. Bischoffsheim, Esq. (gr. Mr. Gleeson), sent *Cattleya labiata* 'Warren House variety.'

Jeremiah Colman, Esq., sent *Cattleya* × *Lowryana*.

J. E. Vanner, Esq., showed *Lælio-Cattleya* × 'General Baden-Powell.'

ORCHID COMMITTEE, MAY 20, 1902.

Mr. HARRY J. VEITCH in the Chair, and twenty members present.

Awards Recommended:—

Gold Medal.

To Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White) for a fine group of Orchids 30 feet in length, and including many fine specimens, especially large plants of Odontoglossum, which have been in his collection for many years.

Silver-gilt Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for an extensive group of Odontoglossums and other Orchids.

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Lælio-Cattleyas, &c.

To the Honble. Walter Rothschild, Tring Park, for a fine collection of Masdevallias, including both the showy and the curious sections.

To Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. H. J. Chapman), for a selection of rare hybrid *Phaius* and Odontoglossums.

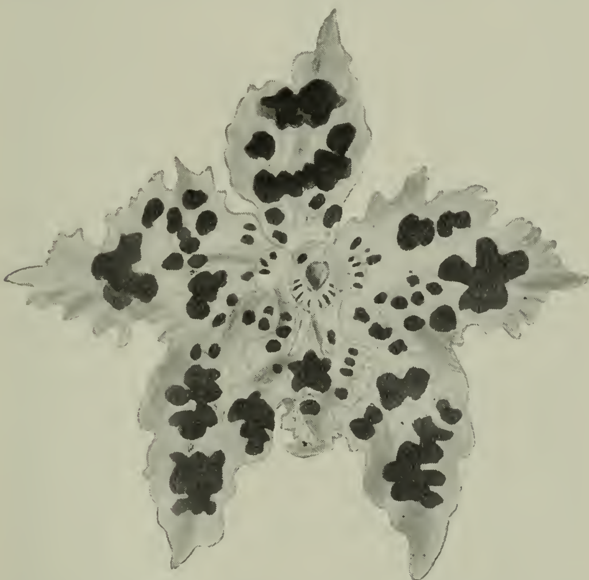


FIG. 92.—ODONTOGLOSSUM × ADRIANÆ 'SYBIL.' (*Journal of Horticulture.*)

First-class Certificate.

To *Odontoglossum* × *Adrianæ* 'Sibyl' (votes, unanimous), from Captain G. L. Holford, C.I.E., Westonbirt (gr. Mr. Alexander). A very fine and remarkable hybrid difficult to classify. The broad sepals and petals resemble those of *O.* × *loochristyense*; the crimped fringed lip *O.* × *Adrianæ*. Sepals and petals canary yellow, heavily barred with red-brown; lip white, with one large and some smaller brown blotches. (Fig. 92.)

Award of Merit.

To *Cypripedium Lawrenceanum hackbridgense* (votes, unanimous), from Sir Trevor Lawrence, Bart., and H. T. Pitt, Esq. A fine form, with the large dorsal sepal lilac rose with dark chocolate lines, the rest of the flower tinged with claret colour.

To *Phaius* × 'Phœbe' *superbus* (*Sanderianus* × *Humblotii*) (votes, unanimous), from Norman C. Cookson, Esq. (gr. Mr. H. J. Chapman). Sepals and petals dark rose, with a yellowish tint; lip purple and rose, with a yellow crest.

To *Phaius* × 'Ruby' (*Cooksoniæ* × *Humblotii*) (votes, unanimous), from Norman C. Cookson, Esq. Sepals and petals purplish-rose; lip dark reddish-purple, with yellow crest and veining in the centre.

To *Odontoglossum* × *Adrianæ Cooksonii* (votes, 10 for, 3 against), from Norman C. Cookson, Esq. Flowers large, white, densely spotted with brown.

To *Odontoglossum crispum* 'Marjorie' (votes, unanimous), from Richard Ashworth, Esq., Ashlands, Newchurch, Manchester (gr. Mr. Pidsley). A singular form of the *O. c. Lowii* class, in which the petals are slightly stalked, with broadly ovate slightly concave blades. Flowers white, with rose-purple blotches, those on the petals following the margin in a single line.

To *Odontoglossum crispum* 'Lady of the Lake' (votes, unanimous), from H. T. Pitt, Esq. Flowers white, tinged with purple, and bearing large purplish blotches.

Botanical Certificate.

To *Epidendrum Schomburgkii*, from Sir Trevor Lawrence, Bart. A Guiana species, with stems three to four feet, bearing terminal heads of showy orange scarlet flowers.

Other Exhibits.

R. I. Measures, Esq., Camberwell (gr. Mr. Smith), showed good *Cattleya Schröderæ* and *Lælia pupurata*.

G. F. Bird, Esq., West Wickham (gr. Mr. Redden), showed a selection of *Odontoglossum crispum*.

F. Wellesley, Esq., Westfield, Woking (gr. Mr. Gilbert), showed *Lælia* × *cinnabrosa* 'Westfield variety.'

D. M. Grimsdale, Esq., Kent Lodge, Uxbridge (gr. Mr. Hooker), showed a group of Odontoglossums and *Cattleya Schilleriana*.

Mrs. Blackwell, The Highlands, Minchinhampton, showed Cypripediums raised between *C. villosum* and *C. Chamberlainianum*.

Drewett O. Drewett, Esq., sent a hybrid *Cypripedium-Parishii* × *Lowii*.

TEMPLE SHOW.

Orchid Committee, May 28, 1902.

Mr. Harry J. Veitch in the Chair, and twenty-seven members present.

(The list of Cups and Medals will be found on page xxvii.)

Awards Recommended:—

First-class Certificate.

To *Phalænopsis Sanderiana*, 'Wigan's variety' (votes, unanimous), from Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young). Flowers bright purplish-rose. **A.M.** May 31, 1899.

To *Odontoglossum crispum* 'Lady Jane' (votes, unanimous), from J. Wilson Potter, Esq., Elmwood, Croydon (gr. Mr. W. H. Young). An exceedingly beautiful variety, with blush-white sepals and broad, slightly

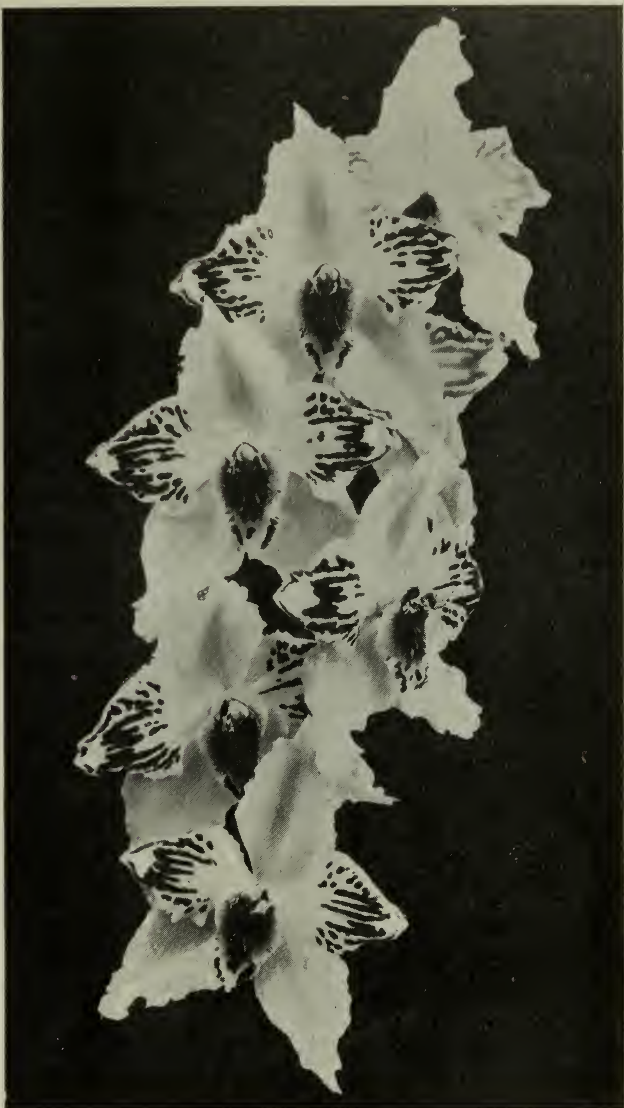


FIG. 93.—ODONTOGLOSSUM CRISPUM 'LADY JANE.' (*The Garden.*)

stalked white petals, with light brown lines on the outer portions. (Figs. 93 and 94.)

To *Odontoglossum* × *ardentissimum* (a spotted *Pescatorei* × *crispum* 'Franz Masereel') (votes, unanimous), from M. Vuylsteke, Ghent. A fine flower, with the greater part of its surface blotched and tinged with dark purple. (Fig. 95.)

To *Odontoglossum* × 'Edward Rex' (votes, unanimous), from Messrs. Sander. A very broad and fine *O.* × *Wilckeanum*. Lemon-yellow heavily marked with red-brown.

To *Odontoglossum Pescatorei Charlesworthii* (votes, unanimous), from Messrs. Charlesworth. Flowers white, spotted with purple.

To *Oncidium varicosum Charlesworthii* (votes, unanimous), from Messrs. Charlesworth, Heaton. Flower with extraordinarily large yellow labellum, with brown markings in front of the crest.

To *Lælio-Cattleya* × *Hyeana splendens* (*L. purpurata* × *C. Lawrenceana*) (votes, unanimous), from Messrs. Charlesworth. Sepals dark rose; petals rosy crimson ; lip purplish crimson.

To *Odontoglossum* × *Wilckeanum Imperatorium* (votes, unanimous),

FIG. 94.—ODONTOGLOSSUM CRISPUM 'LADY JANE.' (*Journal of Horticulture.*)

from M. Jules Hye de Crom, Ghent (gr. Mr. Coene). Flower large, yellow, heavily barred with brown.

To *Zygopetalum rostratum* (votes, unanimous), from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). A rare Demerara species with greenish sepals and petals and large white labellum.

Award of Merit.

To *Cypripedium Godefroyæ leucochilum pulchellum* (votes, unanimous), from Sir Frederick Wigan, Bart. Flower pure white, with purple blotches on the petals and upper sepal.

To *Odontoglossum* × *ardentissimum dulce* (votes, unanimous), from M. Vuylsteke, Ghent. Flower white, spotted with purple.

To *Odontoglossum* × *ardentissimum venificum* (votes, unanimous), from M. Vuylsteke. Middles of the segments tinged and blotched with claret colour.

To *Odontoglossum* × *ardentissimum concinnum* (votes, unanimous), from M. Vuylsteke. Flower white blotched with purple.

To *Odontoglossum* × 'Queen Alexandra' (*Harryanum* × *excellens*) (votes, unanimous), from J. Rutherford, Esq., M.P. (gr. Mr. Lupton). Flower pale yellow blotched with purple.

To *Cattleya Mossiæ* 'Aurora' (votes, 16 for, 7 against), from Messrs. Stanley, Ashton, Southgate. A large rose-coloured flower, with orange disc and purple markings on the lip.

To *Lælio-Cattleya* × *Zephyra alba* (*L. xanthina* × *C. Mendelii*) (votes, unanimous), from Francis Wellesley, Esq., Westfield (gr. Mr. Gilbert). An albino of the yellow ordinary form.

To *Odontoglossum crispum* 'British Queen' (votes, unanimous), from Messrs. Sander. A fine form of the typical best pure white class.

FIG. 95.—ODONTOGLOSSUM × ARDENTISSIMUM. (*Journal of Horticulture.*)

To *Cattleya Mossiæ* 'In Memoriam A. H. Smee' (votes, 15 for, 3 against), from Messrs. Low. Sepals and petals distinctly mottled with rose.

To *Cattleya Mendelii wisetonensis* (votes, unanimous), from Captain Laycock, Bawtry. Flower large, blush white, with large crimped magenta rose lip.

To *Masdevallia* × *Rushtoni superba* (*racemosa* × *ignea Eckhardti*) (votes, unanimous), from Sir Trevor Lawrence, Bart. Flower orange scarlet.

To *Lælia* × 'Helen' (*Digbyana* × *tenebrosa*) (votes, 16 for, 1 against), from Messrs. Charlesworth. Sepals and petals bronzy rose; lip pale rosy lilac, fringed.

To *Cattleya intermedia Aquinii* (votes, unanimous), from Mr. Ed. Kromer, Croydon. Petals tipped with purple, as on the lip.

To *Odontoglossum crispum* 'Calypso' (votes, unanimous), from Messrs. Charlesworth. Flower white, blotched with brown.

To *Odontoglossum crispum* 'Glory of Brussels' (votes, unanimous), from Mr. A. A. Peeters. A showy variety with flowers tinged with purple and blotched with claret colour.

To *Trichopilia rostrata* (votes, unanimous), from Sir Trevor Lawrence, Bart. Flowers white; sepals and petals twisted spirally.

Botanical Certificate.

To Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White), for

Oncidium carthaginense.
Oncidium luteum.
Maxillaria præstans.
Polystachya zambesiaca.
Aspasia lunata.
Trichopilia laxa.
Dendrobium cumulatum.
Microstylis congesta.
Angræcum Maloneyi.
Eulophia andamanensis.

Cultural Commendation.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., for a fine plant of *Zygopetalum rostratum* with several spikes of flowers.

Orchid Committee, June 10, 1902.

Mr. Henry Little in the Chair, and eighteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for a group of rare Odontoglossums and other Orchids.

Silver Flora Medal.

To Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young), for a group of Orchids.

Silver Banksian Medal.

To Messrs. Jas. Veitch, Chelsea, for a collection of hybrid Lælio-Cattleyas, &c.

To Messrs. Stanley, Ashton, Southgate, for a group of Cattleyas, Odontoglossums, &c.

Award of Merit.

To *Lælio-Cattleya* × 'Mabel' (*C. Trianæi* × *L. tenebrosa*) (votes unanimous), from H. S. Leon, Esq., Blatchley Park (gr. Mr. A. Hislop) A fine flower, with sepals and petals rose colour tinged with a bronzy hue. Lip rose with dark purple veining.

To *Cattleya Warneri* 'Little's variety' (votes, 10 for, 4 against), from H. Little, Esq., Baronshalt, Twickenham (gr. Mr. Howard). A fine variety, with sepals and petals bright rose; front of lip crimson purple.

Cultural Commendation.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., for a magnificent specimen of *Cattleya Mossiæ*, a single mass, with forty-eight flowers. One of the best specimen Orchids yet exhibited.

Other Exhibits.

J. T. Bennett-Poë, Esq. (gr. Mr. Downes), showed a fine specimen of *Cattleya Warscewiczii* grown on Tree Fern stem for six years.

Jeremiah Colman, Esq. (gr. Mr. W. P. Bound), sent *Lycaste brevispatha* and *Odontoglossum crispum* 'Gatton Park variety.'

Francis Wellesley, Esq. (gr. Mr. Gilbert), sent the finely coloured *Cypripedium Lawrenceanum Hackbridgense* and the large-flowered *C. L.* 'Colossus.'

J. Gurney Fowler, Esq. (gr. Mr. Davis), showed a magnificent plant of *Cypripedium callosum Sanderæ,* with four flowers.

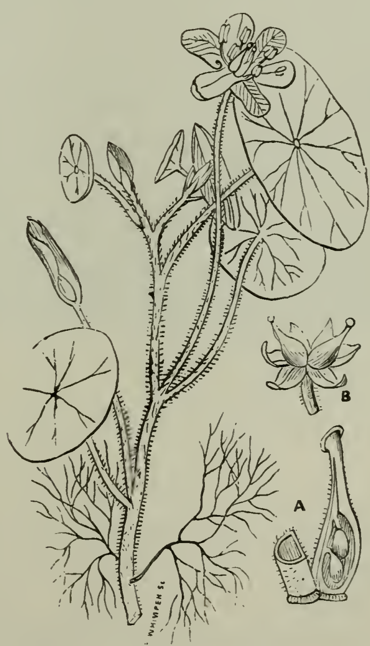
Messrs. B. S. Williams staged a group of Orchids.

Mr. H. A. Tracy, Twickenham, showed white varieties of *Cattleya Mossiæ*; also *C. M.* 'Tracy's variety,' white with a slate-blue tint.

A. Warburton, Esq., showed the finely blotched *Odontoglossum crispum Luciani.*

The Rev. Frank Mason showed two forms of *Cattleya Mossiæ.*

Mrs. Haywood (gr. Mr. C. J. Salter) sent a fine white *Odontoglossum crispum.*



NARCISSUS AND TULIP COMMITTEE.

March 11, 1902.

Mr. H. B. May in the Chair, and seven members present.

Mr. Robert Sydenham, of Birmingham, showed a group of Daffodils.

Narcissus and Tulip Committee, March 25, 1902.

Mr. H. B. May in the Chair, and seventeen members present.

An interesting discussion took place, on the initiative of Percy Williams, Esq., of Lanarth, Cornwall, on the subject of the Daffodil Fly (*Merodon equestris.*) (See p. 181, fig. 60.)

Awards Recommended:—

Silver Flora Medal.

To Miss F. Currey, The Warren, Lismore, Ireland, for a collection of Daffodils.

Silver Banksian Medal.

To Messrs. Barr, of Covent Garden, for a group of Daffodils.

Bronze Banksian Medal.

To Leonard Brown, Esq., of Brentwood, for a group of Daffodils.

Cultural Commendation.

To Mr. R. Sydenham, of Birmingham, for Daffodils exceedingly well grown in jars.

Other Exhibits.

Percy D. Williams, Esq., Lanarth, Cornwall, sent specimens of the true 'College Green' form of Maximus, which he had originally received from Dublin. It is a large form of Maximus; but whether this is due to essential variation or to the vigour infused into the bulbs by the Irish soil and climate, and which in time passes out of them when grown in less congenial surroundings, is a matter of doubt.

Mr. J. Jones, of Ridgeway, Malvern, sent one bloom of a seedling Daffodil.

Messrs. Barr brought a flower named 'Duchess of Normandy.'

Miss Willmott, V.M.H., brought from her garden at Warley a giant cyclamineus flower named 'Edge.'

Messrs. Pearson, of Lowdham, Notts, sent a seedling called 'Alet.'

Narcissus and Tulip Committee, April 8, 1902.

Mr. H. B. May in the Chair, and sixteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Miss Currey, The Warren, Lismore, Ireland, for a very fine group of Daffodils.

Silver Flora Medal.

To Messrs. Barr, of Covent Garden, for a group of Daffodils and Tulips.

Bronze Banksian Medal.

To Messrs. B. S. Williams, of Holloway, for a group of Daffodils.

First-class Certificate.

To Daffodil 'Peter Barr' (votes, 12 for), from Messrs. Barr. A beau-

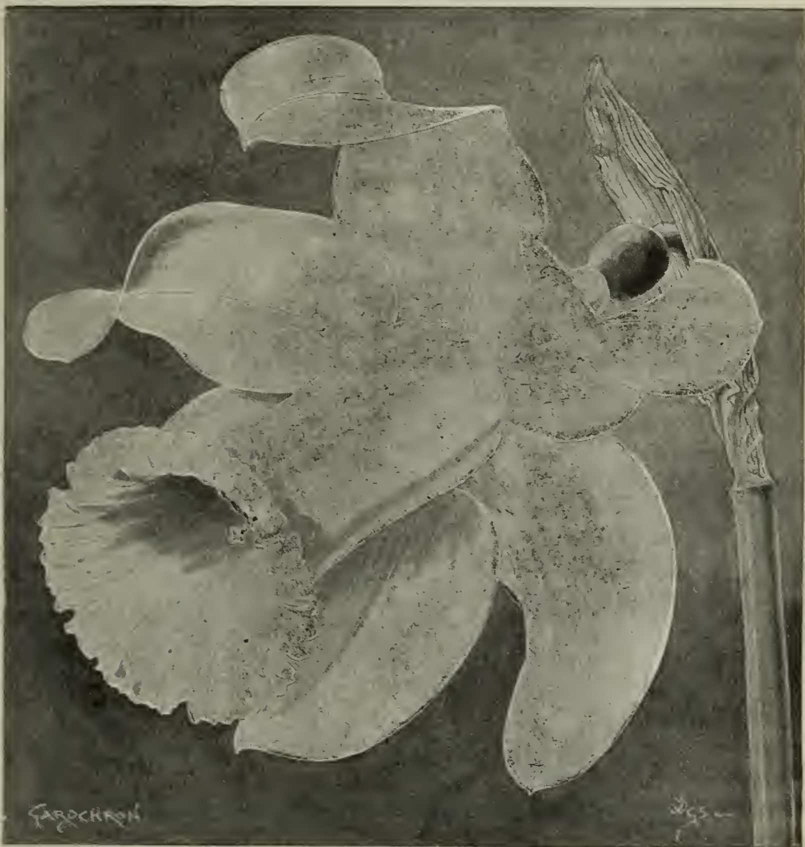


FIG. 96.—DAFFODIL 'PETER BARR.' (*Gardeners' Chronicle.*)

tiful cream-coloured self, considered by some to be an improvement on 'Me. de Graaff.' (Fig. 96.)

Award of Merit.

To Daffodil 'Sir Francis Drake' (votes, 9 for, 4 against), from P. J. Kendall, Esq., Newton Poppleford, Devon.

To Daffodil 'Torch' (votes, 6 for, 3 against), from the Rev. G. H. Engleheart, V.M.H., Appleshaw. An *incomparabilis* of immense vigour with vivid orange-red crown.

Other Exhibits.

Messrs. Ware, of Feltham, sent a collection of Daffodils.

Mr. H. J. Jones, of Lewisham, sent Daffodils and Tulips.

Mr. W. B. Hartland, of Cork, sent Daffodils.

Rev. G. H. Engleheart sent seedling Daffodils 'Chancellor,' 'Herald,' 'Arethusa,' 'Siren,' 'Lucca,' 'Puritan,' and 'Plenipo.'

NARCISSUS AND TULIP COMMITTEE, April 22, 1902.

Mr. H. B. MAY in the Chair, and eighteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Bath, of Wisbech, for a very fine collection of Daffodils and Tulips.

Silver Flora Medal.

To Messrs. Hogg & Robertson, of Dublin, for Daffodils and Tulips.

Silver Banksian Medal.

To Messrs. James Veitch, King's Road, Chelsea, for a collection of Daffodils.

To Mr. H. J. Jones, of Lewisham, for a group of Daffodils.

To Messrs. Williams, Holloway, for a group of Daffodils.

Award of Merit.

To Daffodil 'Warley Magna' (votes, unanimous), from Miss Willmott, V.M.H., Great Warley.

To Daffodil 'Cresset' (votes, 13 for), from Miss Willmott.

To Daffodil 'Incognita' (votes, unanimous), from Miss Willmott.

To Daffodil 'Betty Berkeley' (votes 11 for, 1 against), from Miss Willmott. These are four of Rev. G. H. Engleheart's seedlings.

To Daffodil 'Primrose Phœnix' (votes, unanimous), from Mr. John Walker, Thame.

To Daffodil 'Queen Christina' (votes, unanimous), from Messrs. Barr.

To Daffodil 'Cygnet' (votes, unanimous), from Messrs. Barr.

To Daffodil 'Queen Alexandra' (votes, unanimous), from P. J. Kendall, Esq., Newton Poppleford, Devon.

To Daffodil 'Queen Emma' (votes, 12 for), from Messrs. J. Veitch, Chelsea.

To Daffodil 'Glory of Noordwyk' (votes, 12 for), from Messrs. de Groot, Noordwyk, Holland.

Botanical Certificate.

To Rev. C. Digby, Warham, Norfolk, for a white *Narcissus muticus.*

Other Exhibits.

Mr. Wade, of Riverside, Colchester, sent a collection of Daffodils.

Miss Willmott sent seedling Daffodils 'Sea Gull,' 'Rochester,' 'Terrence,' 'Laura,' 'Lilian,' and 'Aladdin.'

Messrs. Barr, of Covent Garden, sent seedling Daffodils 'Lady Audrey,' 'Hulda,' 'Calpernia,' 'Cleopatra,' 'Sylvia,' 'Mercedes,' 'Hatfield Beauty,' and 'Arthur Gilbertson.'

They also sent Daffodils enclosed in a solid block of ice.

Percy Williams, Esq., of Lanarth, Cornwall, sent Daffodil 'Ptarmigan.'

Mrs. Berkeley, of Great Warley, sent seedling Daffodils 'Celia,' 'Oberon,' and 'Perdita.'

R. A. Danvers, Esq., Shepperton, sent a collection of Daffodils.

P. J. Kendall, Esq., sent a seedling named 'Duke of Wellington.'

Messrs. J. Veitch, Chelsea, sent seedlings named 'Josephine,' 'Surprise,' 'Mina,' 'Gold Cup,' 'Sunflower,' and 'Lilian.'

Messrs. de Groot, Holland, sent seedlings named 'P. R. Dunn,' 'Mrs. H. J. Jones,' 'H. J. Jones,' 'Thirza Cherry,' 'Van Tromp,' and 'Rubens.'

The Rev. G. P. Hayden, M.A., Westbere, sent seedlings 'Barn Owl' and 'Little Dorrit.'

Messrs. Hogg & Robertson sent Daffodils 'Mrs. Betteridge' and 'Countess Cadogan.'

PRIZES.

Group of Daffodil blossoms grown entirely outdoors (Polyanthus varieties excluded); must include some of each section, Magni-, Medii-, and Parvi-Coronati; must contain at least thirty varieties distinct, at least three blooms of each must be shown. Not more than nine blooms of any one variety may be put up. To be staged in bottles, vases, or tubes, not exceeding three inches in diameter at the top (inside measurement), and all the stems must touch the water. Quality of flower will count more than quantity, and correct naming and tasteful arrangement will be duly considered. Any hardy foliage may be used, Daffodil or otherwise. No prize will be awarded unless there are three competitors at least. Open to Amateurs and Gentlemen's Gardeners only. First Prize, a £7. 7*s.* Silver Cup, presented to the Society by Messrs. Barr & Sons. Second Prize, Silver Flora Medal.

1. Mrs. Berkeley, Great Warley.

Equal {
2. W. B. Cranfield, Esq., Bramley House, Enfield.
2. R. A. Dawson, Esq., Charlton, Shepperton.
2. C. G. A. Nix, Esq., Tilgate, Crawley.

NARCISSUS AND TULIP COMMITTEE, MAY 6, 1902.

Mr. H. B. MAY in the Chair, and fifteen members present.

Awards Recommended:—

Silver Banksian Medal.

To Mr. H. J. Jones, of Lewisham, for a group of Tulips.

First-class Certificate.

To *Tulipa Gesneriana lutea pallida* (votes, 7 for, 3 against), from Miss F. Currey, Lismore, Ireland.

To Daffodil 'Ada' (votes, unanimous), from Miss Willmott, Great Warley, one of the Rev. G. H. Engleheart's *triandrus* hybrids, a white self of waxen texture.

Award of Merit.

To Daffodil 'Cecil Rhodes' (votes, unanimous), from Miss Willmott.

To Daffodil 'Watch Fire' (votes, unanimous), from Miss Willmott.

To Daffodil 'Moonray' (votes, unanimous), from Miss Willmott, all three raised by the Rev. G. H. Engleheart.

To *Tulipa Nickeliana* (votes, 9 for), from Miss Willmott.

To *Tulipa elegans* 'Primrose Dame' (votes, 7 for), from Messrs. De Graaff, Leiden, Holland.

Other Exhibits.

Miss Currey showed Tulips 'Zomerschoon' and 'Mrs. Moon.'

G. H. Cammell, Esq., of Brookfield Manor, Hathersage, sent Daffodils 'Derwent,' 'Moscar,' and 'Hathersage.'

W. Cave, Esq., Terrington St. Clement, sent a seedling Daffodil named 'Miss L. Cave.'

Miss Willmott showed Daffodils 'Rev. C. Digby,' 'Amulet,' and 'Warden,' seedlings of Rev. G. H. Engleheart's raising.

Messrs. J. Veitch, Chelsea, sent Daffodils 'Euterpe,' 'Mrs. James Veitch,' 'Laura,' and 'Theodora.'

Messrs. De Graaff showed Daffodil 'Apricot Phœnix' and two flowers of 'Jonquilla' × 'Ajax.'

Miss K. Spurrell, of Bessingham, Hanworth,' sent Daffodils 'Caroline Carver,' 'Lady Jane Jodrell,' 'Clara Herring,' 'May Star,' and 'Bessingham Bouquet.'

Narcissus and Tulip Committee, May 20, 1902.

Mr. H. B. May in the Chair, and sixteen members present.

A very interesting note on the work and history of the Committee was read by the Secretary, C. R. Scrase-Dickins, Esq. (See p. 186.)

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Barr, of Covent Garden, for a magnificent group of Tulips.

Silver Flora Medal.

To Messrs. Hogg & Robertson, Dublin, for a group of Tulips.

To Messrs. J. Veitch, Chelsea, for a group of Tulips.

Silver Banksian Medal.

To Messrs. Bath, of Wisbech, for a group of Tulips.

Award of Merit.

To Tulip 'Scarlet Emperor' (votes, unanimous), from Messrs. Barr.

To Daffodil 'Agnes Harvey' (votes, 6 for, 3 against), from Miss Spurrell, Bessingham.

To Tulip 'Inglescombe Scarlet' (votes, unanimous), from Mr. Ware Inglescombe, Bath.

Other Exhibits.

W. Cave, Esq., Terrington St. Clement, sent Daffodils.

A. D. Hall, Esq., kindly brought interesting Tulips to illustrate his lecture.

Messrs. Barr showed Tulips *maculata grandiflora*, 'The Fawn,' 'Queen Alexandra,' 'Goldfinder,' *Axinensis*, *lutea pallida*, 'La Merveille,' *Aurantiaca maculata*, 'Marjoletti,' 'Ariadne,' and 'Cyclops.'

Miss E. Armitage, of Dadnor, Ross, sent Tulips.

Miss Spurrell sent Daffodils 'Moth' and 'Eos.'

Mr. Ware, of Bath, sent Tulips 'Innovation,' 'Dainty Maid,' 'Red Dragon,' 'Kate Connor,' 'Sulphur Button,' 'Coronation Scarlet,' 'Aurora,' and 'Yellow Gem.'

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS.

(Applicable only to the case of those Fellows who are not engaged in any Horticultural Trade, or in the manufacture or sale of any substance sent for Analysis.)

The Council have fixed the following rates of charges for Chemical Analysis to Fellows of the Society being *bonâ fide* Gardeners or Amateurs.

These privileges are applicable only when the Analyses are for *bonâ fide* horticultural purposes, and are required by Fellows for their own use and guidance in respect of gardens or orchards in their own occupation.

The analyses are given on the understanding that they are required for the individual and sole benefit of the Fellow applying for them, and must not be used for the information of other persons, or for commercial purposes.

Gardeners when forwarding samples are required to state the name of the Fellow on whose behalf they apply.

The analyses and reports may not be communicated to either vendor or manufacturer, except in cases of dispute.

When applying for an analysis, Fellows must be very particular to quote the number in the following schedule under which they wish it to be made.

No.		
1.	An opinion on the purity of bone-dust (each sample)	2*s.* 6*d.*
2.	An analysis of sulphate or muriate of ammonia, or of nitrate of soda, together with an opinion as to whether it be worth the price charged .	5*s.*
3.	An analysis of guano, showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, together with an opinion as to whether it be worth the price charged	5*s.*
5.	An analysis of superphosphate of lime, dissolved bones, &c., showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
6.	An analysis of bone dust, basic slag, or any other ordinary artificial manure, together with an opinion as to whether it be worth the price charged	10*s.*
7.	Determination of potash in potash salts, compound manures, &c. . .	7*s.* 6*d.*
8.	An analysis of compound artificial manures, animal products, refuse substances used for manure, &c.	from 10*s.* to £1
9.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.	Complete analysis of a soil	£3
12.	Analysis of any vegetable product	10*s.*
13.	Determination of the "hardness" of a sample of water before and after boiling	5*s.*
14.	Analysis of water of land-drainage, and of water used for irrigation .	£1
15.	Analysis of water used for domestic purposes	£1 10*s.*
16.	Consultation by letter	5*s.*

Letters and samples (postage and carriage prepaid) should be addressed to the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, 22 Tudor Street, New Bridge Street, London, E.C.

The fees for analysis must be sent to the Consulting Chemist at the time of application.

Instructions for selecting, drawing, and sending samples for analysis will be found on pages 26–33 of "Arrangements, 1902," or can be obtained on application to the Society's Office, 117 Victoria Street, S.W.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY.

GENERAL MEETING.

July 8, 1902.

Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (74).—H. W. Baker, P. B. Baker, Madame A. Bard, S. Barker, Mrs. Barr, R. Bearcroft, Mrs. W. C. Beaumont, S. M. Brodie, Sydney Brough, Rev. S. B. Browne, Edward Bull, William Bull, Edwin Burbury, Hon. Cecil Campbell, Col. Carruthers, J. Willis Clark, Sir C. Clementi-Smith, G.C.M.G., Lady C. Clementi-Smith, Mrs. G. Colles, Miss I. Davidson, Mrs. A. S. Dent, Mrs. Lewis Doulton, H. Eydiman, Miss M. Fearnley, Lady Fermoy, Louis Floersheim, Mrs. Franks, Mrs. L. G. Fry, E. W. Fulker, Dr. E. F. S. Green, W. Holmes, F. Howell, E. Humphreys, Mrs. J. B. Jackson, E. Johnson, Mrs. Lambe, W. Lane, T. Leago, James G. Lees, Mrs. Leete, Mrs. Lennard, Mrs. H. Lewis, E. J. P. Magor, Miss E. Magor, Mrs. V. M. Martin, Jonas Nicholson, J.P., Miss Agnes Nix, G. N. Ormandy, Mrs. Guy Paget, R. J. Pullen, J. C. F. Ramsden, Miss E. W. Reed, Mrs. H. J. Reiss, A. G. Ricks, Rev. C. E. Roberts, M.A., Lady Savile, William von Schröder, Mrs. Schwinde, G. W. Searle, J. W. Smart, A. Murray Smith, Mrs. F. W. Soames, Sydney Spalding, Viscountess Strathallan, C. Dee Thornton, Mrs. E. Topping, Rev. R. Valpy, W. W. Walker, C. O. Walters, Mrs. Wharton, A. J. Williams, Miss Annie Wise, Mrs. J. B. Wood, C. V. Yorke.

A lecture on "Ornamental Trees and Shrubs" was given by the Rt. Hon. the Earl of Annesley (see page 407).

GENERAL MEETING.

July 22, 1902.

Mr. George Bunyard, V.M.H., in the Chair.

Fellows elected (32).—Rt. Hon. A. H. D. Acland, Alex. M. Allan, John Bartley, W. Batchelor, Ralph Bishop, Mrs. Brace, Frank S. Bristowe, A. J. P. Brown, E. Camacho-Guisasola, Mrs. George Clive, Mrs. Coulson,

L. G. Cruickshank, Fritz Eggena, Martin A. Fayers, Mrs. H. G. Few, E. H. Hill, E. T. Hodgson, Mrs. John E. Howard, G. Hunt, Countess of Kingston, Mrs. C. de Lacy Lacy, A. J. McDonald, James Mayne, Lady M. Morrison, W. G. Ray, Lady Stradbroke, H. Straker, James Whytock, F. A. Wollatt, Rupert Williams, E. H. York, Miss A. F. Yule.

Associate (1).—Stanton Brown.

A lecture on "The Botanic Gardens and Flora of Malta" was given by the Rev. Prof. G. Henslow, M.A., V.M.H. (see page 564).

GENERAL MEETING.

August 5, 1902.

Mr. A. H. Pearson in the Chair.

Fellows elected (10).—H. M. Arderne (Cape Town), Mrs. R. N. Byass, Mrs. J. Chapman, Mrs. F. H. Cox, Dibakur Dey, G.B.V.C. (Calcutta), George F. Dutton, John McLennan, Mrs. Maud Pike, Edmund A. Le Gendre Starkie, James Woods.

Affiliated Society (1).—Wormelow Horticultural Society.

A paper on "Small Fruits for Private Gardens," by Mr. James Smith, V.M.H., was read by the Under-Secretary (see page 585).

GENERAL MEETING.

August 19, 1902.

Rev. W. Wilks, M.A., in the Chair.

Fellows elected (15).—F. Abbot, Mrs. Anderson, Wm. Booth, Mrs. A. Brittan, Sir Clinton E. Dawkins, K.C.B., E. W. Foster, Charles H. Gane, J. Jenkins, Junr., Wm. North Lewis, Lily Dowager Duchess of Marlborough, Thomas Parkinson, J. P. Quinton, W. Beresford Smith, J. J. Smithies, Alfred J. Waley.

A lecture on "Horticultural Education" was given by Mr. W. H. Patterson.

GENERAL MEETING.

September 2, 1902.

Mr. A. H. Pearson in the Chair.

Fellows elected (13).—St. Julien Arabin, T. Knight Barnard, C. W. Bell, J.P., D.L., C. Cook, F.R.G.S., F. W. Fryer, K. L. Ghosh, (Calcutta), H. E. Hall, T. Henshaw, W. Llewellin, Mrs. Noble, F. Keeble, M.A., Alex. Scott, Mrs. W. Wilson.

A lecture on "Hardy Fruits in Yorkshire" was given by Mr. A. Gaut (see page 587).

SCIENTIFIC COMMITTEE.

JULY 8, 1902.

Dr. M. T. MASTERS, F.R.S., in the Chair, and ten members present.

Clubbing and Gas-lime.—Rev. W. Wilks described his experience with gas-lime as a remedy, without success. A dressing of three inches in depth was put on in November last, and dug in in February. Cabbages were planted in March and grew well at first, but proved to be very badly affected afterwards. Mr. Saunders undertook to examine the roots.

Digitalis, malformed.—Mr. Holmes exhibited a spike in which the corollas were split and the segments antheriferous. A similar monstrosity was described by Professor Henslow in *Journ. Linn. Soc.* vol. xix. p. 216.

Apple-leaf Blister.—In answer to Mr. A. F. Getting's inquiry Dr. M. C. Cooke, M.A., V.M.H., replied :—" Still as great a mystery as ever. The leaves do not exhibit anything abnormal in structure, except that on some of the decayed spots there are tufts of unusual obtuse, jointed, hyaline hairs. This growth seems to have been stimulated by the disease, whatever it is. There is no trace of fungus growth anywhere, but I found several nematode worms, which possibly followed decay, as they were found on the dead spots. Whether the abnormal tufts of hairs are the representatives of the very rare *Erineum pyrinum* I cannot say, but I should think *not*, as those are described as of a bay colour, and these are colourless, and septate, while those are without septa. The *Erineum* was at one time thought to be a fungus, but now the species are recognised as excrescences formed by minute insects or *Phytopti*. There are several species or kinds found on various trees, but *Erineum pyrinum* was supposed to be confined to the leaves of the Apple."

As an additional note to the foregoing, Dr. Cooke added " that in Dr. R. K. Greville's 'Monograph of the Genus *Erineum*' (*Edinburgh Philosophical Journal*) he writes that 'one described species is wanting to complete this short monograph, but from its excessive rarity I have not been able to procure a specimen. It is *Erineum pyrinum*, Pers. *Disp. Fung.* p. 43, t. 4, f. 2. *E. oblongum laxum spadiceum* is the only character given in his *Synopsis*. Albertini and Schweinitz add to the above distinction : *Planum nec congestum, fila laxa congesta* ; and conclude with *Rarissimum, item unica solum vice inventum in pomario domestico ad folia Pyri Mali. exeunte Junio*. Unfortunately, I can add nothing to this extract, or give any further information about *Erineum pyrinum*. Perhaps some expert, acquainted with the habits of the *Phytopti*, might decide whether these tufted excrescences resembling hairs, which give a glaucous bloom to the under surface of the dead spots of these apple-leaves, are associated at all with *Phytopti*."

Beech with Aphis.—Mr. White, of The Lodge, Wateringbury, Kent, writes as follows:—"A very large and fine specimen of Copper-Beech in my garden has for some years been attacked by what I thought must be 'American blight.' The tree is about eighty feet high, and to all appearances particularly healthy. At present (May 16) it is hard to find, but later in the season every leaf is covered with it. I have never noticed it on the trunk or branches; only the leaves appear infected. I cannot say if it is worse on the lower branches or not, but I think this is most probably the case, as the lower leaves are simply covered, and get fouled with honey-dew, the deposit, I presume, of the insects. I shall be glad to send branches gathered both at the top and bottom of the tree in another month, when the pest will appear at its worst stage, if you wish."

Mr. Saunders reported as follows on the specimens of Beech received:—"The insect infesting the leaves of the Copper-Beech is not the same as that which attacks the stems of Beech trees, neither is it American blight, though nearly related to it, being also one of the aphides, known as *Phyllaphis fagi.* The *Coccus* which forms the white felt-like covering to the Beech *stems* belongs to a different family (the *Coccidæ*), and is more nearly related to the 'Mealy Bugs.' The lower branches of the Copper-Beech are probably more infested by the *Phyllaphis* than the upper ones; and as they feed on the undersides of the leaves, the honey-dew which they deposit naturally falls on to the leaves below. In the case of a large tree, it is difficult to suggest a practical remedy; if it were smaller the pest might be destroyed by spraying the undersides of the leaves with paraffin emulsion or some other similar insecticide."

Athyrium Filix-fœmina, diseased.—Fern fronds were exhibited by Mr. C. T. Druery which had been attacked by some species of fly, the larvæ of which were present in the stalks shown, early in the growing season. The fronds affected were quite suddenly noticed to have their unfolding tips flaccid and pendant, the rest of the frond up to a definite point in the stalks being healthy; but at this stage no puncture or wound was visible even under a lens, and the stalk being opened up revealed no cause. Occasionally the growing portion stiffened again, but grew in a stunted fashion. Later on it became brown and perished. By this time the stalk for some distance downward from the point of attack was discoloured, and when split revealed a small white maggot, which bored its way farther and farther, growing meanwhile until in July, as the exhibits showed, it was about half an inch long, of a very pale violet tint, usually solitary, but sometimes there were two. A considerable number of fronds, mostly *Athyrium*, were attacked; and as the fly was unknown no protective means seemed available, and the only remedy or preventive measure would appear to be the immediate removal of flaccid tips plus an inch or two of subjacent stalk, the egg or incipient larva being thus prevented from developing. Later on its locality is easily determined, as it devours the interior entirely as it proceeds downwards, and can be crushed *in situ* by passing the finger and thumb down the stalk until the firm part is reached, which may be close to the caudex.

Mr. Saunders reports as follows upon the Ferns:—"The grubs in the Fern stalks shown by Mr. Druery are the grubs of one of the sawflies, but I have not yet been able to find any mention of a species which attacks Ferns in this way. Several feed on the fronds, but do not burrow into them. The colour of the grubs is also peculiar, but that may partly be owing to the food. I will report again if I can get any further information on the subject."

Pear, diseased.—Mr. Hooper showed some Pears blackened by disease. Mr. Saunders reported upon them as follows :—" The small blackened, malformed Pears had been attacked by the grubs of the 'Pear Midge,' *Diplosis pyrivora* (fig. 175), which seems to be particularly common this year. The parent insect is a small two-winged fly which somewhat resembles a very small gnat. It lays its eggs among the stamens of the blossoms just before they open. As soon as the grubs are hatched they make their way into the embyro fruit and feed upon it. As soon as they are full-grown they leave the fruit and bury themselves in the ground

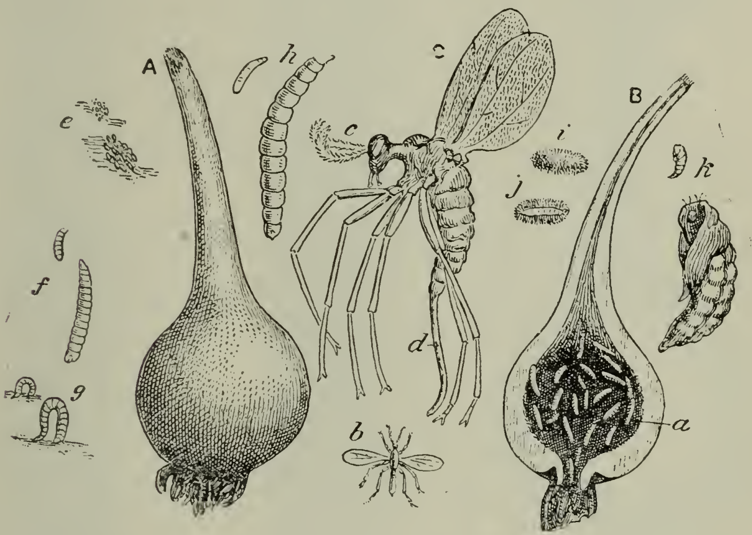


Fig. 175.—Diplosis pyrivora infesting young Pears. (*Journal of Horticulture.*)

A. Affected fruit, natural size when swollen and rounded by the presence of the grub. B. Section of the same showing (*a*) grubs *in situ*. C. Pear-midge ; (*b*) male (natural size) ; (*c*) female (magnified) as seen depositing her eggs ; (*d*) her long ovipositor, with which she pierces the unopened blossom and lays her eggs amongst the stamens ; (*e*) eggs ; (*f, g, h*) grub magnified, and showing its looping gait ; (*i*) cocoon (natural size) ; (*j*) the same opened, showing grub at rest ; (*k*) pupa (natural size and magnified).

about an inch below the surface, and become chrysalides. In this condition they remain until the following spring, when the flies emerge from the chrysalides and visit the flowers. The grubs are probably by this time hidden in the soil, and the only thing to do is to scrape off about an inch and a half of the surface soil and burn it ; or the ground may be dug and the upper soil buried some four or five inches below the surface : this will prevent the flies in the spring reaching the open air. When first the fruit is noticed in the spring to be attacked, all that show signs of being infested should be gathered and destroyed. Sometimes giving the tree a good jarring shake will bring down the injured Pears, which should immediately be picked up and burnt. The soil should be dressed with kainit (half a pound to a square yard), between the middle and end of June, either just before or after rain. In the case of very dry weather at that, time the dressing should be watered-in after it has been applied."

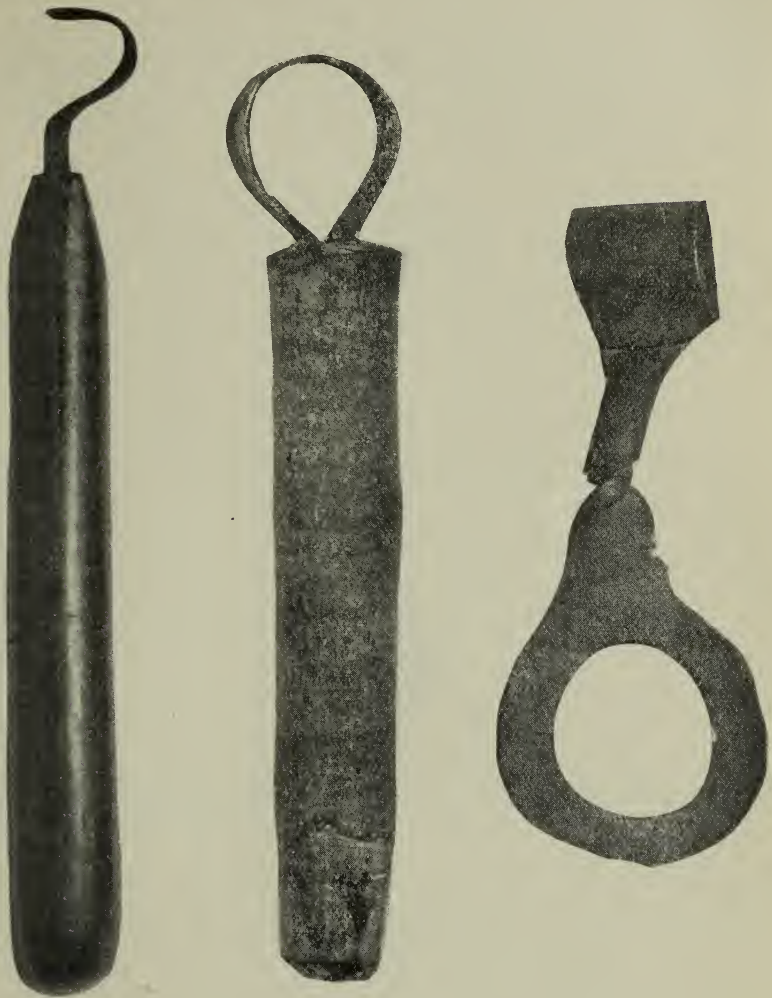
Apples, shrivelled.—Mr. Saunders reported as follows on some Apples exhibited :—"The little shrivelled Apples had certainly been attacked by some insect, but they did not contain any when I opened them. I should imagine from their appearance that they had been infested by the grubs of the 'Apple Sawfly' (*Hoplocampa testudinea*). These little grubs, when full-grown, bury themselves in the earth at a depth of from two to four inches. All the little Apples that fall naturally, or can be shaken off the trees, should be at once collected and burnt; it is of no use merely throwing them away. If the roots of the trees are not very near the surface, the soil, from under such parts of the tree as the grubs are likely to have fallen from, should be removed in the course of the winter, and be burnt or buried deeply, so as to prevent the sawflies from leaving the chrysalides. The sawflies are about quarter of an inch in length, and measure about half an inch across the wings. The insect is black above and yellowish-red beneath, and has four wings."

Crinum sp.—Mr. Elwes, F.R.S., exhibited an umbel of very fine flowers, having the perianth white, with a median crimson stripe. The bulb came from Brazil, and it appears that Mr. Goodman found it also in Jamaica. He suggested that it might be *C. Kirkei* from Zanzibar. Mr. Elwes remarked upon the wide diffusion of several African bulb plants in the last century.

Iris, malformed.—Mr. C. T. B. Crews, of Wokingham, sent a specimen with double flowers. Dr. Masters undertook to examine it, and reported as follows :—"The flowers presented a very remarkable appearance, owing to the presence of an inordinate number of petaloid segments arranged in a complicated and confused manner. Some of these segments were partly staminoid, others partly stylar, but the majority were purely petaloid and variously contorted. The ovary was inversely pyramidal in shape, marked externally by six longitudinal ribs. The three ribs which run into the sepals had a prominent knob just as they passed into them, and in some cases there were other similar, but much smaller, knobs on the petaline ridges. The ovarian cavity appeared to have an irregular number of compartments, with some apparently normal ovules, and others more or less petaloid. The sepals and petals were normal in character, the disturbance in the growth having taken place subsequent to their formation." Mr. Crews states that this plant has now borne similar double flowers for four years.

Leucadendron, malformed.—Professor Henslow showed an inflorescence in which, instead of flowers, the peduncles were covered with bracts like the "wheat-ear" Carnation. It was from a bush growing on the flanks of Table Mountain.

Sycomore Fig.—Professor Henslow showed specimens of this Fig, which is always infested with *Sycophaga crassipes*. To remove them, the Fig is cut open by a peculiar hook-shaped instrument; the process also causes the Fig to acquire great sweetness. The Figs are only cut open and eaten by the poorer classes in Egypt, but the process is the same now as described by Theophrastus in the fifth century B.C. Three forms of



a *b* *c*

Fig. 176.

Fig-cutters were shown. A paper upon the Sycomore Fig will be found in the Society's Journal, vol. xxvii. at p. 128.

Male flowers in edible Figs.—Professor Henslow drew attention to the Fig known as 'Pingo de Mel,' one of the early varieties known as 'St. John's Figs,' since they ripen about St. John Baptist's day, June 24, as it has all the appearance of being a cultivated form of the Caprifig. It has numerous stamens round the orifice, but while the anthers are well-formed they bear no pollen. The female flowers are altogether like gall-flowers of the Caprifig, having the usual globular ovary and sub-peltate stigma.

On referring to Dr. Gustav Eisen's work, "The Fig: its History, Culture, and Curing" (Washington, 1901), that author observes that the male flower was first described in 1714 by La Hire, but it is not certain what the Fig was. Another edible variety which *regularly produces seed* is 'Crosic,' grown in Brittany. A third is grown at Cherbourg, in which the male flowers are degenerated. These are believed to be edible Caprifigs, and it was thought that their origin might be traced to the Phœnician

Fig. 177 represents a male flower, much enlarged. It consists of a calyx of five sepals and five stamens, with pollenless anthers.

Fig. 178 is a female flower, having a calyx of five unequal sepals and a globular ovary to the pistil. This is the usual form of a "gall-flower" in the *Ficus Caprificus*.

Fig. 179 is the abortive, funnel-shaped stigma, also characteristic of a gall flower, being in adaptation to the ovipositor of the *Blastophaga* insect.

traders at a time when the true edible Figs were yet in an undeveloped condition.

The 'Pingo de Mel' would thus seem to resemble the last mentioned. Seedlings raised from Smyrna Figs, which require caprification for maturity, have sometimes male flowers. "Such Figs," observes Dr. Eisen, "must be considered as improved Caprifigs—improved by being raised from seed of Smyrna Figs." These probably contain the usual form of female flowers, and not exclusively those of the gall-flowers of 'Pingo de Mel.'

Scientific Committee, July 22, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and nine members present.

Leucojum droppers.—Mr. H. H. Benton Bradley, of Sydney, sent additional illustrations of bulbs of *Leucojum*, showing two bulbs, one above the other; also similar bulbs artificially separated and both growing when planted.

Prairie Bean.—Rev. W. Wilks showed specimens of a leguminous plant from Kansas, remarkable for flowering before the leaves appear. They were referred to Mr. Nicholson.

Paris with variable number of Leaves.—Mr. Odell showed several flowering stems with five leaves instead of four. The number is constant on the plant. The late Prof. J. S. Henslow wrote a paper on "The Varieties of *Paris quadrifolia*, considered with respect to the ordinary Characteristics of Monocotyledonous Plants" (*Loudon's Mag. Nat. Hist.* vol. v. p. 429, 1832).

Kleinia.—Mr. Odell showed specimens of this South African plant, in illustration of its climbing habit.

Peperoma.—Mr. Odell brought specimens of a minute species from Burmah.

Bulbs pierced by Couch Grass.—Miss Willmot, V.M.H., forwarded specimens in which the couch had penetrated quite through the bulbs from one side to the other. The process is described by M. A. Prunet as being done by a ferment secreted by the tip of the rhizome, ("Sur la perforation des tubercules de pomme de terre," *Rev. Gén. de Bot.*, avec illustrations).

Plum with foliaceous Calyx.—Mr. Hooper showed some blossoms of a Victoria Plum with small but distinctly leaf-like sepals.

Nectarine-Peach.—Dr. Masters received a fruit from Mr. Rivers, one-third of the skin being that of a Nectarine, and the rest that of a Peach. It came from a Peach tree raised from the stone of a Nectarine many years ago.

Sugar Pea.—Mr. Eckford sent examples of this Pea, remarkable for its semi-succulent, edible pod, known in France as "Pois sans parchemin." It has produced three varieties, cultivated in France.

Poon-yet Resin.—Dr. Cooke, V.M.H., read the following account of this resinous-like substance made by bees in trees in Burmah:—"A curious resin, called Poon-yet, or Pwai-ngyet, with a history, is to be met with in Burmah, of which I gave a detailed description in my 'Report on the Gums and Resins in the India Museum' (1874), much of which, being historical, I need not repeat. Mason says, 'There are several species of bees that are characterised by building their nests in the cavities of trees. The wax of one species is dark coloured, of the consistence of resin, and is much used by the Burmese in calking boats.' Some years after the above was written the Rev. C. S. Parish sent specimens of this substance, called Pwai-ngyet, with several of the insects to Mr. F. Smith of the British Museum, who identified the latter with *Trigona læviceps*, first sent from Singapore. From subsequent accounts we learn that 'the *Trigona læviceps* builds its nest generally in the hollow of a tree, entering by a small aperture. These apertures are lined with Pwai-ngyet, and sometimes only show a small rim of that substance raised above the bark of the tree. Sometimes, however, the bees go on building outside, and adding on to the rim until they have formed a wide-mouthed entrance which projects as much as a foot from the tree. These structures commonly assume the shape of the mouth of a large trumpet, flattened horizontally, and have a perpendicular diameter of a foot or so, and a horizontal diameter of three or four inches. They are built with great regularity in their exterior half, but not so regularly towards the base, from the necessity of adapting the structure to the shape of the tree where the hole may chance to be. What the internal economy of the nest may be I cannot say, as the tree has commonly to be felled in order to obtain the contents, and this I have never seen done. I am informed that from five to ten 'viss' are usually obtained from one nest. A viss is about $3\frac{3}{4}$ lbs., and costs about sixpence in the bazaars. This substance appears to consist of oil united with resin. It is soluble in oils and turpentine, but not in spirits of wine. In Burmah the name Pwai-ngyet is often applied in the bazaars to denote any kind of resin or 'dammar,' but the true Pwai-ngyet is a structure formed by the dammar bee for its own habitation probably from a mixture of substances, and is found on various trees and in numerous situations.'"

Potatos, diseased.—Some small tubers were sent by Mr. Eckford, which Dr. Cooke undertook to examine.

Scientific Committee, August 5, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and eight members present.

Larch Disease.—Dr. Cooke, V.M.H., replied thus to Mr. Elwes' inquiry:—

"Some time since some Larch twigs were sent to the Committee which were evidently diseased, but after careful examination I was compelled to report that I could find no fungi present. Afterwards, it appears that specimens were sent to the Botanical Gardens, Edinburgh, and the report made upon them was that they were affected by a fungus called *Allescheria laricis.* This report was communicated to me rather as a reproach, I presume, and I returned a polite request to be furnished with a reference to the authority for the name of the presumed fungus, as I was unacquainted with any such genus as *Allescheria*, and could not trace the name in Saccardo's 'Sylloge'—the most complete work of the day. To this communication I received a reply, dated July 24, to the following effect: 'For *Allescheria laricis* see Hartig in "Centralblatt für d. ges. Forstwesen," 1899, also Hartig, "Lehrbuch der Pflanzenkrankheiten," Aufl. 3, Berlin, 1900. Signed A. W. Borthwick.'

"My next step was to consult the works named above, where I certainly found the name of *Allescheria laricis*, attached to a small woodcut; but although this was apparently the first mention of the genus *Allescheria*, it was without any diagnosis of the supposed genus, or of its affinities, and the only intimation vouchsafed was that it was intended to be described hereafter, and therefore that *Allescheria* as a genus of fungi is simply a naked name, with no claim to recognition, except by the small woodcut of one of its supposed species and the meagre information which accompanies it. From this woodcut it appears that the small conidia resemble those of *Phoma*, being minute and binucleate, produced on sterigmata from each cell of triseptate, clavate sporophores, and that these sporophores are arranged concentrically in oval tufts, which are presumably superficial. Hence we are led to the conclusion that there are no perithecia and that the fungus is allied to the *Hyphomyceteæ*, but whether to the *Mucedineæ* or the *Dematieæ* there is no indication; possibly the former, as no coloration is mentioned. Under these circumstances *Allescheria* remains still a problematical genus, and *Allescheria laricis* an imperfectly described species, or really—as I should term it—a nondescript. It is a great pity that these manuscript names should be recognised at all, as their quotation leads, as in this instance, to endless trouble. Subsequently I made a journey to Kew and consulted my colleague, Mr. George Massee, and found him involved in just the same mystery, for he had sent direct to Germany for specimens of the authentic *Allescheria laricis*, and had received what were supposed to be such, but he confessed that he could find nothing which resembled the woodcut, and was as far as ever from the solution of the mystery."

Silver-leaf Disease.—Dr. Cooke, V.M.H., contributed the following account of its explanation: "Professor John Percival has communicated an interesting and valuable contribution towards elucidating the mystery of the Silver-leaf disease to the Linnean Society (*Journal*, Botany, No. 245, July 1902). He states that the peculiar ashy-grey colour of the leaves is caused by large intercellular spaces, filled with air, which are present beneath the cuticle along the lines of union of the epidermal cells. How these air channels are produced is not clear at present. No spots or blisters are visible, and fungi are absent from the leaves and tissues of the stem and branches. In advanced cases a discoloration of the central parts of the wood is observable when the stems are cut across. Large roots of long-diseased trees were found to be similarly affected. Examination of the discoloured wood revealed the presence of fine fungus hyphæ. Segments of diseased roots placed in a damp chamber in two or three days developed a dense white mycelium round the edge of the diseased patch. In other specimens of Plum and Apricot trees affected with silver leaf the wood of the root invariably showed internal discoloration, and fungus hyphæ were always found in the wood near the junction between the living and dead portions. At first no conidia were found upon the mycelium, but after three or four months' growth small sporophores of *Stereum purpureum* appeared upon pieces of root. In one case only the fully-developed fruiting stage of the *Stereum* has been seen on diseased trees. The appearance of this specimen is described, with its discoloured wood, and the inference that the *Stereum* was in some way responsible for the Silver-leaf disease. Then follow details of the inoculation of healthy Plum-trees with the sporophores of *Stereum purpureum*, and in eight or nine weeks after the leaves exhibited the characteristic silvery appearance. From these experiments it would appear that the disturbing cause is conducted rapidly in the sap of the plant. From the evidence it appears that the infection takes place below ground. In some instances there were old wounds through which the infection might have taken place, in others no abraded surface was noticeable. Whether other species of *Stereum* are capable of setting up the disease, and other matters, are to be investigated later on, when more material is available. Meanwhile this communication should be read in full, and its substance disseminated through all horticultural circles."

Potato Tumour.—Dr. Cooke also added the following investigation: "The young Potatos which were sent to the last Committee were remarkable in appearance, the whole surface being corrugated and distorted by some parasite which it was necessary to discover. At the same time the distorted tubers were much darker in colour, and softened. Cut in section, the centre retained the colour and texture of healthy Potato, but at the periphery, immediately beneath the cuticle, it was excavated with brown cells. These cells contained subglobose brown bodies (about $25 \times 20\ \mu$) on hyaline pedicels, resembling much the gonidia of *Pythium*. This parasite being quite new to me, and unnoticed in any work to which I had reference, I consulted Mr. Massee, who had made special study of this group, and he at once informed me that the same disease appeared last year near Birkenhead, where it completely destroyed a field of Potatos, and that it evidently was allied to *Pythium*, and had been found in Germany, and called *Chrysophlyctis endobiotica* (Schilbersky, Ber. Sent. Bot. Gesell. p. 36, 1896). As far as we have been able to discover, this genus has never been described, but seems to be a close ally of *Pythium*, and very similar to the fungus which causes Beetroot tumour, and known as *Œdomyces leproides* or *Urophlyctis leproides*. Although I did not find them, Mr. Massee informs me that the first-formed spores are subglobose, produced at the apex of a hypha, which has a large vesicular swelling just below the spore, exactly as in the Beet-root disease. It is very unsatisfactory that, as in the case of the Larch disease just under notice, these destructive fungi should be simply named in more or less obscure foreign journals, and not properly described, so that they may be recognised and investigated. In the present instance I believe that I am justified in stating that Mr. Massee has a memoir in preparation, detailing his own investigations together with all that is hitherto known of this new 'Potato tumour.' I am afraid that the disease is of such a nature that it may be classed as incurable, and can only be stamped out by vigorous measures of destruction."

A unanimous vote of thanks was given to Dr. Cooke, V.M.H., for his three reports.

Influence of Scion on Stock.—Mr. W. B. Latham, of the Botanical Gardens, Edgbaston, Birmingham, sent a bough of a Laburnum, from which a cluster of shoots of *Cytisus purpureus* had grown out. It appears that the tree was purchased some twenty-seven or twenty-eight years ago as a young plant of *C. purpureus* grafted on *C. Laburnum*. The scion grew very well for a year or two on the stock, till a strong shoot grew out below where the graft was inserted. This was cut off to save the graft, but the graft quite died out soon afterwards. The stock was left to grow into a Laburnum tree, which is now from fifteen to twenty feet high, and as much in diameter. After some three or four years the *C. purpureus* made its appearance in various parts of the Laburnum, and is now to be seen in tufts all over the tree. A somewhat similar case is recorded in the *Gardeners' Chronicle* (1857, p. 382), by Mr. E. Purser, Clapham Park. He wrote :—" Some few years ago three grafts of the *Cytisus* (*purpureus*) were inserted, and now the whole character of the tree is changing, and every year it loses the yellow flower of the Laburnum and produces the short purple flower."

Cattleya and Lælia Cross.—Mr. Douglas, V.M.H., exhibited a plant, L.-C. 'Juno,' Edenside var., being *C. Mossiæ* × *L. majalis*. It is usually considered an invariable rule that hybrid Orchids betray the characters of both parents. The present plant, though an undoubted cross, was thought to be exceptional. A coloured illustration which Mr. Douglas exhibited of *C. Mossiæ*, together with the plant, showed a degree of yellow in the throat, which was wanting in the living plant. *L. majalis* has a very spotted lip ; but this feature was also wanting in the plant. That a cross or hybrid, though usually intermediate, may have one or other parent prepotent is well known ; but the second generation, as Dr. Masters observed, will often reveal the other parentage more completely.

Gypsophila paniculata dimorphic.—Prof. Henslow called attention to the fact that different plants of this species may have different kinds of flowers, being gynodiœcious ; that is, in some the styles are greatly elongated, while the stamens are abortive ; in others the styles are much shorter and the stamens perfect. They spread outwards, and not inwards as in the case of self-fertilising plants.

Dendrobium Dalhousieanum synanthic.—Dr. Masters exhibited a specimen (received from Mr. W. Potter, Beckenham) of two flowers coherent by their ovaries and the two adjacent sepals, all the other parts being distinct.

Proposed Investigations.—Mr. Elwes wrote, in reference to the Larch disease, of the difficulty experienced in obtaining any assistance from a practical point of view in dealing with what was proving to be a very serious disease among trees and one of immense economic importance. He suggested that, if a qualified person could be found, he should undertake a systematic investigation, for which a small grant from the Royal Society would most probably be forthcoming. Mr. Elwes adds that the disease cannot be studied in the laboratory alone, but only profitably by visiting places where it has appeared, so as to discover the conditions which produce it.

Scientific Committee, August 19, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and ten members present.

Lavender, Improved.—Rev. W. Wilks showed a spray of a new selected Lavender, having large dark purple corollas and calyx. The scent was also stronger than that of the old form. He remarked that the white Lavender was relatively devoid of scent. Mr. Bowles observed that this new variety was somewhat like the *dwarf* form of Lavender cultivated in some gardens.

Galls.—Mr. Odell showed specimens of various galls on the following plants :—*Poterium sanguisorba*, galled by *Eriophyes sanguisorbæ* ; *Polygonum amphibium*, galled by *Cecidomyia persicariæ* ; Oak, *Q. sessiliflora* and *Q. pedunculata*, galled by gall-wasp, *Aphilothrix gemmæ* ; *Salix fragilis*, galled by *Nematus gallicola*; bud-galls on *Campanula glomerata*.

Abelia rupestris phyllotaxis.—Mr. Odell showed three stems of this plant having opposite leaves, whorls of threes and whorls of fours on separate shoots.

Pyrethrum aureum, var. '*Staghorn.*'—Mr. C. T. Druery, V.M.H., exhibited a plant of this variety raised by Messrs. Storrie, Dundee. It is characterised by a distinct tasselling or cresting of the main and lateral apices, precisely as obtains so frequently in Ferns. This form of variation is extremely rare in phanerogams ; the only instance known to the exhibitor being the crested form of *Asparagus plumosus*, in which case it is correlated with extremely Fern-like foliage. In the *Pyrethrum* shown the leaves are distinctly pinnate, with stipitate pinnæ precisely on Fern-lines, as are the terminal. It is stated to be so far fixed that 80 per cent. of the seedlings are true after five years' cultivation.

Malformations.—Mr. Corderoy sent examples of the Wheat-ear *Antirrhinum*, in which no flowers were present, but short branches covered with minute green bracts occupied their position. Also a Brier which had a yellow variegated stem, but the leaves upon it were entirely green, an unusual combination for which no reason could be assigned. And *Lathyrus latifolius* with green flowers. These apparently had received some check, so that, although nearly fully formed, the flowers dropped. The stamens had full-sized anthers, which did not dehisce, the styles were arrested much below the anthers, and the stigmas were immature. As the flowers of Honeysuckle sometimes exhibit a similar appearance late in the season, it may be attributable to the coldness of the month of July this year.

Silver-leaf Disease.—Mr. Worsley exhibited the grafted portion of the stem of a Peach on Plum showing the decayed condition of the centre. He observed that below the graft the dead part decreased by degrees downwards, till in the roots there was none. His impression was that the disease (caused by the fungus *Stereum*, according to Prof. Percival) proceeds upwards and downwards. The specimen was sent to Prof. Percival for further examination.

Onions and Caterpillars.—Mr. J. Walker, Thame, sent some foliage, upon which Mr. McLachlan, F.R.S., reports as follows :—"The larva is that of some Noctuid moth, and probably of *Mamestra Brassicæ*, which will feed on nearly everything, from Oak to Grass. At the present time hand-picking, where the plants are attacked, would perhaps be best, or a good spraying with some of the paraffin preparations. Earlier in the year—say two months earlier—repeated spraying with arsenical or paraffin preparations might save the young plants. At this season the attacks will probably not do very much harm, as the Onions will be well on towards maturity. One can hardly prevent the depositing of eggs, because the moths fly from a distance ; the thing is to preserve the young plants by rendering the foliage distasteful by means of spraying as before mentioned. Even this is uncertain, because the larvæ may move on to the Onions from some other contiguous crop that may have been gathered, such as Cabbage, &c." Some doubts were expressed as to the desirability of using arsenical preparations, in case it might be absorbed by the Onions when eaten in the early stage.

Physianthus and Moths.—Prof. Henslow exhibited flowering sprays of this plant from Cape Town, in which nearly every flower had retained a grey moth, its proboscis having been firmly caught between the anthers, which are fixed to the stigmatic head in Asclepiads. The moths either died from starvation or were picked off by bats, which are aware of their constant presence in these particular flowers, and hunt for them therein.

Pelargoniums with secondary tubers.—In allusion to the illustration lately received of *Leucojum* with secondary tubers below the first, Prof. Henslow showed specimens of small tuberous-rooted Pelargoniums from the slopes of Table Mountain, in which similar secondary tubers were found below those from which the foliage and flowers proceeded. He suggested that they might be water-reservoirs in this particular case, as the plants were in full flower in the dry season. Such tubers occur in other plants (as species of *Erodium*) in the South African deserts.

Phototropism.—Prof. Henslow described an experiment to illustrate the effect of light in connection with gravity, &c. Mustard-seed was grown on a thin layer of cotton wool, kept moist, on a perforated tin tray, suspended under an inverted flower-pot raised upon a support so that the Mustard was illuminated only from below by means of a sheet of white paper. Gravity (the attractive force of the earth) had no effect upon the germinating radicles. If any protruded through the holes they at once turned back, and with all the rest were entwined in the wet wool. Hydrotropism thus entirely superseded gravity. When the tin was suspended horizontally, the hypocotyls or caulicles with the green cotyledons curved downwards; those on the circumference, being more strongly illuminated, curving more rapidly than the cluster in the middle. When the tin was suspended vertically, after two or three days all the seedlings curved downwards in the direction of both light and gravity, phototropism overcoming negative geotropism, or apogeotropism. These terms, of course, only describe the movements of the hypocotyls as "towards the light," or "in opposition to gravity," or "away from the earth." They are not "forces." The experiment suggested the possibility of different degrees of illumination being the primary influence in causing the upward growth of the stem and the downward growth of the root. It may be remembered that aërial roots of Ivy protrude on the less illuminated side, irrespective of gravity. So, too, the radicle of Mistleto grows towards the bough on which the seed is fixed; so that as the direct light from the sky is greater than the reflected light from the soil, the shoot-end of a plant grows upwards and the root-end downwards. Gravity, however, is believed to act upon the root-tip, as Darwin and his son, Dr. Francis Darwin, explain, unless it be overcome by the presence of water, manure, &c. The stem, by growing upwards in opposition to gravity, puts out mechanical tissues to support itself under the influence of gravity, which always tends to pull it down, and has acquired a permanent tendency to rise, as shoots laid horizontally will rear their tips perpendicularly if kept in total darkness. Similarly, it is presumably possible that the root-tip has become sensitive to gravity as a secondary effect. As far as the germination of spores can throw light upon primitive conditions, it has been found that the first cell-plate laid down in the unicellular spore of Ferns and *Equisetum* is approximately in a plane at right angles to incident light, and that the most illumined half lays the foundation of the stem. Again, the dorsiventrality of the prothallium of a Fern, and the development of the rhizoids upon the under side, are determined by different degrees of illumination, and not by gravity.

Scientific Committee, September 2, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, with six members present, and Mr. Gaut, of Yorkshire College, Leeds, visitor.

Phyllotaxis of Aloysia.—Mr. J. W. Odell brought specimens showing variations in the number of leaves to a whorl on different shoots. On the secondary shoots, which resulted from the pinching of the primary one, the leaves were in whorls of three.

White Lavender.—Mr. Odell showed flowers of this variety to prove the existence of fragrance in this variety, which had been disputed.

Double spathe of Richardia Elliottiana.—Mr. Douglas, V.M.H., brought a specimen of a double spathe in this plant, in itself not an uncommon occurrence, but the spathes in the present examples were remarkable for being deeply pinnately lobed.

Helianthus 'Miss Mellish.'—Specimens were exhibited showing the decay and rotting of the root-stock and stem, apparently due to fungus "sclerotia," which were found in the tissues. Dr. Cooke, V.M.H., undertook to report on the specimens on another occasion.

Peloria in Antirrhinum.—From Herr Lorenz, of Erfurt, came specimens of regular flowers of this plant. The regularity in this case is owing to the increase of the irregular portions, so that there are five spurs instead of one only, and all five stamens are produced in a symmetrical manner, thus constituting it a case of regular Peloria. Herr Lorenz remarks:—"Hitherto Peloria flowers have very seldom been found except as isolated blossoms on a spike of otherwise true Snapdragon flowers. This variety, however, bears the true Peloria flowers almost exclusively, and has to a marvellous degree proved constant, even when grown from seed. Peloria flowers in general are known to be sterile to a very great extent, and in the present case the production of seed is very small. Trials which have been made hitherto with seed from Peloria-flowered Snapdragons have failed to give satisfactory results, as the seedlings almost always reverted to the common Snapdragon form. The variety sent was found four years ago amongst a sowing of the darkest-flowering Snapdragon, named "Black Prince," and has been carefully selected and improved since, so that it now produces 80 per cent. of true Peloria flowers."

Celery Leaves.—Some specimens were exhibited by Mrs. Langford, of Thrale. They were found to be affected by a fungus allied to *Phyllosticta* or *Sphærella*.

Twin Cucumbers.—A specimen of this not uncommon peculiarity was exhibited by Lady Laura Hampton. The appearance is probably due to the union of two flowers in a very early stage of their development.

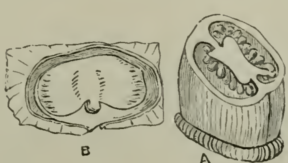
Cracked Pears.—Specimens were shown showing the effect of *Fusicladium* in arresting the growth of the rind of the Pear, which, being unable to expand, cracks as the flesh beneath increases in bulk and exerts pressure upon it. Spraying in an early stage is the only means of preventing the mischief.

White Heather.—Mrs. Streatfield sent specimens of the white variety of *Erica Tetralix* from a Surrey common.

Silver-leaf Disease.—A letter was read from Professor Percival relating to the specimen forwarded to him from the previous meeting:—"From sections of the stump through the points of union of scion and stock, it seems very probable that the fungus which causes the disease had entered at the point of grafting in this particular case. Such examples are not at all uncommon, although in many cases the disease starts in the roots below ground. The disease, I have abundantly proved this year in my own garden, can be induced with the greatest ease by inoculating any part of the tree either above or below ground. The fungus (*Stereum purpureum*) does not itself extend very far in the tissues of the diseased trees, but some of its products, or products resulting from its action on the tissues of the trees, circulate rapidly in an upward direction, and induce the peculiar changes in the leaves. Downward circulation also takes place, but much more slowly. In several cases of inoculation with the fungus on long branches of plants, the disease has spread downwards even after the greater portion of the branch has been cut away at a point several inches below the point of inoculation."

Copper as a cause of Yellow Foliage.—Mr. Gaut alluded to the yellow tint assumed every year by the foliage of certain Apple-trees and Raspberry bushes near Richmond, in Yorkshire. The want of green colour had been attributed to the presence of copper in the soil, but as it was considered that the evidence in support of this opinion was inadequate, further information was solicited.

Melon Disease.—Mr. Willard sent specimens of this disease, characterised by rotting of the bine, and conjecturally attributed to the presence of bacteria. Acting on a suggestion of Dr. Masters, Mr. Willard had inoculated a seemingly healthy plant with some of the juice from a diseased plant. The result was the development of disease within a very short time. The Committee, however, thought the result of the infection would not have manifested itself so rapidly, and that the inoculated plant would shortly have shown symptoms of the disease, even if it had not been inoculated. Further experiment was suggested.



FRUIT AND VEGETABLE COMMITTEE.

HOLLAND HOUSE SHOW, June 24, 1902.

Mr. W. Bates in the Chair, and sixteen members present.

The Cups and Medals awarded by the Council will be found at p. 441.

Exhibits :—

The Earl of Lathom, Lathom House, Ormskirk (gr. Mr. B. Ashton), sent Melon 'Countess of Lathom,' but it arrived too late for the Committee's inspection.

Messrs. Bunyard, Maidstone, staged a small collection of 1901 Apples in excellent condition, and two varieties of Cherries.

Mr. S. Mortimer, Rowledge, Farnham, sent Melons 'The Queen,' 'Advance,' and 'Progress,' also Cucumber 'British King.'

Mr. M. C. Brock, Charsfield, sent an unnamed dark-green Cucumber.

Capt. Carstairs, Welford Park, Newbury (gr. Mr. C. Ross), staged Melons 'Coronation' and 'Baden-Powell.'

Mark Fenwick, Esq., Abbottswood, Stow-on-the-Wold (gr. Mr. M. Jones), sent Melon 'King Edward VII.,' which arrived too late for the Committee's inspection.

Fruit and Vegetable Committee, July 8, 1902.

Mr. H. Balderson in the Chair, and twelve members present.

Awards Recommended :—

Hogg Medal.

To Lord Llangattock, The Hendre, Monmouth (gr. Mr. T. Coomber), for fifteen exceedingly well-grown 'Queen' Pineapples.

Silver Knightian Medal.

To Messrs. Bunyard, Maidstone, for a collection of Cherries.

Cultural Commendation.

To Mr. G. Kelf, gr. to Miss Adamson, South Villa, Regent's Park, for two boxes of Mushrooms.

Other Exhibits.

Mrs. Evans, Forde Abbey, Chard (gr. Mr. J. Crook), sent Peaches 'Amsden June,' which, however, had suffered greatly in transit.

J. Watkins, Esq., J.P., Withington, Hereford, sent Apple 'Lord Beaconsfield,' a handsome variety, and very good for so late in the season.

W. H. Long, Esq., Rood Ashton, Trowbridge (gr. Mr. W. Strugnell), staged Melon 'Western Hero,' and a Tomato named 'Bounds Production,' synonymous with 'King Humbert.'

The Horticultural College, Swanley, sent Lettuce 'Carter's Endive,' a variety with endive-like foliage.

Messrs. Laxton, Bedford, staged Strawberries 'The Laxton' and 'Trafalgar.'

Messrs. Bunyard sent Cherry 'Grosse Gomballoise,' a dark-coloured fruit of good flavour.

Mr. Julius Honings, Neus am Rhein, Germany, sent Gooseberry 'Früheste,' syn. 'Early Sulphur.'

Fruit and Vegetable Committee at Chiswick, July 11, 1902.

Mr. H. Balderson in the Chair, and ten members present.

Awards Recommended :—

First-class Certificate.

To Pea 'Carter's Daisy' (votes, unanimous), from Messrs. Sutton, Reading.

To Pea 'Senator' (votes, unanimous), from Messrs. Daniels, Norwich.

Award of Merit.

To Pea 'Sutton's Harbinger' (votes, 7 for, 2 against), from Messrs. Sutton. This variety is distinct from other varieties named 'Harbinger.'

To Pea 'Little Marvel' (votes, unanimous), from Messrs. Sutton.

To Pea 'Early Giant' (votes, unanimous), from Messrs. Sutton.

To Pea 'Western Express' (votes, 9 for, 1 against), from Messrs. Veitch, Exeter.

Fruit and Vegetable Committee, July 22, 1902.

Mr. G. Bunyard, V.M.H., in the Chair, and twelve members present.

Awards Recommended :—

Silver-gilt Knightian Medal.

To Messrs. Ray, Teynham, Kent, for a large collection of Cherries.

First-class Certificate.

To Strawberry 'Givons Late Prolific' (votes, 10 for), from H. P. Sturgis, Esq., Givons, Leatherhead (gr. Mr. W. Peters). Raised from 'Waterloo' × 'Latest of All,' and given an Award of Merit, July 2, 1901. Fruit large, wedge-shaped, bright crimson, with red flesh of excellent flavour. A very fine late variety, and the plants exhibited showed a very fruitful habit. (Fig. 180.)

Award of Merit.

To Strawberry 'The Khedive' (votes, unanimous), from Messrs. Veitch, Chelsea. Raised from 'Lord Suffield' × 'British Queen.' Fruit of medium size, long, very dark red colour, with prominent seeds; flesh firm, and of excellent flavour.

Other Exhibits.

Messrs. Cross, Wisbech, sent Apple 'Early Victoria.'

F. A. Bevan, Esq., Trent Park, New Barnet (gr. Mr. H. Parr), sent some very large, handsome Tomatos named 'Coronation.'

Mr. Geo. Lee, Clevedon, staged Gooseberry 'Scorpion,' a large pale yellow variety of fair flavour, and Red Currant 'La Versaillaise.'

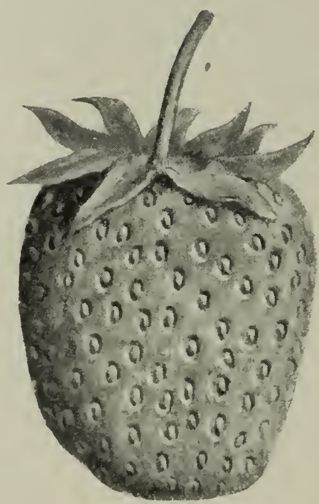


Fig. 180.—Strawberry 'Givons Late Prolific.' (*Journal of Horticulture.*)

Messrs. R. Veitch, Exeter, sent large, well-filled pods of Pea 'Glory of Devon.'

Mr. G. Hobday, Romford, staged Pea 'Essex Hero,' a promising variety, which the Committee desired to be tried at Chiswick.

Mr. Andrews, Campsea Ashe, sent Black Currant 'Campsea Ashe.' The Committee requested plants to be sent to Chiswick for trial and comparison with 'Boskoop.'

Messrs. Rivers, Sawbridgeworth, sent a box of beautiful 'Duke of York' Peaches.

Dr. Bonavia, Westwood, Worthing, staged a basket of the very seldom seen American Grape called the Strawberry Grape, admirably grown.

Mr. W. Taylor, Hampton, sent fruits of Peach 'Libra,' a variety raised by the late R. D. Blackmore, Esq.

Fruit and Vegetable Committee, August 5, 1902.

Mr. H. Balderson in the Chair, and eleven members present.

Awards Recommended :—

Gold Medal.

To Miss Adamson, South Villa, Regent's Park, (gr. Mr. G. Kelf), for a remarkably fine collection of fruit.

Silver-gilt Knightian Medal.

To E. A. Hambro, Esq., Hayes Place, Hayes, Kent (gr. Mr. W. Beale), for six bunches of superb black Hamburgh grapes, cut from a vine 100 years old.

Silver Banksian Medal.

To Messrs. Harrison, Leicester, for eighty dishes of Peas.

Other Exhibits.

Messrs Laxton, Bedford, sent a box of Strawberry 'Trafalgar' grown in the North of England and of large size.

Mr. H. Becker, Jersey, sent Gooseberry 'Gunner,' a very good early variety.

Fruit and Vegetable Committee at Chiswick, August 14, 1902.

Mr. A. Dean in the Chair, and eleven members present.

Awards Recommended :—

Award of Merit.

To Potato 'New Century' (votes, unanimous), from Messrs. Dicksons, Chester.

To Potato 'Northumbria' (votes, 7 for, none against), from Mr. Geo. Wythes, V.M.H., Syon House, Brentford.

Fruit and Vegetable Committee, August 19, 1902.

Mr. H. Balderson in the Chair, and seven members present.

Award Recommended :—

Silver-gilt Knightian Medal.

To Messrs. Veitch, Chelsea, for a group of heavily-fruited Plum-trees in pots.

Other Exhibits.

W. W. Shuter, Esq., Belsize Grove, Hampstead (gr. Mr. T. Armstrong), sent a box of beautiful Peaches.

Mr. A. Johnson, Duffield Gardens, Stoke Poges, sent a large unnamed Melon, which the Committee desired to see again with a name.

The Duke of Northumberland, Syon House (gr. Mr. Geo. Wythes, V.M.H.), staged Vegetable Marrow 'Wythes' Prolific' raised from 'Prince Albert' × 'Bush Marrow.' It was requested that seeds be sent to Chiswick for trial with other varieties.

T. Parkinson, Esq., Castle Pygyn, Abergwili, South Wales, sent Apple 'French Crab' in excellent condition.

C. C. Paine, Esq., Hillfield, Haverstock Hill (gr. Mr. H. B. Vyse), sent some remarkably fine fruits of *Monstera deliciosa.*

Dr. Bonavia, Westwood, Richmond Road, Worthing, staged fruits of the 'Spotted Melon of Lucknow' (Chitla Kharbooza). A very pretty variety, resembling an ornamental Gourd in appearance; with very white flesh, exceedingly sweet in flavour, and a slight Cucumber taste. Grown as Melons are usually grown in this country, the plant grows and crops very freely.

Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kelf), sent Plum 'McLaughlin's Gage.'

Fruit and Vegetable Committee, September 2, 1902.

Mr. A. H. Pearson in the Chair, and nine members present.

Award Recommended :—

Cultural Commendation.

To Mr. G. Shawyer, Cranford, Hounslow, for exceedingly fine trusses of Tomato 'Cranford Prolific.'

Other Exhibits.

Mr. W. Bunn, Colwall, Malvern, sent Tomato 'Bunn's Superlative.' A pretty variety, of good flavour.

Messrs. Cross, Wisbech, staged large and excellent fruits of Apple 'Early Victoria.' This is a variety well worth the attention of growers.

Sir Walter Gilby, Bart., The Orchards, Elsenham, Essex (gr. Mr. W. Plester), brought four varieties of the 'Cherry Plum.' This Plum is very hardy, growing wild in the hedgerows in Sussex and other parts of England. The fruit does not possess much flavour raw, but is excellent when cooked or stewed.

Mr. C. Lorenz, Hoflieferant, Erfurt, sent two fruits of Musk Melon 'Eureka,' which unfortunately arrived in an absolutely rotten condition.

Mr. C. Crooks, Hadsor House Gardens, Droitwich, sent Melon 'Hadsor Favourite,' over-ripe.

Mr. R. V. Mather, Abbey View, Kelso, sent Melon 'Lilburn Favourite,' not quite ripe, and the Committee desired to see it again.

Miss Adamson, South Villa, Regent's Park (gr. Mr. G. Kelf), sent three varieties of excellent Peaches.

Fruit and Vegetable Committee, at Chiswick, September 12, 1902.

Mr. H. Balderson in the Chair, and nine members present.

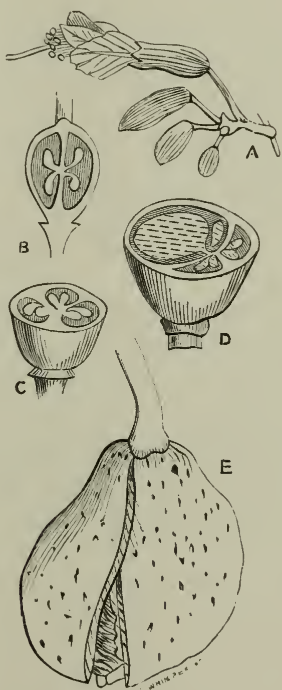
The Committee examined the collection of Tomatos, Beans, and Potatos growing in the Gardens, and by reason of their heavy crop and excellent appearance ordered some of the following varieties of Potatos to be cooked, viz.:

'Alderman.'
'Commonwealth.'
'Dalmeny Beauty.'
'Earl Roberts.'
'Henry Fincham.'
'Shamrock II.'
'The Marfield.'
'Up-to-Date.'
'Victoria Improved.'

Award Recommended:—

Award of Merit.

To Potato 'Commonwealth' (votes, unanimous), from Mr. J. C. Scammell, Wilton, Salisbury.



FLORAL COMMITTEE.

HOLLAND HOUSE SHOW, JUNE 24, 1902.

Mr. W. MARSHALL in the Chair, and twenty-seven members present.

The Cups and Medals awarded by the Council will be found at p. 441.

Awards Recommended:—

First-class Certificate.

To *Asparagus myriocladus* (votes, unanimous), from Mr. R. Greenfield, jun., Bath Street, Leamington. A distinct and very pretty dwarf Asparagus introduced from South Africa. The growths are very sturdy and clothed with narrow deep-green leaves.

Award of Merit.

To *Iris* 'Sunshine' (votes, 7 for), from G. Yeld, Esq., Clifton Cottage, York. A delightful flower of the German or Flag Iris section with canary-yellow incurving standards and paler falls, with a conspicuous deep yellow beard.

To *Rhododendron* 'Lady Clementine Walsh' (votes, unanimous), from Messrs. John Waterer, Bagshot. Very pale pink, medium-sized, well-shaped flowers, spotted with green on the upper segment. The truss is large and very compact.

To Double Begonia 'Masterpiece' (votes, unanimous), from Messrs. Blackmore and Langdon, Twerton-on-Avon, Bath. Large substantial rich crimson flowers with smooth petals.

To Double Begonia 'Professor Lanciani' (votes, 8 for, 4 against), from Messrs. Blackmore and Langdon. A vigorous variety with bright salmon-coloured flowers.

To Double Begonia 'Miss Dorothy Hardwick' (votes, unanimous), from Messrs. Blackmore and Langdon. A bold Hollyhock-shaped flower of a pale shell-pink colour, the petals slightly frilled.

To *Iris orientalis* 'Snow Queen' (votes, 6 for), from Messrs. Barr, Covent Garden. A slender-growing Iris with deep-green sword-shaped leaves and white flowers; the basal half of the falls is greenish yellow.

To *Sparaxis* 'Fire King' (votes, unanimous), from Messrs. Wallace, Colchester. A dwarf bulbous plant with small Iris-like leaves six inches long. Closely allied to the Ixias. Flowers nearly two inches across, borne in pairs on slender stems a foot long. The centre is rich yellow, with a deep-maroon zone edged with brownish red.

Other Exhibits.

E. M. Mundy, Esq., Shipley Hall, Derby (gr. Mr. J. C. Tallack), sent some hybrid *Streptocarpus* bearing an abundance of flowers.

From Rev. J. F. Anderson, Carham Vicarage, Coldstream, N.B., came flowers of *Cytisus scoparius Andreanus* raised from seed. They were exceedingly fine, but not sufficiently distinct to warrant an award being made.

Percy Waterer, Esq., Fawkham, Kent, sent six new varieties of Sweet Peas. It was requested that seed be sent to Chiswick.

Messrs. Kelway, Langport, sent new Delphiniums and Pæonies.

Messrs. Cooling, Bath, sent flowers of *Rosa rugosa* 'Empress of India.' The Committee asked to see a plant.

Messrs. Dobbie, Rothesay, sent Aquilegias and a very fine strain of *Mimulus*.

Mr. Turner, Slough, sent five varieties of *Rosa Wichuraiana*.

From Messrs. Bunyard, Maidstone, came *Vitis heterophylla variegata* and *Senecio Grayi*.

Messrs. Sander, St. Albans, sent *Heliconia* 'Edwardus Rex,' and *Alocasia* 'Alexandra Regina.'

Messrs. R. Veitch, Exeter, sent flowers of *Scabiosa caucasica magnifica* and *Dianthus multiflorus* 'Émilie Paré.' The Committee asked to see a plant of the last named.

Messrs. Jas. Veitch, Chelsea, sent *Torenia Fournieri compacta*.

Mr. F. Burdett, Scotswood, Sunningdale, sent *Viola* 'Maggie Mott.'

Mr. Chapman, Carrowflat, Grangemouth, sent *Lobelia* 'King Edward.'

Messrs. Wood, Wood Green, sent hanging baskets.

Floral Committee, July 8, 1902.

Mr. W. Marshall in the Chair, and seventeen members present.

Awards Recommended :—

Gold Medal.

To Percy Waterer, Esq., Fawkham, Kent, for 100 varieties of Sweet Peas.

Silver-gilt Flora Medal.

To Lord Rothschild, Tring Park (gr. Mr. E. Hill), for a group of Carnation 'Cecilia.'

Silver-gilt Banksian Medal.

To Mr. Perry, Winchmore Hill, for hardy flowers.

To Mr. Surman, Beckenham, for single Petunias.

To Messrs. Paul & Son, Cheshunt, for a collection of sprays of hardy foliage and flowering trees and shrubs.

To Messrs. Kelway, Langport, for Delphiniums.

Silver Flora Medal.

To Lady Nina Balfour, Newton Don, Kelso (gr. Mr. W. Wood), for a wonderfully well-flowered group of Malmaison Carnations.

To Mr. Russell, Richmond, for stove and greenhouse plants.

Silver Banksian Medal.

To Messrs. Cannell, Swanley, for single Begonias.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Mr. May, Dyson's Lane, Upper Edmonton, for new zonal Pelargoniums.

To Messrs. Cutbush, Highgate, for Carnations.

To Messrs. Ware, Feltham, for hardy flowers.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

To Messrs. Low, Enfield, for greenhouse plants and hardy Water Lilies.

Bronze Banksian Medal.

To G. Ferguson, Esq., The Hollies, Weybridge (gr. Mr. F. W. Smith), for Delphiniums.

Award of Merit.

To *Alstrœmeria* 'Mrs. Salter' (votes 11 for, 5 against), from J. H. Salter, Esq., Tolleshunt D'Arcy, Witham, Essex. A remarkably handsome, vigorous, and very floriferous variety with medium-sized rich orange-red flowers, the upper segments stained with yellow and streaked with brown.

To Border Carnation 'Lady Carrington' (votes, unanimous), from Martin R. Smith, Esq., V.M.H., Warren House, Hayes, Kent (gr. Mr. C. Blick). A pleasing variety, with large, well-formed, sweet-scented, pale-pink flowers.

To *Dracæna* 'His Majesty' (votes, 11 for), from Mr. May, Upper Edmonton. A very effective Dracæna with large, arching, sharply-pointed, bronze-green leaves, margined with crimson. It is free in growth, and colours well in small pots.

To *Delphinium* 'Kitty Wardall' (votes, 12 for, 4 against), from Messrs. Kelway, Langport. A strong spike, well set with large, perfectly double, pale-blue flowers shaded with mauve.

To *Polypodium irioides ramo-cristatum* (votes, 13 for), from Messrs. Bull, Chelsea. A free-growing Fern with long, deep green, much-divided fronds, freely crested at the tips.

To H.P. Rose 'Frau Karl Druschki' (votes, unanimous), from Messrs. B. R. Cant, Colchester. This grand Rose was raised by Mr. P. Lambert, of Trèves, in Rhenish Prussia. It is a cross between 'Merveille de Lyon' and 'Caroline Testout.' It is very free-flowering, with large, shapely white, slightly fragrant flowers, and is without doubt the finest white H.P. Rose grown.

Other Exhibits.

The Rev. the Marquis of Normanby, Mulgrave Castle, Whitby (gr. Mr. J. Corbett), sent flowers of Carnation 'Beauty of Mulgrave,' a cross between 'Mrs. Lawson' and a crimson-flowered variety.

Hugh Aldersey, Esq., Aldersey Hall, Chester, sent a collection of Sweet Peas.

J. T. Bennett-Poë, Esq., V.M.H., Holmewood, Cheshunt (gr. Mr. Downes), sent a *Lobelia* named *coronopifolia*. It was considered to be identical with *L. tenuior grandiflora*, which received an award of merit July 13, 1897.

C. T. D. Crews, Esq., Billingbear, Wokingham (gr. Mr. F. Ashman), sent a double-flowered form of *Iris ochroleuca.* It was referred to the Scientific Committee.

H. J. Elwes, Esq., V.M.H., Colesborne, Cheltenham (gr. Mr. W. Walters), sent flowers and bulbs of an unnamed *Crinum* found at Santos, Brazil, whither it had probably been introduced from Africa. The flowers are white, with a conspicuous red stripe down the centre of each segment.

Mr. F. G. Crampton, Gate House, Sissinghurst, sent flowers of a new H.P. Rose, 'King Edward VII.,' a cross between 'General Jacqueminot' and 'Madame Gabriel Luizet.'

Messrs. R. Veitch, Exeter, sent flowers of *Lonicera Hildebrandiana* and *Dianthus multiflorus* 'Émilie Paré.'

Mr. Fry, Addington, West Malling, sent hybrid Fuchsias and *Diplacus.*

Mr. R. Osenton, Foots Cray, Kent, sent Ivy-leaved *Pelargonium* 'Coronation.' The Committee asked to see it again with a plant of 'Ryecroft Glory' for comparison.

Mr. Turner, Brentwood, sent *Pelargonium* 'Panama.'

From Mr. Wood, Woodville, Kirkstall, came flowers of *Lathyrus Drummondii* under the name of *L. latifolius* 'Mrs. Wood.'

Messrs. Parsons, Swansea, sent a Gloxinia with white flowers showing a tendency to doubling.

Messrs. Veitch, Chelsea, sent seedling Roses and hardy flowering shrubs.

Messrs. Clibran, Altrincham, sent bedding Lobelia 'Mrs. Clibran,' a compact, free-growing, floriferous variety. The flowers are deep blue with a small white eye.

Messrs. B. R. Cant, Colchester, sent seedling Roses.

Mr. Wade, Colchester, sent hardy flowers and Sweet Peas.

Messrs. Williams, Upper Holloway, sent Irises.

Messrs. Wallace, Colchester, sent hardy flowers.

Floral Committee, July 22, 1902.

Mr. W. Marshall in the Chair, and twenty members present.

Awards Recommended :—

Silver-gilt Banksian Medal.

To Messrs. Cutbush, Highgate, for Carnations.
To Mr. Perry, Winchmore Hill, for hardy flowers.
To Messrs. B. R. Cant, Colchester, for new Roses.

Silver Flora Medal.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.
To Messrs. Jones, Shrewsbury, for Sweet Peas.

Silver Banksian Medal.

To Messrs. Veitch, Chelsea, for hardy Water-Lilies.
To Messrs. Barr, Covent Garden, for hardy flowers.

Award of Merit.

To *Maranta insignis* (votes, 13 for) from Messrs. Bull, Chelsea. An uncommon foliage plant from Brazil, with oblong leaves eighteen inches long by four inches broad. The colour is bright green, deepening towards the wavy margins, and freely blotched with olive-green. The under surface is purplish red.

To H.P. Rose 'Ben Cant' (votes, unanimous), from Messrs. B. R. Cant, Colchester. A cross between 'Suzanne Marie Rodocanachi' and 'Victor Hugo.' The shapely flowers are of medium size, bright red in colour, and pleasingly fragrant.

To climbing Monthly Rose 'Field Marshal' (votes, 13 for) from Messrs. W. Paul, Waltham Cross. A vigorous, free-flowering variety, with deep-crimson double flowers.

Other Exhibits.

From the Royal Botanic Society, Regent's Park, N.W. (gr. Mr. E. F. Hawes), came a large well-flowered plant of *Crinum cruentum*, 'Regent's Park variety.'

F. A. Bevan, Esq., Trent Park, New Barnet (gr. Mr. H. Parr), sent Carnations.

J. Edwards, Esq., Blackley, Manchester, sent a handsome plant of *Athyrium f.f. ramulosissimum.*

Mr. Lee, Clevedon, sent Campanulas.

Messrs. Peed, West Norwood, sent Carnations.

Mr. Turner, Slough, sent Roses.

Mr. Johnson, Burton-on-Trent, sent flowers of *Chrysanthemum maximum* 'Miss Amy Johnson.'

Mr. Wade, Colchester, sent Lilies.

Mr. Green, Dereham, sent flowers of a new Cactus Dahlia.

Messrs. Veitch, Chelsea, sent *Lilium concolor*, stated to be the true type, with small, self-coloured, orange-scarlet flowers, whereas those certified as *concolor* on July 14, 1896, were freely spotted with crimson.

Messrs. Paul, Cheshunt, sent new Roses.

Messrs. Cheal, Crawley, sent Sweet Peas.

Floral Committee, August 5, 1902.

Mr. W. Marshall in the Chair, and seventeen members present

Awards Recommended :—

Silver Flora Medal.

To Mr. Prichard, Christchurch, Hants, for hardy flowers.

Silver Banksian Medal.

To Messrs. Hobbies, Dereham, for zonal Pelargoniums.

To Messrs. Ware, Feltham, for Phloxes, &c.

To Mr. Turner, Slough, for Carnations.

Bronze Banksian Medal.

To Mrs. Charrington, The Warren, Hever, Edenbridge, for Carnations.

First-class Certificate.

To *Astilbe chinensis Davidii* (votes, unanimous), from Messrs. Veitch, Chelsea. This is the most important hardy perennial introduced during the past few years, as it is free in growth, delightful in blossom, and, being

Fig. 181.—Astilbe chinensis Davidii. (*Journal of Horticulture.*)

quite distinct from any other hardy plant, is sure to find many admirers. It varies in height from three to five feet, its flowering spikes being at least two feet long and laden with small reddish-purple flowers with violet anthers. It comes from Central China, where it is known as 'Hung-Sheng-Ma.' (Fig. 181.)

To *Libocedrus macrolepis* (votes, unanimous), from Messrs. Veitch. A grand new conifer from South China, but not likely to prove hardy enough for out-door culture in these Isles, except in such favoured parts as Devon and Cornwall and the South-west of Ireland. It is, however, well suited for the embellishment of cool conservatories, and if allowed sufficient headroom will develop into good-sized trees. Its habit reminds one of *Thujopsis*, with flat brown branches clothed with flat glaucous-green leaves, much after the fashion of strong-growing Selaginellas.

Award of Merit.

To Border Carnation 'Mr. Leigh White' (votes, 13 for), from Lady Ardilaun, St. Anne's, Clontarf, Dublin (gr. Mr. A. Campbell). A delightfully fragrant, free-flowering variety, with bold shapely white flowers, some of the petals slightly splashed with pink.

To Border Carnation 'Cedric' (votes, 13 for), from Mr. Douglas, Great Bookham. Flowers large, yellow ground, edged and heavily shaded near the centre of the petals with brownish red.

To Border Carnation 'Bookham White Clove' (votes, 15 for, 1 against), from Mr. Douglas. A magnificent variety, with large, pure white, clove-scented flowers.

Other Exhibits.

The Earl of Ilchester, Holland House, Kensington (gr. Mr. C. Dixon), sent flowers of *Hibiscus Rosa-sinensis brilliantissimus* and *Eichhornia crassipes*.

Colonel Beddome, F.L.S., West Hill, Putney, sent *Campanula peregrina*, a native of Asia Minor.

Miss Richardson, Crown Hill, Devon, sent Pinks.

Messrs. Barr, Covent Garden, sent a small collection of hardy flowers.

Messrs. Bull, Chelsea, sent Crotons.

Messrs. B. R. Cant, Colchester, sent new Roses.

Mr. Potten, Cranbrook, sent hardy flowers.

Messrs. Cheal, Crawley, sent hardy flowers and sprays of flowering shrubs.

Carnations were exhibited by :—

1. Lady Ardilaun, Clontarf, Dublin (gr. Mr. A. Campbell).
2. H. Balderson, Esq., Corner Hall, Hemel Hempstead.
3. Mr. Douglas, Great Bookham.
4. Mr. Bradley, Peterborough.
5. Messrs. Phillips & Taylor, Bracknell, Berks.

Floral Committee at Chiswick, August 12, 1902.

Mr. W. Marshall in the Chair, and seven members present.

Awards Recommended :—

Highly Commended.

To Phloxes :—

1. 'Kaiser Wilhelm.'
2. 'Regulus.'
3. 'Le Vengeur.'
4. 'James Farquhar.'
5. 'Sylphide.'
6. 'Ferdinand Cortez.'
7. 'Sesostris.'
8. 'Éclaireur.'

A descriptive report will be found at p. 649.

FLORAL COMMITTEE, AUGUST 19, 1902.

Mr. W. MARSHALL in the Chair, and nineteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Mr. May, Upper Edmonton, for a group of Codiæums (Crotons).
To Messrs. Kelway, Langport, for a large collection of Gladiolus.

Silver Flora Medal.

To Mr. Prichard, Christchurch, for a group of herbaceous flowers.
To Messrs. Ware, Feltham, for a group of hardy flowers.
To Messrs. Cannell, Swanley, for a collection of annuals.

Silver Banksian Medal.

To Messrs. Paul, Cheshunt, for a collection of Roses
To Messrs. Storrie, Dundee, for Begonias, Lobelias, &c.
To Messrs. Webb and Brand, Saffron Walden, for a collection of Hollyhocks.

Bronze Flora Medal.

To Mrs. Davies-Evans, Highmead, Llanybyther (gr. Mr. Fox), for a collection of Nymphæas.

Bronze Banksian Medal.

To P. Purnell, Esq., Woodlands, Streatham Hill, for a group of stove and greenhouse plants.
To Messrs. Bellgrove, Hammersmith, for a group of Codiæums.

First-class Certificate.

To *Buddleia variabilis,* var. *Veitchiana* (votes, unanimous), from Messrs. Veitch, Chelsea. This handsome novelty was recently introduced from Central China, and in growth and foliage is similar to the type. The raceme of pale mauve flowers is about 10 inches in length, closely packed together, and abundantly produced. The plant is said to attain a height of about 15 feet, and is in every way very much finer than the ordinary variety. (Fig. 182.)

Award of Merit.

To *Senecio clivorum* (votes, 13 for), from Messrs. Veitch, Chelsea. Another plant recently introduced from Central China, and growing about 4½ feet high. with foliage 9 inches long and six inches broad, borne on long petioles. Flowers in cymes 3½ inches across, and of rich yellow colour. (Fig. 183.)

Kniphofia 'Rufus' (votes, 11 for, 6 against), from Mr. Prichard, Christchurch. Spike 5 inches long, the upper portion being a deep orange-red, changing to pale yellow at the lower part.

To *Gladiolus* 'Coronation' (votes, unanimous), from Messrs. Kelway, Langport. A very vigorous variety with a stout spike. Flowers white, with crimson spots on the segments.

To *Gladiolus* 'Empire' (votes, unanimous), from Messrs. Kelway. A vigorous variety, producing a long spike. Flowers flesh-pink, with deeper marginal markings of the same colour. Segments pale yellow with crimson markings

FIG. 182.—BUDDLEIA VARIABILIS, VAR. VEITCHIANA. (*Journal of Horticulture.*)

To *Cordyline indivisa*, var. 'P. Elder' (votes, 10 for, 1 against), from Mr. P. Elder, Forbes House, Ham. This is exactly similar to the type, except that the colour of the foliage is of a dull brown colour.

To *Montbretia* 'George Davison' (votes, unanimous), from Mr. G.

Davison, Westwick Gardens, Norwich. Flowers 3 inches in diameter, of a rich yellow colour, and abundantly produced on stout stems about 3 feet high.

Fig. 183.—Senecio clivorum. (*Journal of Horticulture.*)

To Carnation 'The Shah' (votes, unanimous), from Martin R. Smith, Esq., V.M.H., Hayes, Kent (gr. Mr. C. Blick). A very fine variety, of perfect form, and petals of great substance; colour yellow ground, splashed with deep crimson.

To Cactus Dahlia 'F. A. Wellesley' (votes, 13 for), from Mr. Shoesmith, Woking. Flowers a rich carmine, shading to ruby on the margins of the florets.

To *Caladium* 'Giroud' (votes, 12 for, 1 against), from Messrs. Bull, Chelsea. Foliage pea-green, with small splashes of cream and deep claret. A very distinct variety.

Other Exhibits.

Messrs. Bull, Chelsea, sent a collection of Caladiums, chiefly new varieties.

Messrs. Hugh Low, Enfield, staged a group of Ericas and Statices.

Messrs. Barr, Covent Garden, sent a group of hardy flowers.

Mr. Amos Perry, Winchmore Hill, staged a group of hardy flowers.

Mr. Shoesmith, Woking, brought a collection of Cactus Dahlias.

Messrs. Veitch, Chelsea, staged *Sambucus canadensis* and *Rosa Wichuraiana* 'Myra,' raised from *Wichuraiana* × 'Crimson Rambler.'

Messrs. Barr sent *Miscanthus* (syn. *Eulalia*) *sinensis zebrina stricta.*

B. Wentworth Vernon, Esq., Stoke Bruerne Park, Towcester (gr. Mr. W. Batchelor) sent eleven varieties of Carnations.

Owen Turner, Esq., Park Tower, Ipswich, sent Carnations 'Audrey Turner' and 'Hawthorne,' both of which the Committee desired to see again.

A. E. Scott, Esq., Rotherfield Park, Alton, Hants (gr. Mr. W. H. Yates), staged fine sprays of *Rhus Cotinus.*

Mr. Geo. Springthorpe, Fosse Road, South Leicester, sent *Chrysanthemum maximum* in two varieties.

Messrs. Cannell staged *Godetia nana laciniata.*

The Duke of Northumberland, Syon House (gr. Mr. Geo. Wythes, V.M.H.), sent two varieties of *Campanula pyramidalis grandiflora.*

Mr. Empson, Holme Chase, Bletchley, sent Carnation 'Mrs. Broome Giles.'

Mr. H. B. May, Upper Edmonton, staged Carnation 'Prince of Wales.'

Floral Committee, September 2, 1902.

Mr. W. Marshall in the Chair, and nineteen members present.

Awards Recommended:—

Award of Merit.

To *Nymphæa stellata* 'Mrs. Ward' (votes, 11 for), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A very handsome but tender Water-Lily, probably a hybrid between *N. stellata* and *N. zanzibarensis.* The sweet-scented substantial flowers, with long pointed petals, are of a warm pink suffused with blue

To *Ceanothus* 'Indigo' (votes, 10 for, 3 against), from Mrs. W. H. Burns, North Mymms Park, Hatfield (gr. Mr. C. R. Fielder). The flowers of this uncommon 'Blue-bush' are deeper in colour than those of any other *Ceanothus*, the nearest to it being 'Sceptre d'Azur.' They are deep blue and borne with great freedom. In the colder parts of the country it should be grown against a wall, as it often suffers in severe winters.

To Tea Rose 'Peace' (votes, unanimous), from Mr. Piper, Uckfield. This is a grand bedding variety, with a habit similar to that of 'G. Nabonnand.' It is exceedingly floriferous, with open pale-sulphur or cream-coloured fragrant flowers.

To Sweet Pea 'Dorothy Eckford' (votes, 10 for, 5 against), from Messrs. Hobbies, East Dereham. The flowers of this variety are remarkable for their good form, substance, and snowy whiteness. Perhaps the best white Sweet Pea yet raised.

To *Sterculia Russelliana* (votes, unanimous), from Mr. Russell, Richmond. An Australian Aralia-like greenhouse plant of free and graceful growth, and a splendid table plant. It bears some resemblance to *S. rupestris*, its elegant leaves consisting of about six long narrow pale-green segments, the centre one being much the longest, with a prominent white midrib.

To *Thuya occidentalis Ellwangeriana pygmæa aurea* (votes, 12 for), from Mr. Turner, Slough. A very dense-habited conifer in which the tips of the shoots are bronzy yellow and the yellow foliage suffused with green. It is quite distinct from the ordinary golden-leaved American Arbor-vitæ, and is likely to prove a useful plant for window-boxes and winter-bedding.

Other Exhibits.

Owen Turner, Esq., Park Road, Ipswich, sent Carnations.

Sir Trevor Lawrence, Bart., V.M.H., Burford, Dorking (gr. Mr. W. Bain), sent *Onosma pyramidalis*, an unusual hardy plant.

Miss A. E. Langston, Pembridge, Herefordshire, sent a seedling Pelargonium.

C. E. Bowden, Esq., Reading, sent Carnations.

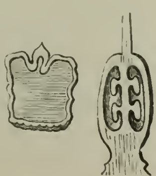
Dr. Doig, Wych Hill, Woking, sent flowers of a greatly improved form of the common Lavender; the individual blossoms being much larger and of a very much deeper colour, reminding one of Heliotrope blossoms.

From Messrs. Grieve, Broughton Road, Edinburgh, came a showy seedling *Dianthus*, and a strain of bronze Violas.

Messrs. Veitch, Chelsea, sent *Lindenbergia grandiflora*, a yellow-flowered plant of Salvia-like habit.

Mr. Shawyer, Cranford, Hounslow, sent a seedling Chrysanthemum.

Messrs. Bull, Chelsea, sent *Philodendron corsinianum*, a greenhouse ornamental-leaved plant.



ORCHID COMMITTEE.

HOLLAND HOUSE SHOW, June 24, 1902.

Mr. Harry J. Veitch in the Chair, and eighteen members present.

The Cups and Medals awarded by the Council will be found at p. 441.

Awards Recommended :—

First-class Certificate.

To *Lælio-Cattleya* × 'Aphrodite' var. 'King Edward VII.' (*C. Mendelii* × *L. purpurata*) (votes, unanimous), from Messrs. Sander. A very large blush-white flower, with crimson-lake front to the labellum.

Fig. 184.—Miltonia vexillaria gigantea. (*Journal of Horticulture.*)

To *Miltonia vexillaria* 'Queen Alexandra' (votes, unanimous), from Messrs. Sander. Flowers very large, pure white, with a pale yellow disc to the lip, on which are three faint purple lines.

To *Miltonia vexillaria gigantea* (votes, unanimous), from Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young). Flower of the best large type, and almost entirely of a bright crimson-rose colour. (Fig. 184.)

To *Sobralia* × *Wiganiæ* (nat. hyb.) (votes, unanimous), from Sir

Frederick Wigan, Bart. (gr. Mr. W. H. Young). Closely resembling *S. Veitchii* (*macrantha* × *xantholeuca*). Flower yellowish, tinged with rose, and with purplish-lilac colour on the lip.

To *Cypripedium Godefroyæ leucochilum* 'Hessle' variety (votes, unanimous), from W. P. Burkinshaw, Esq., Hessle, Hull (gr. Mr. Barker). Flower cream-white, the petals and dorsal sepal having a broad reticulation of purple.

To *Cattleya* × 'Miss Harris' *superba* (*C. Schilleriana* × *C. Mossiæ*) (votes, unanimous), from Messrs. Stanley, Ashton, Southgate. Sepals and

FIG. 185.—ZYGONISIA × ROLFEANA. (*Gardeners' Chronicle.*)

petals dark purplish rose. Lip formed like *C. Schilleriana*, rose purple, with a darker veining in front.

Award of Merit.

To *Zygonisia* × *Rolfeana* (*Aganisia lepida* × *Zygopetalum maxillare Gautieri*) (votes, 17 for, 1 against), from Messrs. Sander. Habit of *Zygo-Colax*, but more slender. Sepals and petals cream-white, blotched with purple; lip violet. (Fig. 185.)

To *Odontoglossum* × *loochristyense* 'Princess Margaret' (votes, unanimous), from Messrs. Sander. Flowers whitish, blotched with red-brown. Shown as *O. harvengtense* var. 'Lindenia,' vol. x., p. 95.

To *Lælio-Cattleya* × *Martineti* 'Prince Arthur' (*L. tenebrosa* × *C. Mossiæ*) (votes, unanimous), from Messrs. Sander. Sepals and petals yellowish, tinged with rose; lip rose, with claret-coloured veining.

To *Cattleya* × 'Prince Edward' (*Schilleriana* × *Warscewiczii*) (votes, unanimous), from Sir Frederick Wigan, Bart., and Messrs. Sander. Sepals and petals purplish rose; lip dark rose, with crimson flush and veining.

To *Odontoglossum crispum* 'Imperatrix Regina' (votes, unanimous), from Messrs. Sander. A distinct flower of a reddish claret-colour, with a clear white star-like ray round the column, and a white margin.

To *Odontoglossum crispum* 'Her Majesty' (votes, unanimous), from Messrs. Sander. Flowers very large, white, with yellow crest.

To *Odontoglossum crispum* 'Princess Hélène' (votes, unanimous), from Messrs. Sander. Flowers white, tinged with purple and heavily blotched.

To *Odontoglossum crispum punctatissimum* 'Princess Maud' (votes, unanimous), from Messrs. Charlesworth, Bradford. Flowers large, white, tinged with lilac, and densely marked with small purple spots.

To *Odontoglossum crispum* 'Princess Victoria' (votes, unanimous), from Messrs. Sander. A very handsome variety, with finely-marked flowers.

Cultural Commendation.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., V.M.H., for a fine plant of the rare and singular *Maxillaria scurrilis*.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., for a basket of well-grown plants of the orange-scarlet *Habenaria rhodocheila*.

Other Exhibits.

Sir Frederick Wigan, Bart., staged a good group of Orchids.

Jeremiah Colman, Esq., showed an effective group of Orchids.

Messrs. Jas. Veitch, Chelsea, showed hybrid Lælio-Cattleyas, &c.

Messrs. Charlesworth staged a group of hybrid and other Orchids.

Messrs. Hugh Low arranged a group of Orchids.

Orchid Committee, July 8, 1902.

Mr. Henry Little in the Chair, and thirteen members present.

Awards Recommended :—

Silver Banksian Medal.

To Messrs. Hugh Low, Bush Hill Park, for a group of Orchids.

Botanical Certificate.

To *Cirrhæa viridipurpurea*, Lindl., from Sir Trevor Lawrence, Bart., Burford (gr. Mr. W. H. White). Flowers insect-like, in pendulous racemes; colour greenish, marked with dark purple. A fine specimen, with about twenty racemes of flowers, was shown.

Other Exhibits.

Captain G. L. Holford, C.I.E., C.V.O., showed *Lælio-Cattleya* × 'Earl Grey,' a fine hybrid allied to *L.-C.* × *Callistoglossa*. Sepals and petals rosy lilac; lip almost entirely reddish maroon.

Lord Rothschild (gr. Mr. E. Hill) showed *Odontoglossum* × *Wilckeanum* 'Tring Park variety,' flowers white, spotted with cinnamon brown; and *Cattleya Gaskelliana alba.*

W. A. Bilney, Esq., Weybridge, showed a dark form of *Cattleya* × *Hardyana.*

Messrs. Jas. Veitch, Chelsea, showed the white-petalled *Cattleya Warscewiczii* 'Countess of Derby,' and *Lælio-Cattleya* × 'C. G. Roebling' *albida.*

Messrs. Wm. Bull, Chelsea, showed *Cattleya Mendelii* 'Souvenir de William Bull.' A pretty blush-white flower.

Messrs. Sander, St. Albans, showed hybrid and other Orchids.

Messrs. Williams, Holloway, staged a group of Orchids.

Sir Wm. Marriott, Blandford (gr. Mr. Denny), sent *Disa* × *Diores* (*Veitchii* × *grandiflora*).

Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young), showed *Cattleya* × 'Germania' (*granulosa Schofieldiana* × *Hardyana*).

Orchid Committee, July 22, 1902.

Mr. Harry J. Veitch in the Chair, and sixteen members present.

Awards Recommended:—

First-class Certificate.

To *Cattleya* × *Wavrimana* 'Wigan's variety' (*Warscewiczii* × *granulosa*) (votes, unanimous), from Sir Frederick Wigan, Bart., Clare Lawn, East Sheen (gr. Mr. W. H. Young). Flower showy, resembling *C. granulosa* in shape, but larger in all its parts. Sepals yellowish, tinged with rose; petals pale rose, with the yellow ground-colour showing through in the centres; lip yellowish at the base, the erected tips of the side-lobes purple; isthmus reddish purple, with yellow edges; front lobe rose-colour, with purple veining.

Cultural Commendation.

To Mr. G. E. Day, gr. to H. F. Simonds, Esq., Woodthorpe, Beckenham, for a specimen of *Grammangis Ellisii* with a fine spike of twenty-five flowers; the same plant having been equally well-flowered and shown last year.

To Mr. G. Cragg, gr. to W. C. Walker, Esq., Winchmore Hill, for a well-flowered plant of *Dendrobium Falconeri.*

Other Exhibits.

Baron Sir Henry Schröder, Bart., V.M.H. (gr. Mr. H. Ballantine), sent *Cypripedium* × 'Antigone' (*niveum* × *Lawrenceanum*).

Messrs. Jas. Veitch showed *Lælia* × 'Helen (*Digbyana* × *tenebrosa*), *Lælio-Cattleya* × 'Norba' (*C. Mossiæ* × *L. xanthina*), and other hybrids.

Mrs. Haywood, Woodhatch Lodge (gr. Mr. C. J. Salter), showed *Cypripedium* × *Harri-Leeanum.*

De B. Crawshay, Esq. (gr. Mr. Stables), sent *Odontoglossum* × *loochristyense* 'Theodora.'

J. F. Alcock, Esq., showed *Sobralia* × *Veitchii*, or an allied hybrid.

ORCHID COMMITTEE, AUGUST 5, 1902.

Mr. HARRY J. VEITCH in the Chair, and fifteen members present.

Awards Recommended :—

Silver Flora Medal.

To Captain G. L. Holford, C.V.O., C.I.E., Westonbirt (gr. Mr. H. Alexander), for a group of finely-grown Orchids, the central plant in which was a superb specimen of *Vanda cærulea*.

FIG. 186.—LÆLIO-CATTLEYA × 'ADOLPHUS' SUPERBA. (*Journal of Horticulture.*)

To Messrs. Hugh Low, Bush Hill Park, for a group of Cattleyas, and other Orchids.

First-class Certificate.

To *Lælio-Cattleya* × 'Adolphus' *superba* (*L. cinnabarina* × *C. Aclandiæ*) (votes, unanimous), from Messrs. Charlesworth, Bradford. A singular and pretty hybrid, with an upright spike of several wax-like flowers with lanceolate sepals and petals, of a reddish Indian yellow, spotted with purple. The rounded front lobe of the lip, and the tips of the side-lobes, rose-purple, with yellowish markings in the centre. The original variety was given an Award of Merit at the "Hybrid Conference" July 1899. (Fig. 186.)

Cultural Commendation.

To Mr. H. Alexander, grower to Captain Holford, for a splendidly-grown plant of *Vanda cærulea* with thirty-seven leaves and perfect from base to top. The plant bore two spikes of twelve and sixteen large sky-blue flowers, all expanded together.

Other Exhibits.

F. A. Rehder, Esq., Gipsy Hill (gr. Mr. Norris), showed *Cypripedium* × 'Sophie' (*Gowerianum* × *niveum*).

J. F. Alcock, Esq., Berkhamsted, showed *Odontoglossum Harryanum.*

H. Little, Esq., Twickenham (gr. Mr. Howard), showed good forms of *Cattleya Warscewiczii.*

Mr. Jas. Douglas, Great Bookham, showed *Lælio-Cattleya* × 'Juno,' Edenside variety' (*L. majalis* × *C. Mossiæ*).

Messrs. Bull, Chelsea sent *Cypripedium* × 'Decia' (*Charlesworthii* × *superciliare*).

Messrs. Charlesworth, Bradford, showed a collection of hybrid Orchids.

ORCHID COMMITTEE, AUGUST 19, 1902.

Mr. HARRY J. VEITCH in the Chair, and eleven members present.

Awards Recommended :—

First-class Certificate.

To *Cattleya* × 'Lady Ingram,' 'Westfield variety' (*C. Eldorado* × *C. Dowiana aurea*), (votes, 9 for, 1 against), from Francis Wellesley, Esq., Westfield, Woking (gr. Mr. Gilbert). A fine flower, of delicate fragrance, with the general features of *C. Eldorado*, but nearly as large as *C. aurea*. Sepals and petals blush-white ; disc of lip rich orange, changing to chrome-yellow at the sides ; edges of side-lobes and front rose-purple ; margin blush-white, fringed.

Award of Merit.

To *Lælio-Cattleya* × *Ingramii*, 'Rosslyn variety' (*L. Dayana* × *C. Dowiana aurea*), (votes, unanimous), from H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood). An improvement on the original variety. Sepals and petals bright rose ; lip claret-colour, with an obscure veining of yellow at the base.

Botanical Certificate.

To *Houlletia Brocklehurstiana*, from Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White). A Brazilian species, first flowered by Mr. Brocklehurst at Macclesfield in 1841. Flowers nearly three inches across, yellowish, closely marked with reddish purple.

To *Sarcanthus appendiculatus*, from Sir Trevor Lawrence, Bart. Leaves terete, spikes bearing several flowers half an inch across, yellow, striped with red.

Cultural Commendation.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., for a fine specimen of *Odontoglossum aspidorhinum*. Lehm., with twenty-four spikes. The third year of flowering so profusely.

Other Exhibits.

Norman C. Cookson, Esq., Wylam (gr. Mr. H. J. Chapman), sent *Cypripedium* × *vexillo–Io*.

W. M. Appleton, Esq., Weston-super-Mare, showed *Cypripedium* × 'Julia' (*Lawrenceanum* × *exul*), *C.* × 'Phœbe' (*philippinense* × *bellatulum*), *C.* × 'Eos' (*niveum* × *Charlesworthii*), *C.* × *Tautzianum lepidum* (*niveum* × *barbatum Crossii*), and *C.* × *Rolfei* (*bellatulum* × *Rothschildianum*).

Fig. 187.—Odontoglossum Wilckeanum Rothschildianum. (*Journal of Horticulture.*)

Messrs. Sander, St. Albans, staged a small group of Orchids.

Messrs. Hugh Low, Bush Hill Park, sent *Cattleya Eldorado splendens*, and other Orchids.

Sir J. Miller, Bart. (gr. Mr. Hamilton), showed *Lælio-Cattleya* × *Massangeana*.

H. Whateley, Esq., Kenilworth, showed *Odontoglossum crispum* 'Blanche Whateley' with a large purple blotch in each segment.

R. I. Measures, Esq. (gr. Mr. Smith), showed a nearly white hybrid, near to *Cattleya* × 'Parthenia.'

Orchid Committee, September 2, 1902.

Mr. Harry J. Veitch in the Chair, and eighteen members present.

Awards Recommended:—

First-class Certificate.

To *Odontoglossum* × *Wilckeanum Rothschildianum*, (votes, unanimous), from Norman C. Cookson, Esq., Oakwood, Wylam (gr. Mr. H. J.

Fig. 188.—Lælio-Cattleya Cooksoniæ. (*Journal of Horticulture.*)

Chapman). Flowers $4\frac{1}{2}$ inches across; yellow, heavily blotched with red-brown. (Fig. 187.)

To *Lælio-Cattleya* × *Cooksoniæ* (*L.-C.* × 'Clive' × *C. labiata*), (votes, 11 for, 4 against), from Norman C. Cookson, Esq. (gr. Mr. H. J.

Chapman). A fine hybrid of dwarf habit. Sepals and petals rosy lilac; lip purplish crimson, suffused with yellow at the base, which also bore lines of darker purple. (Fig. 188.)

Award of Merit.

To *Cattleya granulosa*, 'Hessle variety' (votes, unanimous), from W. P. Burkinshaw Esq., Hessle, Hull (gr. Mr. Barker). Flower large, sepals and petals yellow, heavily spotted with purple; lip broad, fringed, rosy carmine.

To *Cypripedium* × 'A. de Lairesse' (*C. Curtisii* × *C. Rothschildianum*) (votes, unanimous), from the Botanic Gardens, Birmingham. Dorsal sepal greenish white, with dark purple lines; petals green, spotted with chocolate-brown; lip greenish, shaded with brown.

To *Oncidium Forbesii Bradshawæ* (votes, unanimous), from Messrs. Stanley, Ashton, Southgate. A distinct form in which the brown markings of the type are nearly suppressed, the flower being almost wholly yellow, the situation of the darker markings being indicated by a greenish line.

Botanical Certificate.

To *Anœctochilus concinnum*, Hort., from Mr. E. Kromer, Bandon Hill, Croydon. Leaves dark reddish olive, with copper-coloured veining. Flowers white.

Other Exhibits.

De B. Crawshay Esq. (gr. Mr. Stables), showed *Odontoglossum* × *Crawshayanum* (*Hallii* × *Harryanum*).

Francis Wellesley, Esq., Woking (gr. Mr. Gilbert), sent *Lælia* × 'Iona,' 'Westfield variety' (*tenebrosa* × *Dayana*), and *Cypripedium* 'Mrs. Arthur Wells' (*Selligerum majus* × *Rothschildianum*).

H. T. Pitt, Esq. (gr. Mr. Thurgood), showed *Cattleya Gaskelliana*, 'Rosslyn variety'; and *Cattleya Dowiana*, 'Pitt's variety.'

J. S. Moss, Esq., Wintershill, sent *Lælio-Cattleya* × *Mylamiana* (*L. crispa* × *C. granulosa*).

Sir Trevor Lawrence, Bart. (gr. Mr. W. H. White), showed a fine three-flowered inflorescence of the large white *Habenaria Susannæ*.

ELECTION AND PRIVILEGES OF FELLOWS AND TERMS OF SUBSCRIPTION.

Anyone interested in Horticulture is eligible for election as Fellow, and is invited to join the Society.

Candidates for election are proposed by two Fellows of the Society. Forms for proposing new Fellows may be obtained from the Office, 117 Victoria Street, Westminster. Ladies are eligible for election as Fellows of the Society.

A Fellow subscribing 4 guineas a year (or commuting) is entitled—

1.—To One Non-transferable (personal) Pass and Five Transferable Tickets admitting to all the Society's Exhibitions, and to the Gardens on any day except Sundays.

2.—To attend and vote at all Meetings of the Society.

3.—To the use of the Libraries at the Society's Rooms.

4.—To a copy of the Society's Journal, containing the Papers read at all Meetings and Conferences, Reports of trials made at Chiswick Gardens, and descriptions and illustrations of new or rare plants, &c.

5.—To purchase, at reduced rates, such fruit, &c., as is not required for the experimental purposes of the Society.

6.—To a share (in proportion to the annual subscription) of such plants as may be available for distribution. Fellows residing beyond a radius of 35 miles from London (by the A B C Railway Guide) are entitled to a double share.

7.—Subject to certain limitations, to obtain Analysis of Manures, Soils, &c., or advice on such subjects, by letter from the Society's Consulting Chemist, Dr. J. A. Voelcker, M.A.

8.—To have their Gardens inspected by the Society's Officer at the following fees:—One day, £2. 2*s.*; two days, £3. 3*s.*; *plus* all out of pocket expenses.

9.—To exhibit at all Shows and Meetings, and to send seeds, plants, &c., for trial to the Society's Gardens at Chiswick.

10.—To recommend any lady or gentleman for election as a Fellow of the Society.

A Fellow subscribing 2 guineas a year (or commuting) is entitled—

1.—To One Non-transferable Pass and Two Transferable Tickets.

2.—To the same privileges as mentioned in Nos. 2, 3, 4, 5, 6, 7, 8, 9, 10, as above.

A Fellow subscribing 1 guinea a year (or commuting) is entitled—

1.—To One Transferable Ticket (in lieu of the non-transferable Personal Pass), and the privileges mentioned in Nos. 2, 3, 4, 5, 6, 7, 8, 9, 10, as above.

N.B.—Each Transferable Ticket or Non-transferable personal Pass will admit three persons to the Gardens at Chiswick on any day *except* days on which an Exhibition or Meeting is being held, when each Ticket or Pass will admit One Person only. The Gardens are closed on Sundays.

An Associate subscribing 10s. 6d. a year is entitled—

1.—To One Non-transferable Pass, and to privileges as mentioned in Nos. 3, 4, and 9.

N.B.—Associates must be *bonâ fide* Gardeners, or employees in a Nursery, Private or Market Garden, or Seed Establishment, and must be recommended for election by Two Fellows of the Society.

COMPOUNDING FOR SUBSCRIPTION.

Any Fellow wishing to commute his annual subscription may do so by making one payment of **Forty Guineas** in lieu of a £4. 4*s.* annual subscription; of **Twenty-five Guineas** in lieu of a £2. 2*s.* annual subscription; or of **Fifteen Guineas** in lieu of a £1. 1*s.* annual subscription; such commutation entitling the Fellow for life to all the privileges of the corresponding annual subscription.

Local Horticultural and Cottage Garden Societies may be Affiliated to the Royal Horticultural Society on application.

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS.

(*Applicable only to the case of those Fellows who are not engaged in any Horticultural Trade, or in the manufacture or sale of any substance sent for Analysis.*)

The Council have fixed the following rates of charges for Chemical Analysis to Fellows of the Society being *boná fide* Gardeners or Amateurs.

These privileges are applicable only when the Analyses are for *boná fide* horticultural purposes, and are required by Fellows for their own use and guidance in respect of gardens or orchards in their own occupation.

The analyses are given on the understanding that they are required for the individual and sole benefit of the Fellow applying for them, and must not be used for the information of other persons, or for commercial purposes.

Gardeners, when forwarding samples, are required to state the name of the Fellow on whose behalf they apply.

The analyses and reports may not be communicated to either vendor or manufacturer, except in cases of dispute.

When applying for an analysis, Fellows must be very particular to quote the number in the following schedule under which they wish it to be made.

No.		
1.	An opinion on the purity of bone-dust (each sample)	2*s.* 6*d.*
2.	An analysis of sulphate or muriate of ammonia, or of nitrate of soda, together with an opinion as to whether it be worth the price charged	5*s.*
3.	An analysis of guano, showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, together with an opinion as to whether it be worth the price charged	5*s.*
5.	An analysis of superphosphate of lime, dissolved bones, &c., showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
6.	An analysis of bone dust, basic slag, or any other ordinary artificial manure, together with an opinion as to whether it be worth the price charged	10*s.*
7.	Determination of potash in potash salts, compound manures, &c.	7*s.* 6*d.*
8.	An analysis of compound artificial manures, animal products, refuse substances used for manure, &c.	from 10*s.* to £1
9.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.	Complete analysis of a soil	£3
12.	Analysis of any vegetable product	10*s.*
13.	Determination of the "hardness" of a sample of water before and after boiling	5*s.*
14.	Analysis of water of land-drainage, and of water used for irrigation	£1
15.	Analysis of water used for domestic purposes	£1 10*s.*
16.	Consultation by letter	5*s.*

Letters and samples (postage and carriage prepaid) should be addressed to the Consulting Chemist, Dr. J. Augustus Voelcker, 22 Tudor Street, New Bridge Street, London, E.C.

The fees for analysis must be sent to the Consulting Chemist at the time of application.

Instructions for selecting, drawing, and sending samples for analysis will be found on pages 26–33 of "Arrangements, 1903," or can be obtained on application to the Society's Office, 117 Victoria Street, S.W.

GREAT SHOW OF BRITISH-GROWN FRUITS AND VEGETABLES AT CHISWICK,

SEPTEMBER 29, 30, AND OCTOBER 1.

ROYAL HORTICULTURAL SOCIETY,
117 VICTORIA STREET, S.W.
January 1, 1903.

DEAR SIR OR MADAM,

The Great Autumn Show of British-Grown Hardy Fruits, which the Society has held for several years past at the Crystal Palace, has become as much a thing to be regularly looked for by Fruit Growers as the Show at the Temple in May is looked for by Growers of Flowers.

A very strong desire has, however, been expressed that Vegetables should also find a place at this Show, and the Council have acceded to this request, only stipulating that they absolutely refuse to accept any prizes (or monies offered for prizes) which are accompanied with the restriction that the seeds from which the Vegetables have been grown have been procured from any one specified firm. The Council are of opinion that growers should be at perfect liberty to procure what seeds and whence they please. The authorities of the Crystal Palace having always strictly prohibited the introduction of Vegetables at this Show, it has been decided to hold it this year at Chiswick, which is nearer to London, and far more quickly and more easily accessible therefrom.

It is calculated that such a Show, with prizes for both Fruits and Vegetables, cannot be held under an expenditure of £350 to £400. If, therefore, the Show is to take place, it will be necessary for all who are interested (and who is not ?) in the encouragement of the growth of good Fruits and Vegetables *within* the United Kingdom, instead of depending so much on external and foreign supplies, to combine in raising a sum of at least half the amount of money required. Will you, dear Sir or Madam, help to do this ?

Cheques and Postal Orders should be made payable to me or crossed " London & County Bank."

I am,

Yours faithfully,

W. WILKS,

Sec. R.H.S.

NOTICES TO FELLOWS.

JANUARY 1903.

Notice is hereby given that the Annual General Meeting of the Fellows of the Society will be held at the Drill Hall, Buckingham Gate, Westminster, on Tuesday, February 10, 1903, at 3 P.M. precisely.

LETTERS.

All letters on *all* subjects should be addressed—The Secretary, R.H.S. Office, 117 Victoria Street, Westminster, S.W.

TELEGRAMS.

"**HORTENSIA, LONDON,**" has been registered, and is sufficient address for all telegrams.

LIST OF FELLOWS.

A list of all the Fellows of the Society will be sent out the last week in January. Fellows are requested to look at their own names in it, and, if in any way these are incorrect or the address insufficient, they are requested to inform the Secretary at once. Another use which all Fellows might make of this list is to consult it with reference to their friends' names, and if any of them are not found recorded therein they might endeavour to enlist their sympathies with the Society and obtain their consent to propose them as Fellows forthwith. A condensed statement of the Privileges and Subscriptions of Fellows will be found on page clxxvii of this present volume.

SUBSCRIPTIONS.

All Subscriptions fall due on January 1 of each year. To avoid the inconvenience of remembering this, Fellows can *compound* by the payment of one lump sum in lieu of all further annual payments; or they can, by applying to the Society, obtain a form of instruction to their bankers to pay for them every January 1. Fellows whose subscriptions remain unpaid are debarred from all the privileges of the Society; but their subscriptions are nevertheless recoverable at law, the Society being incorporated by Royal Charter.

Several Fellows, in paying their Subscriptions last year, made the mistake of drawing their cheques for Pounds instead of for Guineas. Kindly note that in all cases it is Guineas, and not Pounds.

DISTRIBUTION OF PLANTS, &c.

Fellows are particularly requested to note that a list to choose from of all the plants available for distribution is sent every year to every Fellow, enclosed *in the "Report of the Council,"* in the last week in January of each year, and a ballot for order of being served is made on March 1. The distribution begins on March 2. Fellows having omitted to fill up their application form before May 1 must be content to wait till the next distribution. The work of the Gardens cannot be disorganised by the sending out of plants at any later time in the year.

Plants cannot be sent to Fellows residing outside the United Kingdom, owing either to length of time in transit or to vexatious regulations in some foreign countries; but the Council will at any time endeavour to obtain for Fellows living abroad any unusual or rare seeds which they may have been unable to procure in their own country.

JOURNALS WANTED.

The Secretary would be very greatly obliged for any of the following back numbers:—Vol. IV., Part 14; Vol. V., Part 1; Vol. XIII., Part 1; Vol. XVII., Parts 1 and 2; Vol. XIX., Part 1; Vol. XX., Part 3; and Vol. XXVI., Part 4.

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS, &c.

Full instructions are contained in "Arrangements" for the current year, and an epitome thereof will be found on page clxxviii of this volume.

CHISWICK TRIALS, 1903.

Cactus Dahlias
Border Chrysanthemums } Only varieties introduced during the last five years.

German Irises—Flags.

Phloxes, new varieties.

Poppies—Seed to be sent before February 1.

Anyone wishing to contribute any of the above for trial is requested to send two plants of each to Superintendent, R.H.S. Gardens, Chiswick, London, W.

Potatos, new varieties.

N.B.—They *must* be named when sent. 20 tubers of each.

Tomatos, new varieties, named. 20 seeds of each.

Peas, new varieties, named. Half-pint of seed. To be sent as above.

French Beans, Dwarf and Climbing. Half-pint of seed.

PLANTS CERTIFICATED.

A list of all the Plants, Fruits, Flowers, Vegetables, &c., certificated by the Society up to January 1, 1900, has been published, price 5*s.*, now reduced to 2*s.* 6*d.* The section devoted to Orchids, interleaved with lined foolscap and bound in cloth, can be obtained for Fellows by special order, price 5*s.*

The compilation of this volume has entailed an enormous amount of labour and research, and it is hoped that many Fellows will purchase a copy, not merely for the value of the information it contains, which, however, is very great, but also in order to take a small share in the very considerable expense necessarily incurred in the publication of such a work. It can be obtained by Postal Order from the Society's Office, 117 Victoria Street, Westminster, S.W.

NEW FELLOWS.

The Centenary of the Society in March 1904 is fast approaching, and the Secretary is most anxious to double the number of Fellows before that eventful date. Will every Fellow assist him by sending in the name of at least one new Fellow during the coming year?

LECTURES &c.

Any Fellows willing to Lecture in 1904 or to communicate Papers on interesting subjects are requested to communicate with the Secretary.

MEETINGS AND SHOWS.

The following are the dates fixed for 1903-4:—**1903**—January 13, 27; February 10, 24; March 10, 24; April 7, 21, Auricula and Primula Show; May 5, 19, English Tulip Show; Temple Show, May 26, 27, 28; June 9; Holland House Show, June 25, 26; July 7, 21, Carnation Show; August 4, 18; Sept. 1, Dahlia Show; Sept. 15; British Fruit and Vegetable Show at Chiswick, September 29, 30, October 1; October 13, 27; November 10, 24; December 15. **1904**—January 5, 26. All the above are at the Drill Hall, Buckingham Gate, excepting Temple Show, Holland House Show, and Chiswick Show.

It will be noticed, 1st, that by the kindness of the Earl of Ilchester the Holland House Show (which last summer was so sadly marred by the sudden illness of the King taking place on the very day) is to be repeated. And 2ndly, that the Show of British-Grown Fruits is to be combined with a Show of Vegetables, and is to be held at Chiswick instead of at the Crystal Palace, where Vegetables are prohibited. Fellows are requested to try and make both these Shows a success by inducing all their acquaintances to attend them.

A reminder of every Show will be sent in the week preceding to any Fellow who will send to the R.H.S. Office, 117 Victoria Street, S.W., a sufficient number of halfpenny cards *ready addressed* to himself.

HYACINTH AND TULIP PRIZES.

The Royal Society for Bulb Culture, at Haarlem, has kindly presented the Royal Horticultural Society with a sum of money to be distributed in prizes at the Drill Hall on March 24, 1903.

HYACINTHS :—120 Hyacinths in pots (one bulb in each pot in not less than forty varieties, and not more than three pots of any one variety). *Open.*

First prize, £7 ; second prize, £5 ; third prize, £3.

TULIPS :—100 pots of Tulips (three bulbs of one variety in each), to include fifty varieties at least, and not more than two pots of any one variety. *Open.*

First prize, £4 ; second prize, £3 ; third prize, £2.

NEW HOME FOR THE SOCIETY.

Every Fellow of the Society should endeavour to contribute *something* to the New Hall now just commencing to be built. All said and done, it will cost from first to last from £35,000 to £40,000. Surely *every* Fellow will like to have at least a few bricks in the building to his credit. Address—"The Treasurer, R.H.S. Office, 117 Victoria Street, Westminster, S.W."

DRACÆNAS.

The Superintendent, R.H.S. Gardens, Chiswick, W., would be greatly obliged for any old plants of Dracænas, however old and leggy. Please shake out all the earth from the roots and send direct.

EXAMINATION.

The Society's Annual Examination in the Principles and Practice of Horticulture will be held on Wednesday, April 22, 1903. Candidates should send in their names not later than the 1st of March. A Scholarship of £25 a year is offered in connection with this examination. Full particulars may be obtained by sending a stamped and directed envelope to the Society's offices.

AFFILIATED SOCIETIES.

Secretaries of Affiliated Societies can now obtain on application a specimen copy of a new Card which the Council have prepared for the use of Affiliated Societies wishing to have a Card for Certificates, Commendations, &c. It can be used for Fruit or Flowers, and is printed in two colours—art shades of deep blue and green. Price 3*s.* 6*d.* for 10 copies, 5*s.* 6*d.* for 20, 11*s.* 6*d.* for 50, 20*s.* for 100.

The Council have also struck a special Medal for the use of Affiliated Societies. It is issued at cost price in Bronze, Silver, and Silver-gilt—viz., Bronze, 5*s.* 6*d.*, with case, complete ; Silver, 12*s.* 6*d.*, with case, complete ; Silver-gilt, 16*s.* 6*d.*, with case, complete.

POPPY SEED.

The Secretary will be pleased to send a packet of his 1902 crop of Shirley Poppy Seed to any Fellows who like to send to Rev. W. Wilks, Shirley Vicarage, Croydon, a stamped envelope ready addressed to themselves. The seed should be sown as early as possible in March. This is an offer made by the Secretary in his private capacity, and it causes much inconvenience when requests for seed are mixed up with letters, &c., sent to the office in London instead of as above directed. Two thousand five hundred packets were given away last year. This year the crop of seed is smaller, and only about 1,000 will be available.

ADVERTISEMENTS.

Fellows are reminded that the more they can place their orders with those who advertise in the Society's Publications the more likely others are to advertise also, and in this way the Society may be indirectly benefited. An Index to the Advertisements will be found on page 34.

EXTRACTS FROM THE PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY.

GENERAL MEETING.

September 23, 1902.

Mr. George Bunyard, V.M.H., in the Chair.

Fellows elected (27).—Capt. A. H. Anson, R.N., Mrs. Hudson Bainbridge, Samuel Barrow, Surgeon-Major Bedford, Mrs. Brooks, Edward Carter, John L. Cassels, David Davy, Miss Edlmann, George M. Gerahty, A. L. Gwillim, Miss Hamshar, Mrs. Edward Harvey, Herbert Hawksley, R. G. Hinnell, James Jenkin, Mrs. L. D. Jesson, Mrs. H. L. Johnston, A. Melville, James Mills, Richard H. Prestwich, Mrs. Pye-Smith, Joseph Roby, Mrs. Spicer, J. S. Turnbull, Archer R. Upton, James Watson.

Associates (9).—Joseph S. Blair, Andrew Campbell, D. McWhirter Campbell, James S. Colvin, James Cunningham, Arthur Edwards, Frederic Longmire, W. Cameron McKechnie, Griffith Thomas.

Affiliated Society (1).—Doddington Cottage Garden Society.

A lecture on "Some lesser known Japanese Trees and Shrubs" was given by Mr. James H. Veitch, F.L.S. (see page 857).

GENERAL MEETING.

October 7, 1902.

Mr. F. G. Lloyd, J.P., in the Chair.

Fellows elected (40).—K. B. Barnejee (India), E. W. Bower, L. Chandler, T. C. Cheeseman, A. Clark, Miss J. H. Cobbold, Col. Davison, F. D. Docker, William Drew, C. C. Edlmann, George Edwards, G. Forth, Mrs. F. M. Garratt, Mrs. Trevor Goff, R. M. Grier, J. D. Hands, Miss Harvey-Hart, H. L. Hayman, B. R. Heaton, James Hilton, Henry Lawrence, J. Mallinson, J. Milburn, Haridas Mitra (India), F. W. Voysey Peterson, W. W. Pettigrew, Mrs. A. B. Railton, Stephen Sellon, Jesse Shambrook, N. C. Shiach, Reginald Soames, Miss Steel, Mrs. G. J. Thomas, Joseph Tindall, H. E. Tyler, Mrs. T. J. Waddingham, T. J. Waddingham, C. J. Walker, A. J. Whitaker, S. Windover.

A lecture on "Experiments with Chemical and other Manures" was given by Mr. F. W. E. Shrivell (see page 995).

GENERAL MEETING.

October 21, 1902.

Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (27).—Mrs. S. C. Allinson, Miss E. Arkwright, E. Ascherson, Ezra Ball, Henry Clayden, F. Milnes Favell, Mrs. Gotto, Mrs. H. C. Hambro, G. Hemming, R. H. Hudson, Mrs. T. Jennings, H. Kemball (India), Cowley Lambert, J.P., James Mann, Mrs. W. Martin, Col. H. Moore, James Moorhouse, W. E. Neal, George H. Peace, P. E. Pilditch, J. H. Prince, Samuel Rideal, Lady Owen Roberts, J. H. Showell, W. A. Voss, Col. White (Jamaica), Hon. Mrs. Wood.

Associates (2).—H. Cowley, F. W. J. Jeffery.

Affiliated Society (1).—Horowhenua (New Zealand) Horticultural Society.

Mr. Harry J. Veitch, F.L.S., in the absence of Sir Trevor Lawrence, Bart. (President of the Society), presented the Victoria Medal of Honour in Horticulture to Mr. George Massee, F.L.S., Mr. J. T. Bennett-Poë, M.A., and Mr. Henry Cannell, Senr.

The Rev. W. Wilks, M.A. (Secretary), read the following letters received from His Majesty the King and His Royal Highness the Prince of Wales:

Balmoral Castle: September 30, 1902.

My dear Holford,—The King has been much pleased to hear of the intention of the Royal Horticultural Society to commemorate its centenary in 1904 by the erection of a new Horticultural Hall for the use of the Society. I showed the King Sir Trevor Lawrence's letter, and his Majesty commanded me to tell you that he perfectly remembered having addressed the Society in 1890 as Sir Trevor states, and you are to tell Sir Trevor, from the King, that the words His Majesty spoke in 1890 he repeats now, if possible with a stronger feeling than ever, not only of the desirability but of the actual necessity of such a building as it is proposed by the Society to erect. Sir Trevor and the Society, the King commands me to say, have His Majesty's best wishes in their undertaking, and as a small donation from His Majesty, by way of showing the interest he takes in the Royal Horticultural Society, I am now commanded to forward you a cheque for one hundred guineas towards the fund which is being raised for the new building.

Believe me, my dear Holford,

Very truly yours,

D. M. Probyn.

To Captain George Holford, C.V.O., C.I.E.

York House, St. James's Palace, S.W.: October 18, 1902.

My dear Holford,—I am desired by the Prince of Wales to let you know that the Royal Horticultural Society have His Royal Highness's cordial approval for their scheme for celebrating the centenary of the Society. The Prince of Wales also directs me to enclose you a cheque for fifty guineas towards the funds which are being raised for the new building.

Yours very sincerely,
W. Carington.

Captain George Holford,
Dorchester House, Park Lane, W.

A paper on "Hardy Summer and Autumn Flowering Bulbs," by Mr. P. Rudolph Barr, was read by the Under-Secretary (see page 894).

GENERAL MEETING.

November 4, 1902.

Mr. James Hudson, V.M.H., in the Chair.

Fellows elected (39).—G. F. Banks, A. S. Barhem, Mrs. W. A. Bewes, Roland H. Biffen, M.A., Herbert Burnett, F. Carey-Bouch, George Carter, A. R. Cobbett, Arthur Cole, Thomas Coleman, Bernard W. Crisp, John Crook, J. W. Dickinson, C. H. C. Du Cane, Oswald H. Ellis, Mrs. Farler, Lady Julia Follett, Hon. Mrs. Harbord, Alfred C. Harper, H. Haynes, Mrs. Smith Jackson, Mrs. Kemball, Major C. A. Leslie, C. Liddiard, A. B. Lowry, Major G. A. Marshall, James Middleton, J. W. Oddie, Mrs. Phillips, Mrs. Ricardo, Mrs. Sebastian, E. J. Thompson, A. H. Tozer, Mrs. Watson, Miss E. Welsford, E. A. White, Mrs. James Wigan, Mrs. R. C. Winder, Brand Van Zyl (Cape Town).

Associate (1).—F. Gallop.

A lecture on "The Dietetic Values of our Common Vegetables" was given by the Rev. Prof. G. Henslow, M.A., V.M.H. (see page 968).

GENERAL MEETING.

November 18, 1902.

Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (44).—W. H. Berry, F. Strange Brice, Mrs. Forrester Britten, Mrs. Brodie, J. F. Bull, J. Darker Butterell, Rev. F. W. Champneys, M.A., Mrs. Chew, Harry S. Colt, H. G. Day, Allan Edwards, Edmund Fawcett, A. D. Fort, Josiah Goodman, Mrs. C. Goschen, G. E. Grimsdale, E. Harris, E. Hasler-Potter, The Right Hon. Lord Hastings, Capt. H. Hincks, H. W. A. Hislop, Mrs. J. F. Huggins, R. W. Hutchinson, Mrs. E. B. Johnson, S. W. Lord, Carl E. Melchers, Mrs. Milner, W. Melville Newton, J.P., Edwin C. Norden, Mrs. F. Ogilvy, Eric M. Paget, Major F. G. Parsons, Mrs. H. Perrin, Mrs. E. Price, John Proffitt, Mrs. H. A. Rigg, Mrs. H. Salway, Dr. Otto Stapf, F.L.S., Ralph Tanner, Major H. Terry, Lady Tweedmouth, Henry C. Vale, E. C. Watts, James Wilson.

A lecture on "Spraying Fruit Trees and Packing Apples as practised in Canada" was given by Mr. Cecil H. Hooper (see page 982).

GENERAL MEETING.

December 9, 1902.

Mr. Harry J. Veitch, F.L.S., in the Chair.

Fellows elected (50).—Rev. S. F. Akroyd, G. C. Alexander, M. Afflatt, W. I. Armitage, C. S. Aylward, A. E. Bainbridge, W. Brazil, Miss Burns, Mrs. Carew, Mrs. Cator, J. A. Christie, E. G. Clarke, Mrs. Clarkson, W. J. Courtauld, H. C. Davidson, E. Dixon, Miss Jessie Fraser, E. Frederick, John Gardner, F. G. Gerrish, G. B. Green, A. Greig, Mrs. H. Grenfell, James Hamlin, Rev. F. C. Harvey, W. B. Henley, Miss M. A. Henty, Wm. Hough, Lady Jackson, Mrs. Jervoise, Miss C. A. Jones, A. A. McBean, G. T. Malthouse, H. F. M. Morres, T. Norman, A. Savidge, A. C. Seward, W. F. Stuttaford, T. Sutcliffe, Benj. Sykes, Mrs. J. B. Taylor, R. H. Tebb, W. Troy, W. Wadmore, Miss M. I. Wells, Mrs. Wentworth, A. S. Whitington, W. H. Williams, G. A. Wilson, Mrs. C. Wyndham.

Affiliated Societies (2).—Amateur Horticultural Society of Hobart (Tasmania), Wisbech Daffodil Society.

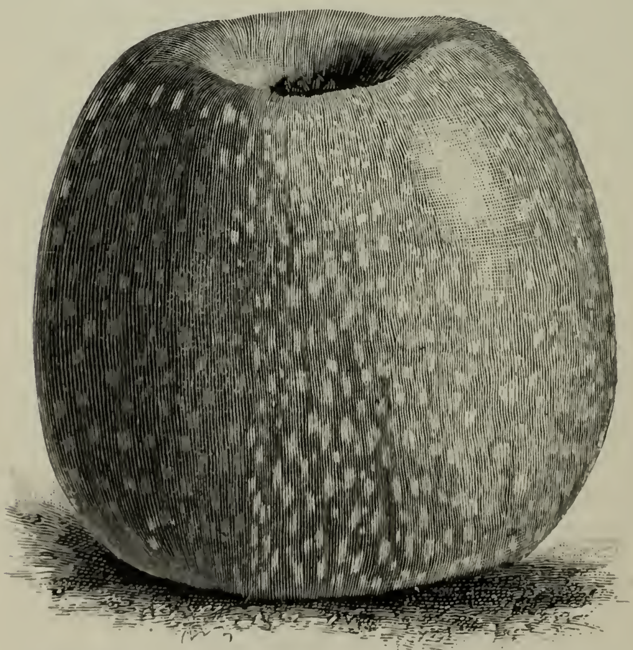


Fig. 259.—Apple Borsdorfer. (*Journal of Horticulture.*)

SCIENTIFIC COMMITTEE.

SEPTEMBER 23, 1902.

Dr. M. C. COOKE, M.A., V.M.H., in the Chair, and seven members present.

Diseased Helianthus.—Stems of *Helianthus* exhibited were rotting at the base and dying off in great numbers. Dr. Cooke pointed out that externally there were, here and there, traces of white mould, but when cut down longitudinally the pith was found to be occupied by numerous sclerotia similar to and perhaps identical with those found in Potato-haulms and Tomato-stems, and these appear to be quite sufficient to account for the dying off. This Potato disease is fully described in Worthington Smith's "Diseases of Field Crops," p. 15, and the life history of the sclerotium given, in which it is shown that the ultimate development is a small *Peziza*, there called *Peziza postuma*, but undoubtedly the same as had previously been described as *Peziza Libertiana*, and more recently called *Sclerotinia Libertiana*, and by Massee as *Sclerotinia Sclerotiorum* (see Massee's "Plant Diseases," p. 150, fig. 32). It seems to be found indiscriminately upon plants of various kinds, but commonly on Potato and Tomato, Chrysanthemum, Cucumber, Turnip, and Sunflower,

Pear Disease.—The Pears sent to the last meeting, cracked, shrivelled, and blackened by the attacks of *Fusicladium pyrinum*, were reported upon by Dr. Cooke as follows:—"In no case could I find any evidence of the presence of the *Entomosporium*, which produces similar results. It is noteworthy that, intermixed with the *Fusicladium*, were found profusely the hyaline, curved, and septate conidia of some species of *Fusarium*, which certainly bears no relationship to the *Fusicladium*, and would be a distinct parasite. This requires further investigation, since many of the species of *Fusarium* are destructive parasites, and this has every appearance of being a new and undescribed species."

Leaf-spot of Celery.—Leaves of Celery were exhibited spotted with somewhat orbicular bleached spots, at first brownish, and then whitened towards the centre. Dr. Cooke pointed out that scattered over these spots are the minute black dots which represent the perithecia, enclosing the sporules. These are not so numerous as in most other species, and the sporules are long and thread-like, oozing out in a tendril in damp weather ($35–40 \times 1–2\ \mu$). It is the same species which occurs on the leaves of Parsley, and is known as *Septoria Petroselini*, Desm. It occurs also in France, Belgium, Germany, Italy, and South America.

Abnormal Pear.—Rev. W. Wilks showed an instance of a fleshy fruit-like growth resulting from a double flower. The end of the flower-stalk in these cases becomes fleshy internally, but externally bears leaves in successive whorls one above another, like so many calyces. No true fruit or seed is formed. The condition is not uncommon.

Clubbing in Cabbages.—Mr. Massee pointed out that if the seed-bed is well dressed with lime, and the seedling plants get over the first three weeks of their life free from attack, there is comparatively little danger of subsequent infection.

Chlorosis of Apple and other Trees.—In reference to this subject, discussed at the last meeting, Mr. Gaut now sent twigs of Apple trees and of Raspberries from a garden in Yorkshire, together with samples of the soil taken at a depth of nine inches and of eighteen inches respectively. It was suggested that the samples be sent to the analyst to determine whether or no they contain copper.

Pollination in Orchards.—Mr. F. J. Chittenden, F.R.H.S., sent the following communication :—It has been frequently noticed that in large plantations of one particular variety of Apple or Pear the quantity of fruit produced greatly diminishes from the outside of the plantation towards its centre, and the explanation apparently is that foreign pollen—that is, pollen from another variety of Apple or Pear, as the case may be—is necessary for the proper fertilisation of the ovules, in order that fruit may be set at all. It seems also that incomplete fertilisation may also take place, owing possibly to weakness in the pollen of the particular variety, resulting in the formation of misshapen or malformed fruit.

The fertilisation of the ovules depends chiefly upon three factors :—

1. The occurrence of suitable weather conditions at the time of the receptivity of the stigma and the ripening of the pollen.

2. In the case of self-sterile varieties, the presence of bees or other insects to carry pollen from one flower to another. Müller gives a list of nine bees visiting flowers of Apple (*Bombus Hortorum*, L. ♀ being especially abundant), as well as other insects (seven) visiting the flower for honey or pollen : and a list of six bees (*Apis mellifica*, L. ♀ very abundant), as well as twenty-four other insects visiting the flowers of Pear (*Fert. of Flowers*, pp. 238, 239). He also says that if bees fail to visit the flowers, self-fertilisation occurs in each case, but he is presumably speaking of the wild plants, *Pyrus Malus*, L., and *P. communis*, L., and not of garden varieties.

3. In the case of the self-sterile varieties, the presence of plants in the near neighbourhood whose pollen will fertilise the ovules of the self-sterile variety.

This last factor is the one most under the control of the grower, and therefore the one upon which definite knowledge is essential, and though much has been done in America in finding out which are the self-sterile varieties, &c., very few definite experiments, carried out on lines which admit of a minimum of error in the result, appear to have been conducted, or at least recorded, in this country. American results are not altogether reliable here, owing (1) to the difference in the varieties grown, and (2) the difference in the meteorological conditions.

In an attempt made quite recently to ascertain which varieties of Pears were self-sterile, and therefore not suitable for large plantings by themselves, I tested the following fifteen varieties :—'Bellissime d'Hiver,' 'Beurré d'Amanlis,' 'Beurré Superfin,' 'Catillac,' 'Conference,' 'Doyenné du Comice,' 'Durondeau,' 'Easter Beurré,' 'Émile d'Heyst,' 'Jargonelle,' 'Joséphine de Malines,' 'Louise Bonne of Jersey,' 'Pitmaston Duchess,' 'Williams's Bon Chrétien,' 'Olivier de Serres.' Of these only two, 'Conference' and 'Durondeau,' set fruit under such conditions that foreign pollen (*i.e.* pollen of some other var.) was unable to obtain access to the stigmas—in other words, only those two varieties proved self-fertile.

So far the evidence is positive; the evidence with regard to the other thirteen varieties is not conclusive, the weather prevailing at the time possibly interfering with the setting of the fruit. Negative evidence can only be accepted in such cases after a long series of experiments extending over several years with varying climatic conditions. In some cases, although the trees flowered very well, and were growing close to other varieties, only one or two fruits were set, showing that weather conditions interfered greatly with the production of fruit.

Thirteen varieties of Apples were experimented on—'Beauty of Kent,' 'Cellini,' 'Cox's Orange,' 'Claygate Pearmain,' 'Gladstone,' 'Lord Derby,' 'Lady Sudeley,' 'Mannington Pearmain,' 'Northern Greening,' 'Schoolmaster,' 'Stirling Castle,' 'Sandringham,' 'Sturmer Pippin'—and again only two varieties set fruit under conditions precluding the entrance of foreign pollen—'Gladstone' and 'Stirling Castle.' Of course, here again, the negative evidence does not conclusively prove that the remaining eleven varieties are self-sterile.

The weather prevailing at the time, high winds and wet, prevented any cross pollination experiments being carried out with accuracy; but it is worth noting that, although the Pear-blossoms are, as a rule at least, proterogynous, yet it frequently happens that one or two of the anthers have shed their pollen before the bud opens; this fact points to the necessity for special care in the choice of flowers for cross pollination.

China Asters.—Specimens of these plants, showing the symptoms so commonly met with, were referred to Dr. Cooke for report, the supposition being that the condition was due to the Aster-worm, described and figured in Vol. xxv. p. clxxiii.

Spot in Grapes.—From Derby came specimens of Muscats affected with this fungus, now too commonly met with. It is due to a species of *Glœosporium*, described and figured in the *Gardeners' Chronicle* on December 6, 1890, and in Viala's work on diseases of the Vine. Destruction by fire of the affected berries, so far as possible, and the use of a fungicide spray next season, are the only remedies that can be suggested.

Distorted Apples.—Some distorted fruits were shown, whose small size and crippled appearance were attributed to imperfect fertilisation and a check to growth.

Cannas.—Some specimens from Rougham Hall were exhibited, in which the leaves had failed to expand properly. This was supposed to be due to some arrest of growth, the reason for which could not be ascertained without knowing all the circumstances under which the plants were grown.

Canada Rice.—Mr. Douglas, V.M.H., showed a specimen of this annual Canadian grass, whose seeds are used as an article of food. A fine clump may be seen at Kew; experimental plots of it have also been planted in some of the Norfolk Broads.

Begonias.—Mr. S. Brown, of Newark, sent male flowers of tuberous Begonias in which the anthers had been replaced by stigmas, and the upper surfaces of the petals were covered with imperfect ovules. Such changes are common in cultivated Begonias.

Chrysanthemum leucanthemum.—Dr. Masters, F.R.S., showed a specimen in which stalked flower-heads proceeded from the axils of the leaves all up the stalk.

Sweet Pea.—Dr. Masters also showed flowers of 'Lady Grisel Hamilton' from his garden, in which the base of the standard was deeply divided into two rounded lobes; almost all the flowers on the plant were thus affected, and some few on other varieties, so that it seemed as if this formation was, or if selected might be, a precursor of a separate race.

Griselinia littoralis.—Mr. Burbidge, V.M.H., sent from Dublin a specimen of this New Zealand shrub, with small ovoid berry-like fruits, which are very rarely produced in this country.

Diseased Melons.—In reference to the supposed bacterial disease of Melons referred to at the former meeting, Mr. Willard, Holly Lodge Garden, Highgate, N., sent the following letter, which confirms his original statement:—

"Acting on your suggestion, I have tested inoculation still further. Two plants were selected which had finished their fruit off satisfactorily, and to all appearance were remaining healthy. The first had a hard woody stem; the sap of a diseased plant was introduced by a scratch in the bark, the next day discoloration took place, in three days the disease could be seen, and in a week the plant succumbed. In the case of the other, which was somewhat more succulent, the inoculation was done on Monday morning, and the plant was practically dead on the following Friday, the disease going right through the stem, seeming to cut off the supply of sap from the root. I may add that these two plants had thick healthy green leaves, more so than usual for plants which finish their fruit quite up to ripeness. The house has not been shaded, and the plants have had abundance of air during the day, with a little left on at night."

Scientific Committee, October 7, 1902.

Dr. Russell, F.R.S., in the Chair, and ten members present.

Crotolaria species.—Rev. W. Wilks exhibited a flowering branch of a species raised from seed received from Uganda. It closely resembled *C. Cunninghamii*, from the neighbourhood of the Gulf of Carpentaria in Australia. Dr. Rendle, who examined it for identification, reported that it was quite distinct from the Australian plant and was in his opinion probably identical with *C. agatiflora*, Schweinf., a native of East Tropical Africa, but specimens for comparison were not sufficiently numerous to be quite certain.

Effects of Hail in Kent.—Rev. W. Wilks also showed stems of trees of which the bark had been ripped open in considerable lengths by the hail of the late storm. The wood was entirely exposed as the bark curled backwards: it was received from Mr. Woodward, of Teston, Kent. It was recorded that six tons of hail were found in the basement of a house after the storm.

Fir and Cryptococcus.—Mr. F. Lloyd, High Sheriff of Buckinghamshire, sent a bough infested by this insect. The tree had died after four years' attack. Mr. Saunders undertook to examine and report upon it.

Mushrooms and Mites.—Mr. Gaut, of Leeds, sent some specimens badly attacked by mites, which, with their eggs, were quite observable. They are said to be wholly destroying the crop. Mr. Saunders examined them, and reported as follows :—" The Mushrooms are badly attacked by one of the 'bulb-mites,' *Rhizoglyphus echinopus.* I do not see what can be done to destroy them except to clear out the whole of the Mushrooms and the top soil of the bed, and begin afresh. Any method of killing the mites would certainly destroy the Mushrooms also ; soaking the upper part of the bed with boiling water would kill the mites, but it would equally kill the Mushrooms, and most probably the spawn. Before making a new bed, I should wash down the walls or woodwork that had in any way come in contact with the bed with paraffin emulsion or paraffin mixed with water, one part of oil to twenty of water, or with boiling water."

Vine Leaves Burnt.—Leaves of Madresfield Court Grape were received from Mrs. J. B. Wood, Henley Hall, Ludlow. No fungus could be detected. It was suggested that the appearance was probably due to the effects of the sun shining through the glass on the leaves when wet.

Begonia Leaves Diseased.—Leaves were received from Mr. C. Newington, of Oakover, Ticehurst, Sussex. An examination by Mr. Saunders revealed no insect pest ; but Dr. Cooke remarked that the peculiarity of the disease occurring along the ribs and veins was very suggestive of *Glœosporium*, so that it might be an incipient stage of that fungus ; such being the feature of this disease on leaves of the Plane-tree. On further microscopic examination, however, it was discovered that the disease originates in the attack of an exceedingly small white insect of the *Tarsonymus* tribe, and that saprophytic fungi follow on its depredations, so that if the plants are kept free from the insect the disease will cease to occur. Dusting with tobacco powder or syringing with a weak insecticide is advised. Many stove and greenhouse plants are subject to similar attacks besides Begonias.

Chlorosis in Palms.—Mr. Odell exhibited seedlings of *Kentia*, showing yellow, unhealthy leaves, taken from a batch of some thousands of seedlings, of which only a very small proportion were affected. A plant of *Kentia* submitted to the committee in February last (with five others) was in the same state as the seedlings shown, but when grown in a coolhouse with little shade, and potted in soil containing a trace of iron, the leaves developed the ordinary colour. Mr. Odell added that Kentias and Seaforthias (*Archontophœnix*) seem more subject to chlorosis than such genera as *Cocos* and *Rhapis*.

Germination in Amaryllids.—Mr. Worsley read a paper on this subject, which is given fully at page 852.

Abnormal Onion.—Mr. Healey, of Hampton, Middlesex, sent a very curious formation. The Onion was well formed below, and bore a green stem of some six inches in length, which terminated with another Onion,

Fig. 260.—Abnormal Onion.

also well formed. It was thought that it replaced the flowering bud, this having been broken off, but an examination by section showed that such was not the case; so that it arose from the replacement of the flower-bud by a true bulb. Mr. Healey adds: "The sheath around the Onion below, over the second bulb, and right to the top, was continuous; and when pulled up the sheath was not even broken." (Fig. 260.)

Physianthus Catching Moths.—Professor Henslow showed flowers of this American Asclepiad, often cultivated at Cape Town, nearly every flower of which had securely caught a small grey moth, its proboscis being nipped between the anthers. They either died of starvation, or, as was frequently the case, they were carried off by bats, which seemed to know that they were likely to find food in these particular flowers, and visited them accordingly.

Scientific Committee, October 21, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and fourteen members present.

Roses.—Rev. W. Wilks exhibited specimens he had received from the herbarium of M. Maurice de Vilmorin of *Rosa sericea*, with long decurrent thorns; of *R. macrophylla* var. *crasseaculeata*, with very large thorns; and illustrations and photos of *R. macrophylla*, a large crimson-flowered species (see figs. 134–140).

Begonia, crested.—Sir Trevor Lawrence, Bart., V.M.H., sent several flowers showing different degrees of cresting of the petals. In some the entire petal was reduced to a midrib covered with projections.

Leaf-miner.—Mr. Holmes showed specimens of a leaf-miner on Hogweed, which Mr. Saunders undertook to examine.

Cankerous Growth.—Mr. Hooper showed some fruit-tree branches with a cankerous growth, and Daffodil bulbs attacked by the dipterous fly *Merodon equestris* (see p. 181).

Auricula Aphis.—Mr. Douglas brought plants of an Auricula, the roots of which were infested with an aphis, but the plants themselves were perfectly healthy. The aphis appeared to be *Trama Auriculæ*, and had been observed twenty-five years ago.

Vigour in Hybrids.—Mr. Douglas, V.M.H., called attention to a plant of a hybrid between *Cattleya Dowiana* and *C. velutina*; the first parent has usually three to five flowers, and the latter three only; but the hybrid bore nine. The specimen illustrated the usual result of increased vigour in hybrid plants, sometimes at the expense of fertility. It was observed that hybrids of *Cypripedium Fairieanum* will not cross. Mr. G. Paul, V.M.H., remarked that extraordinary growth occurred in hybrid Crimson Rambler Roses, long shoots sixteen feet in length occurring in one season, but accompanied with some decrease in the production of flowers.

Carnation Leaves Rooting.—Mr. Douglas brought leaves of a Tree Carnation, one branch of which bore leaves with minute roots, arising from the pericycle of the fibro-vascular bundles, and issuing from beneath the epidermis all along the midrib. Mr. Massee, V.M.H., observed that it was not infrequent when eelworms were at the roots; the roots then often appear from the stem as well as from the leaves.

Exhibition of Fungi.—Mr. Douglas also suggested that it would be advisable to hold an exhibition of fungi, displaying the edible and poisonous species in separate collections, to be collected by the members of the committee or other persons interested in these plants. Rev. W. Wilks proposed September 15, 1903, for the first exhibition. Dr. Cooke, V.M.H., kindly promised to read a paper upon the subject at the General Meeting of the Society on that day.

Cactus Blistered.—Mr. Shea showed seedling plants with blistered patches. Mr. Worsley observed that he was familiar with the occurrence for many years on old plants, but this appeared to be the first instance on young plants. He had noticed flies on it, and thought that possibly they might have been the initial cause of the mischief, the fungus following.

Peach Mildewed.—Mr. E. Salmon sent a history of a Peach raised from a stone, first in a pot, then in an unsuitable environment, and finally in his garden, nine years ago. The one sent was attacked by the ordinary Peach-mould.

Lime-trees and Undergrowth.—A member inquired if there was any truth in the belief that nothing will grow under Lime trees. It was not generally accepted by the Committee; but a Swede who was an experienced gardener said that it was the common belief in Sweden that such was the case (see page 667).

Pine-bark and Coccus.—Mr. Saunders reports as follows on specimen sent to the last meeting by Mr. F. G. Lloyd: "As far as I could see it was a different species from that which infests Beeches; but as I was not quite sure I sent specimens to Mr. Newstead, who replies as follows: 'I think the insect you sent me on Fir-bark is the Pine-aphis (*Chermes Pini*), but I could not, unfortunately, extract an insect from the white sacs. Could you send me a further and plentiful supply in order that I may make quite sure of the insect?' It is pretty certain that Mr. Newstead thinks it is a different species from that on the Beech, for he suggests that it is a *Chermes*, whereas the other species is a *Pseudococcus*."

Ipomœa rubro-cærulea.—Mr. Worsley showed a blossom of this plant, observing that it has been described as being at first red, then blue, but in his experience this order was reversed, as it opens a deep blue, and then becomes of a crimson tint.

Arctotis, sp.—Mr. Worsley also showed specimens of *A. arborescens*, 'Jacquin' (white), and *A. Leichtliniana* (yellow). The former species was the first to be introduced from South Africa; it is commonly called the South African Daisy, as it has white ray florets touched outside with crimson.

Gnaurs or Embryo buds on Tulip-tree.—Mr. F. W. Burbidge, V.M.H., sent specimens with the following note: "At Sybil Hill, Clontarf, belonging to the demesne of St. Anne's, there is growing a Tulip-tree (*Liriodendron tulipiferum*), and on the lower part of the gnarled old trunk large rounded warts or 'gnaurs' are clustered. They vary in size from 2 to 3½ inches across, and look like rough-skinned Potatos. Similar warts on Beech, Cedar, Deodar, and other trees are not uncommon, but I never happen to have seen a Tulip-tree produce them before. They consist of thick, soft, fleshy 'bark,' surrounding a hard woody core. Their branch-like character is shown by a twig and leaf growing from the smaller examples sent herewith. How or why they are produced is not very evident. The corrugated portion of the bole on which they grow is, however, much shaded by surrounding shrubs."

Gladiolus.—Mr. Jenkins, Hampton Hill, sent a very long spike of a crimson variety; the height was 3 ft. 8 in. It was the growth from a corm which had remained out of the ground and neglected from October 1900 to June 1902, when it was planted.

Passiflora, n. sp.—Dr. Masters showed a specimen which had been accidentally introduced by Messrs. Charlesworth with a *Cattleya Mossiæ*; it had not yet been described or named, but a description will shortly be published. The foliage is of a highly ornamental character.

Bunt, n. sp. introduced.—Mr. Massee described the introduction into England of a new species of this fungus as follows: "Twelve years ago one of the cereal bunt fungi was sent from Patagonia and Bahia Blanca, where it was stated to be very abundant. The host plants were *Bromus unioloides*, H.B.K., and *Festuca bromoides*, L. As usual, the fungus formed a black mass in the ovary of the host plant, and proved to be a new species—*Cintractia patagonica*, Cooke and Massee. Quite recently a traveller in these regions observed that *Bromus unioloides* was extensively grown, mixed with Lucerne for fodder. Seed of the *Bromus* was brought home and sown in Lincolnshire, and on producing fruit was observed to be attacked by the *Cintractia*. The above illustrates one of the methods by which injurious fungi are introduced from one country to another, and unless great care be taken to stamp out the newcomer, it is just possible that we may eventually have to add another cereal fungus-pest to our already long list."

Scientific Committee, November 4, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and ten members present.

Ergot, Prevalence of.—Mr. Hooper observed that this disease was particularly abundant this season, and exhibited specimens on Cocksfoot and Rye-grass. It generally is frequent in wet autumns.

Apple-trees in Blossom.—Mr. Hooper also referred to the occurrence of flowers on Apple-trees, a fact elsewhere noted and probably due to the mildness of the weather. Dr. Masters observed that when such flowers occurred on spurs, they were instances of precocious flowering.

Tomatos and Bordeaux Mixture.—Mr. Hooper also called attention to the advantages of using this fungicide on outdoor Tomatos, which were shown, when left to themselves, to have completely failed; but those sprayed bore at least half a crop even in this unfavourable autumn.

Crocus, rare species.—Mr. Bowles showed a blossom of *C. speciosus* var. *Aitchisoni*, which bore a fine pale-coloured flower; the country whence it was received was not known.

Cypripedium Malformed.—Mr. Saunders showed a drawing of a flower having the labellum erect and one additional petal. Dr. Masters undertook to add further details.

Apple-leaf Black Mould.—Dr. M. C. Cooke, V.M.H., reported as follows upon the Apple-leaves submitted for examination:—"They were badly diseased with the attack of a black mould new to the British Isles. The leaves were dead or dying at the ends of the branches, and the under surface sprinkled on the dead parts with black dots, which proved to be the tufts of conidia probably produced by *Coniothecium Questieri*, Desm., which was found and described in France in 1857 on leaves of *Cornus sanguinea*. The conidia are brown, very variable both in form and size, and muriformly septate, clustered in glomerules, and mixed with a few slender threads, This parasite has appeared so seldom that no experiments have been made upon it, but it is recommended to strip off, sweep from the ground, and burn all fallen leaves, so as to prevent the diffusion of the pest. Even when this is done, if there is any foliage left, it should be sprayed with one of the copper solutions to destroy the germinating powers of the conidia."

Flax Wilt.—Dr. Cooke said :—" Since the last meeting of the Committee I have learnt that experiments have been undertaken at the N. Dakota experimental station (Bulletin No. 50) to ascertain the cause of the disease known as 'Flax Wilt' and 'Flax-sick soil,' a disease which appears to be known in Ireland, as well as in Belgium, Germany, and other Flax-producing countries of Europe. I may premise that it has long been known that Flax cannot be grown continuously for any long period upon the same soil, because the soil becomes 'sick' and the Flax seedlings die off and do not produce a crop. The cause of this has hitherto been a mystery, but has generally been attributed to exhaustion of the soil. From the result of these experiments it appears to be, not the exhaustion of any of the chemical constituents of the soil, but the prevalence of a minute fungus in the soil, which preys upon the *débris* of the previous year's crop, and attacks the young seedlings of the new year, causing them to wilt and die. The name of this new fungus is *Fusarium Lini*."

Outgrowths on Potato Tubers.—Dr. Cooke supplied the following additional facts upon this disease, lately reported upon :—" It was attributed to a newly described fungus under the name of *Chrysophlyctis endobiotica*, although at the time I advocated its decided affinity to the tumour produced on Beetroot. More recently specimens have been sent to Berlin, with the result that Dr. Magnus has not only confirmed this affinity, but has demonstrated that it is the same species, which is known as *Œdomyces leproides*, Trabut, so that the 'Beetroot tumour' and the 'Potato tumour' are caused by the same fungus. This should be noticed, since the form on Potatos has for two years been destructive in several localities in the British Isles, and is quite capable of infesting Beetroot in like manner" (see page cxliv).

Iris Black Mould.—Dr. Cooke also reported upon diseased Irises sent to the committee :—" Since the last meeting a plant of *Iris ochroleuca* has been submitted to me for examination. The roots were in a perfectly sound condition, but the leaves were affected in a similar manner to those of other specimens sent to the committee recently, and of which I find no record in the reports of our meetings. The leaves turn yellow and sickly, and then brown, dying towards the tips. Upon these brown patches occur sooty or blackish spots, often of considerable extent, rather velvety under a lens, which manifest the appearance of a black mould

(*Heterosporium*). It occurs on the leaves of *Iris*, *Freesia*, *Antholyza*, and *Hemerocallis*, and is known not only in Europe, but at the Cape, New Zealand, and the United States of America; and will be found described in Massee's *Plant Diseases*, pp. 321 and 440, and figured in the present volume of the *R.H.S. Journal* on Pl. V., p. 386, fig. 90. Spraying with potassium sulphide is reported to check the disease, and all diseased leaves should be cut off and burnt. If these precautions are attended to, and the foliage is not watered, the disease may be controlled. Also spraying with ammoniacal copper solution checks the disease, after clearing away diseased leaves."

Grubs among Sedums.—Mr. Saunders reported as follows on some specimens sent by Mr. Maynard, Wymondham, Norfolk: "They are the grubs of one of the weevils, either the black Vine-weevil (*Otiorhynchus sulcatus*), or the clay-coloured weevil (*O. picipes*), but the grubs of these species are so much alike that it is almost impossible to tell them apart. However, as the life-history of both is exactly the same, it does not make much difference from a cultivator's point of view. The parent weevils lay their eggs at the roots of various soft-rooted plants: Sedums, Primulas, Begonias, Cyclamen, and Ferns being great favourites. The weevils themselves are also very destructive to the foliage and tender shoots of Vines and many other plants, particularly Ferns and Dracænas. I do not know of any means of killing the grubs except by picking them out from among the roots. Any insecticide that would kill the grubs would certainly be equally destructive to the plant. The beetles are not often seen, as they feed at night, and hide themselves very carefully during the day. They may be caught by putting a white cloth under the plant that they are attacking before it becomes dark. If the plant is in a pot it is better, if possible, to lay it on its side; then, after it has been dark for an hour or so, throw a strong light suddenly upon the plants. This will generally cause the weevils to fall off, when they will easily be seen on the cloth; if they do not fall, give them a jarring shake, and search well. Small bundles of dry moss or hay make good traps; they should be laid on the soil in pots, near the stems of the plants, or, in the case of creepers, tied on to the stems or shoots, so that when the weevils are seeking shelter, they should find one close at hand. The traps should be examined every morning. These weevils are either black, and about half an inch in length, or of a dull, pale, yellowish-brown colour, and about half an inch in length, according to the species.

Partial Separation of Parental Characters in a Hybrid Cypripedium.—Capt. C. C. Hurst sent a flower with the following communication: "A plant of *Paphiopedilum* × *Canhami* (*P. superbiens* × *P. villosum*), which hitherto has always produced normal flowers with me, has now produced the curious flower exhibited. One side of the lip or slipper is normal in colour, being evidently a fair blend between the parent species. The other side of the lip may be divided into three distinct areas: (1) a narrow band of rich brown-purple, as in the parent *P. superbiens*; (2) a broad band of greenish-yellow, as in the parent *P. villosum*; (3) the remainder of the lip being a normal blend between the two parents. We have here evidently a partial separation of the mixed 'blood' of the parent species, the result being a mosaic rather than a blend. It is interesting to note that the hairs within the lip are sharply separated, as in the colour, and there is also a slight tendency to separation in the colour of the dorsal sepal and the petals. Whether this partial 'sport' will prove permanent remains to be seen, though it is not very likely. We really know very little about the manner in which the cells of hybrids are determined and formed, but this particular case suggests that when the cells were being formed in the areas (1) and (2), the parental determinants, instead of working together to form a blend, somehow separated, the *P. superbiens* determinants alone forming No. (1) area, and the *P. villosum* determinants forming No. (2). Similar 'sports' have been recorded in the allied hybrid *P.* × *Harrisianum* (*P. barbatum* × *P. villosum*), for the history of which see *Cypripedium* × *Dauthieri Rossianum*, Rchb. f. in *Gardeners' Chronicle*, 1888, i. p. 425; *C.* × *D. marmoratum*, *Rev. Hort. Belge*, 1889, p. 241 (with plate); *C. Dauthieri* × (dimidiate), *Gardeners' Chronicle*, 1895, i. p. 335, fig. 45; cf. also *Orch. Rev.* 1894, pp. 20, 147."

Acorns from the Cape.—Prof. Henslow showed specimens illustrating the great amount of variation occurring in the size and shape of acorns from trees growing in and near Cape Town. They are all from original importations from Europe of the common Oak. One tree was remarkable for bearing a large number of acorns all of which had three embryos. They were cultivated by the Dutch more on account of the acorns for pigs' food than for timber, as this is rather inferior to Oak grown in England. Numerous avenues have been planted in the colony.

Self-burial of Bulbs.—Mr. Worsley showed a bulb formed below the previous one; and had come to the conclusion that its position indicated the, so to say, intention of Nature to deepen the position of the bulb. It bore numerous contractile roots of the usual spindle-shaped form, which were strongly wrinkled at the base. Prof. Henslow called attention to a paper on this subject (*Bot. Gaz.* xxxiii. p. 401) on Californian *Liliaceæ*, of which some bury their bulbs (as does *Colchicum*) by means of the rhizome alone, without contractile roots; while others do it entirely by these organs.

Wireworm.—Mr. Baker mentioned that these pests had been very troublesome this season, particularly where mineral fertilisers had been used. On a very poor chalky bank some Vetches were very badly attacked, especially on some long slips, which, for experimental purposes, had been dressed with potassic and phosphatic fertilisers. On these slips, fresh shoots were continually being produced and destroyed. Another field near, situate in the valley, was planted with Peas, and some rows of these also received dressings of the same fertilisers. A fine crop resulted notwithstanding the wireworm attacks. Turnips were drilled between the rows, and these were badly attacked, especially where the mineral fertilisers had been used for the Peas. Although the Turnips were badly pierced, they were much finer otherwise than on the rows where these fertilisers had not been used. It is admitted that much organic matter favours wireworm, but the attack was much more severe where the mineral fertilisers were used. It may be noted that the Vetch is not often much injured by wireworm. In the case of the Peas and succeeding Turnips, a possible explanation may be that the increased vigour of the

Peas, induced by the minerals, largely increased the supply of combined nitrogen, and this, in conjunction with the residual minerals, produced more succulent Turnips, which were, therefore, more favoured by the pests.

Scientific Committee, November 18, 1902.

Dr. M. T. Masters, F.R.S., in the Chair, and sixteen members present.

Dr. M. C. Cooke, V.M.H.—Dr. Masters rose to offer in the name of the Committee their hearty congratulations and goodwill to Dr. M. C. Cooke on having been presented by the Council with the Society's Victoria Medal of Honour. Dr. Cooke in reply observed, in thanking the Committee, that he had no anticipation of the honour, as it was quite unexpected, since whatever he had done was always *con amore*. (Fig. 261.)

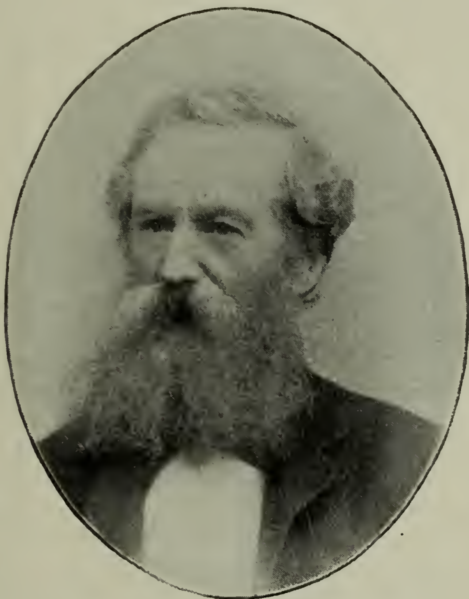


Fig. 261.—M. C. Cooke, M.A., L.L.D., V.M.H. (*Journal of Horticulture.*

Malformed Cypripedium.—Dr. Masters reported on the drawing submitted at a previous meeting by Mr. Saunders. The flower is an illustration of a common tendency in Orchids to produce the flower-segments in whorls of two. The two lower sepals were confluent into a single segment placed anteriorly, and forming one of a pair with one of the ordinarily lateral petals, here displaced so as to become median and posterior. The other lateral petal is absent. Numerous malformations in the genus *Cypripedium* are given in Dr. Masters's paper on the subject in the *Journal of the Linnean Society*, vol. xxii. 1887, p. 402, and in "Orchids, Single and Double," *Gardeners' Chronicle*, May 5, 1885.

Stenoglottis longifolia.—Mr. Odell brought spikes of this South African Orchid with fasciated stems. The flowers are very small, pale rose, and spotted with crimson. He observed that the method of cultivation was similar to that of *Disa* in a cool-house. Professor Henslow remarked that *D. grandiflora*, "The Glory of Table Mountain," does not seed freely there, but propagates itself chiefly by underground stolons.

Lily fasciated.—Mr. H. Simpson, Wandsworth, sent a fine specimen of *Lilium auratum* in this condition.

Acorns striped.—Rev. M. C. H. Bird, of Brunstead Rectory, Stalham, Norwich, sent specimens of Acorns peculiar to one tree in the above locality, a variety of the common Oak: they are very small, and transversely striped with narrow black bands. *Quercus nigra*, of the U S.A., has similar striping, but the cause is unknown.

Ruellia, cleistogamous form of.—Mr. H. C. Davidson, Great Totham, Witham, Essex, called attention to this hitherto unknown peculiarity. The Ruellias referred to should have borne "large blue flowers"; but the flowers borne were white, and so small that they could hardly be seen unless they were looked for. The envelope was early pushed off, like that of *Eschscholzia*, but the pods swelled and produced seeds. One of the plants carrying the tiny white flowers and also ripened seed-pods has since produced a larger single blue flower.

Fertility of Hybrids.—Capt. Ch. C. Hurst sent the following communication: "At the meeting of the Committee on Oct. 21, under the heading 'Vigour in Hybrids,' it was observed that 'hybrids of *Cypripedium Fairieanum* will not cross.' According to the records, this statement can hardly be accurate, because on sixteen distinct occasions hybrids of *C. Fairieanum* have produced offspring which have duly flowered. The following is a list of the crosses recorded (for detailed references see the forthcoming *Orchid Stud Book*). (1) *Paphiopedilum* × *vexillarium*, a hybrid between *P. barbatum* and *P. Fairieanum*, has been successfully crossed with *P. barbatum*, *P. bellatulum*, *P. hirsutissimum*, *P. Spicerianum*, *P. insigne*, *P. Stonei*, *P.* × *calophyllum*, *P.* × 'Io,' and *P.* × *Williamsianum*. (2) *P.* × *Arthurianum*, a hybrid between *P. insigne* and *P. Fairieanum*, has been successfully crossed with *P.* 'Argus,' *P. Spicerianum*, and *P.* × *Leeanum*. (3) *P.* × 'Niobe,' a hybrid between *P. Spicerianum* and *P. Fairieanum*, has been successfully crossed with *P. insigne*, *P. Spicerianum*, *P.* × *Orphanum* and *P. javanico-superbiens*. We may therefore conclude that whatever degree of fertility may be peculiar to hybrids of *P. Fairieanum*, it cannot be said that they are absolutely sterile." Mr. Veitch quite corroborated Mr. Hurst's observations.

Introduction of fungus pests.—Dr. Cooke, V.M.H., made the following observations: "Apropos of Mr. Massee's statement at a recent meeting of the Committee, that a fungus pest, a smut on grasses (*Cintractia*), was introduced into Britain with a species of *Bromus* from Patagonia, a similar instance has come to hand as to the introduction of the destructive Apple and Pear scab (*Fusicladium dendriticum*) into South Australia. This disease was apparently wholly unknown in that colony previous to 1877, when its introduction was attributed to an infected Seckle Pear-tree which was imported from America. This is not improbable, and should serve as a warning to ruthlessly destroy any and all imported plants which give evidence of disease, and to thoroughly disinfect the soil."

Ferns proliferous.—Mr. Druery, V.M.H., exhibited a pinna of *Athyrium* *filix-fœmina* var. *plumosa*, Druery, showing a profusion of young plants developed from dorsal—*i.e.* soral—bulbils, which first appear as fleshy excrescences among the sporangia, most of which abort. As a rule, the bulbils only develop into minute excrescences, it is extremely difficult to maintain vitality during the winter, owing to the almost immediately subsequent decay of the deciduous fronds; hence only few plants have been raised by this means. This year, however, due probably to the moist season, the bulbils appeared much earlier than usual, and developed fronds which appear in the specimen very clearly on the upper surface. This proliferous trait is inherited from the progenitor, the Axminster *A. f. plumosa*.

Apple Pyriform.—Mrs. Bayldon, of Dawlish, sent an Apple closely resembling a Pear, from a large tree in an old cottage garden.

Black Hamburgh Grape failing.—Abortive flowering shoots were sent by Mr. G. H. Ricketts of Cranemoor Lodge, Christchurch, Hants, who observes that "every year the branches promise fairly well, but the Grapes fall, and are good for nothing." Failure in root-action, probably water-logging, was the general opinion of the Committee. Mr. S. T. Wright of Chiswick, to whom they were submitted, reports that, in his opinion, the Vine is "Canon Hall Muscat, a notoriously bad setter, which only succeeds well as a bearer in a few places. I would suggest rooting it out or grafting with a more reliable variety. Black Hamburgh never shows bunches in the form of the specimen sent."

Potatos with tuberous shoots.—Mr. C. Osman, Sutton, showed samples of Potatos which had sent out shoots, each of which bore numerous small Potatos. The peculiarity had been figured by Dr. Lindley about the middle of the last century, but it is not so common as super-tuberation or secondary tubers issuing from the main one. This has been common in certain places this year, apparently due to prolonged degree of damp warm weather, which causes the Potato to start into growth, but instead of forming leafy shoots produces tubers. The variety known as "The Garden" is said to be particularly liable to it.

Plant Dyes.—Dr. Plowright sent the following communication, together with specimens of the dyes described:—

"*The Common Larkspur.—Delphinium Consolida*, as the older botanists used to call it, is a plant of considerable interest. The generic name *Delphinium*, for instance, is taken from Delphis, a dolphin, the similitude being in the flower-buds before they expand. One of the aberrant members of the *Ranunculaceæ*, it was in the olden times admitted to a place in the English flora on doubtful grounds. 'The expressed juice of the petals with the addition of a little alum makes a good blue ink,' as Withering tells us in his *Botanical Arrangements* (14th edition). The quantity of juice which can be expressed from the petals is very little; but when they are crushed with a small quantity of water, and alum added, a green liquid is obtained. That it is possible to write with this is evident from the sheet of writing now exhibited; but whether it merits the designation of ink is another matter. The green colour is not due to chlorophyll. It is capable of retaining its colour for more than a year, as is evident from the specimen exhibited: in point of fact, the sentence written with the 1901 ink is rather darker than that written with the 1902 ink. But this green fluid possesses another character of considerable optical interest: it is fluorescent. When viewed by reflected light it is green, as is the case when daylight is transmitted, not only ordinary daylight, but even direct sunlight. When, however, an artificial light is viewed through it, the fluid appears red; the electric light, gas light, or even the flame of a wax vesta match has the same effect. A solution of chlorophyll in alcohol is also fluorescent, but in the reverse way, being green by transmitted, and reddish by reflected light. (1) Indigo-red dissolved in alcohol. This specimen is prepared from woad after the manner described by Prof. M. W. Beyerick, of Delft: 'To an infusion of fresh woad leaves, isatin and hydrochloric acid are added, and the mixture boiled.' It assumes a dark, almost black colour, which is due to the deposition of innumerable acicular crystals of indigo-red, which are readily observable under the microscope. These crystals are insoluble in water, so that if the fluid be filtered they remain on the filter as a black powder; this may be dissolved by alcohol. (2) A red colouring matter soluble in water and in alcohol. Obtained by treating dry woad seed with hot water and hydrochloric acid. This specimen is an alcoholic solution. This colouring matter is turned green by an alkali, thereby differing from indigo-red. (3) An alcoholic solution of red colouring matter contained in the flower-heads of *Hypericum perforatum*. This has been known for a very long time. Linnæus speaks of the Scandinavians colouring the spirituous liquors by it. It is turned bright green by an alkali. (4) The male catkins of the black Poplar crushed with water and hydrochloric acid. (5) Petals of *Geranium sylvaticum* crushed with alum and water. (6) Petals of *Centaurea Cyanus* crushed with alum and water. This is said by the older botanists to yield a 'blue ink'; but the mixture thus obtained can hardly be called blue, but rather a dirty chocolate. It has, however, a red fluorescence by transmitted light." These two last (5 and 6) are probably the so-called erythrophyll.

Cladium Mariscus.—Specimens were received from Dr. Plowright, who writes:—"These distorted leaves were found upon plants growing on Ashwicken Fen during the past season. Many plants were similarly affected." They had evidently received some check during growth.

Helenium autumnale virescent, &c.—Mr. Worsdell showed specimens of this not uncommon malformation, together with an interesting account of the matter. (See page 943.)

Crimson Oak Leaves.—Rev. W. Wilks showed leaves of the common Oak which came from one single tree in a large wood, of a bright crimson colour on both sides, especially on the lower side. It was remarkable that no other trees bore such leaves in the neighbourhood.

Scientific Committee, December 9, 1902.

Dr. M. T. Masters, F.R.S., in the chair, and ten members present.

Carnation Leaves Rooting.—Mr. Douglas observed, with regard to a remark of Mr. Massee's—that roots are sometimes produced on the leaves when the main roots were affected—that in the case of those he had exhibited, the main roots were perfectly sound, and he could suggest no cause for the appearance of the roots on the leaves.

Nephrolepis tuberosa.—Mr. Saunders exhibited some of the tubers found on the roots of this plant. They did not appear to have "eyes" or buds upon them, so as to be propagative. It was suggested that their use may be for water storage only.

Celeriac Diseased.—Specimens were sent by Mr. Kitson, The Chantry, Netherbury. Dr. Cooke, V.M.H., undertook to examine and report upon them.

Hyacinth Bulbs Diseased.—Mr. Saunders gave the following report upon the bulbs sent to the last meeting:—"The bulb contained a large number of the bulb-mite, *Rhizoglyphus echinopus*, and these mites were, no doubt, the cause of the injury to the bulb. Besides the mites, there was a quantity of a greenish mould, which I imagine only began to grow on the bulb after it had been killed by the mites. When bulbs are thus infested with mites, nothing can be done to save them. When only a few mites are at the base of the bulb, where the attack generally commences, they may be killed by immersing the bulbs for five minutes in water at a temperature of 115° or 120° Fahr. If some sulphide of potassium (6 ozs. to a pint) be added to the water, this remedy would be all the more efficacious; indeed it is said that soaking the bulbs in this solution cold for twenty minutes will kill the mites. It is very essential that any of the soil from pots which has contained bulbs infested by this pest should not be allowed to get mixed with fresh soil on the potting-bench or elsewhere." Dr. Cooke added:—"There is such a profuse crop of saprophytic moulds, as *Penicillium*, that they effectually mask the disease, whatever it may be, and there are numerous Acari present."

Dictamnus Fraxinella.—Mr. Bowles referred to the germination of the seeds of this plant, as they were sown as soon as ripe, but did not germinate. The Rev. W. Wilks observed that the seeds of *Dictamnus* will not germinate if kept any time out of the ground, and added that the best method with all suchlike seeds which germinate with difficulty is to sow them at once, the same day they are gathered, in a pan with a tile over it touching the earth, and leave the tile on all through the winter and well into the spring. Then if it be removed the seeds will generally quickly spring up.

Physiological Experiments.—Professor Henslow described an experiment he had carried out with two objects in view.

The first was to ascertain if darkness had any effect upon the direction of growth of roots. He grew some Mustard on a perforated tin over a glass of water, the latter having black paper pasted all over it, excepting a narrow strip facing the light, which could fall upon the roots in the water. They, however, grew vertically downwards uninfluenced under these conditions by either light or darkness.

The second object was to see if water arrested the growth of the primary roots, as in a paper on "A Theoretical Origin of Monocotyledons from Aquatic Dicotyledons" (*Journ. Linn. Soc.* vol. xxix. p. 486), he had inferred from the great number of coincidences, both in morphology and anatomy, that such must have been the case. One such agreement was the total arrest of the axial root in all Monocotyledons, and also in aquatic Dicotyledons, as *Ranunculus aquatilis*, *Trapa*, *Ceratophyllum*, *Victoria regia* &c. Such proved to be the case with the Mustard. The conical extremity of the root became brown and died, while strong secondary roots with root-hairs arose from the pericycle just above the dead apex. Experimental verification thus corroborated the above induction.

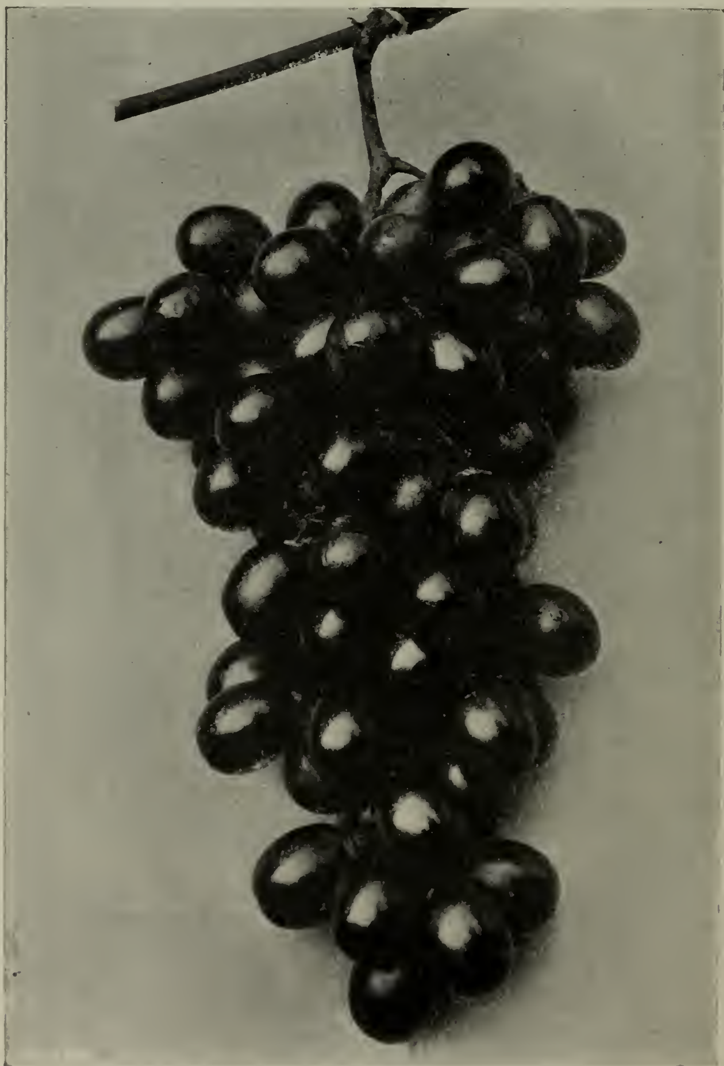


Fig. 262.—Grape Madresfield Court. (*The Garden.*)

FRUIT AND VEGETABLE COMMITTEE.

SEPTEMBER 23, 1902.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and fifteen members present.

Awards Recommended:—

Silver-gilt Knightian Medal.

To Mrs. Nix, Tilgate, Crawley (gr. Mr. E. Neal), for 80 dishes of fruit.

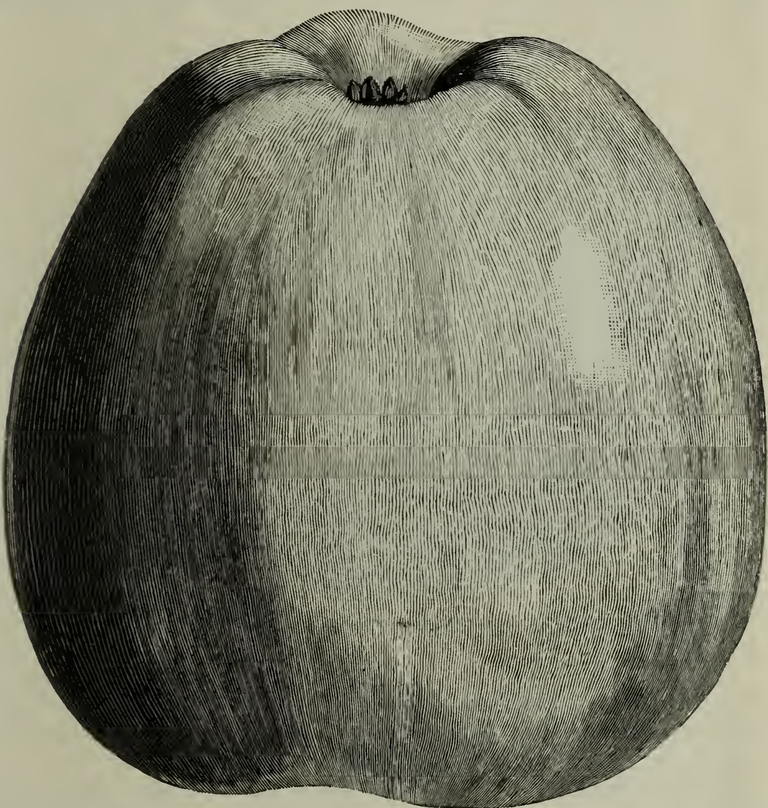


FIG. 263.—APPLE 'ROYAL LATE COOKING.' (*Journal of Horticulture.*)

Silver Knightian Medal.

To Lord Llangattock, The Hendré, Monmouth (gr. Mr. T. Coomber), for two exceedingly large and well-grown fruits of 'Smooth Cayenne' Pine Apples.

Other Exhibits.

Mr. R. D. Hughes, 35 Middle Lane, Denbigh, sent fruits of 'Late Moorpark' Apricot.

Mr. J. Crook, Forde Abbey, Chard, staged a small collection of Plums, Apples, and Peaches.

Mr. W. J. Godfrey, Exmouth, sent Apple 'Venus Pippin.'

The Earl of Lathom, Lathom House, Ormskirk (gr. Mr. B. Ashton), sent Melon 'Countess of Lathom' raised from 'Eastnor Castle' × 'Dickson's Exquisite.' A pretty and well-netted fruit, but over-ripe.

Mrs. C. Roberts, Rose Hill House, Ipswich, sent Tomato 'Rex,' a dark-coloured flattish fruit of fair flavour.

Mr. H. E. Browne, Ivy Cottage, Barnham Junction, Bognor, sent a promising unnamed Melon, which the Committee wished to see again riper, and with name.

Dr. Stocker, Avery Hill, Elsham (gr. Mr. S. Abbey), brought some very fine 'Lady Palmerston' Peaches, a free-bearing late variety of fair flavour.

Fig. 264.—Apple 'Rival.' (*Journal of Horticulture.*)

Mr. C. Dalby, Greenham Lodge Gardens, Newbury, sent Apple 'Cook's Wonder,' a variety not superior to many existing varieties.

Mr. Rolfe, Lawn Cottage, Barnet, sent Apple 'Mrs. Rolfe.'

Leopold de Rothschild, Esq., Gunnersbury House, Acton, W. (gr. Mr. J. Hudson, V.M.H.), sent Melon 'Rex,' a handsome pale yellow and well-netted fruit with scarlet flesh.

Mr. W. H. Dyer, Fremley, staged Tomato 'Dyer's Seedling.'

Mr. A. Dean, Richmond Road, Kingston-on-Thames, exhibited three lots of Onion 'Ailsa Craig' grown under the auspices of the Surrey County Council. 1. Farmyard manure, on the same plot for three years. 2. Chemical manure, on the same plot for three years. 3. No manure, on the same plot for three years. No. 1 was much the largest and best example. No 2 was smaller, but very clean and bright. No. 3 very small, and not to be compared with Nos. 1 and 2.

FIG. 265.—GRAPES AND LEAVES. (*Gardeners' Chronicle.*)

(*To face page* ccix.)

Fruit and Vegetable Committee, October 7, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and eighteen members present.

Awards Recommended:—

Gold Medal.

To Lady Wantage, Lockinge Park, Wantage (gr. Mr. W. Fyfe), for a collection of Fruit and Vegetables.

To Messrs. Dobbie, Rothesay, for a magnificent collection of Potatos.

Hogg Medal.

To the Earl of Harrington, Elvaston Castle, Derby (gr. Mr. J. H. Goodacre), for a collection of Fruit.

Award of Merit.

To Pear 'Michaelmas Nelis' (votes unanimous), from Messrs. Bunyard, Maidstone. Fruit of medium size, obovate, skin pale green, and covered with small russety dots, eye large and open, set in a shallow basin, stalk $1\frac{1}{2}$ inch long, inserted in a deep cavity, flesh very melting, juicy, and of excellent flavour, a very fine autumn Pear. (Fig. 266.)

To Melon 'The Peer' (votes unanimous), from Mr. J. H. Goodacre, Elvaston Castle Gardens. Fruit rather large, round, yellow, well netted, green flesh, and of very rich flavour.

Other Exhibits.

Mr. A. S. Galt, The Forbury, Reading, sent a seedling Apple of no special merit.

Mr. W. Seaward, Hanwell, staged Tomato 'Hanwell Victory,' a pretty round fruit in good clusters.

Messrs. E. A. White, Paddock Wood, Kent, sent fruiting branches and fruit of Apples that had been washed with a fungicide named 'Spimo'; both fruit and foliage were very clean and healthy.

Mr. J. H. Goodacre sent bunches of 'Diamond Jubilee,' 'Black Morocco,' and a new seedling grape raised from 'Gros Colmar' × 'Black Alicante,' a variety with very large oval berries. The Committee desired to see the new one again next year. (Fig. 265.)

Mr. A. W. Cook, Orlestoke Park Gardens, Devizes, sent Pea 'Carter's Michaelmas.'

Mr. J. Crook, Forde Abbey Gardens, Chard, sent four varieties of Peas that had been sprayed with 'Spimo'; the haulm and pods were very free from insect or fungoid pests.

Mr. T. H. Slade, Poltimore Gardens, Exeter, sent a Pear named 'Sénateur Vaisse,' synonymous with 'Fondante d'Automne.'

Messrs. J. Veitch, Chelsea, sent Damson 'The Langley,' raised by crossing 'The Farleigh' Damson ♀ with 'Black Orleans' Plum ♂. The branches exhibited were carrying a great crop of fruit of roundish oval shape. This variety should be valuable for its lateness and its free-bearing habit.

Messrs. J. Veitch also sent Pear 'Lord Methuen,' raised from 'Williams's Bon Chrétien' × 'Citron des Carmes.'

R. Banks, Esq., Kingston Lacy, Wimborne, sent some new hybrid

Vegetable Marrows, of a dark green colour with orange stripes. It was requested that seeds might be sent to Chiswick.

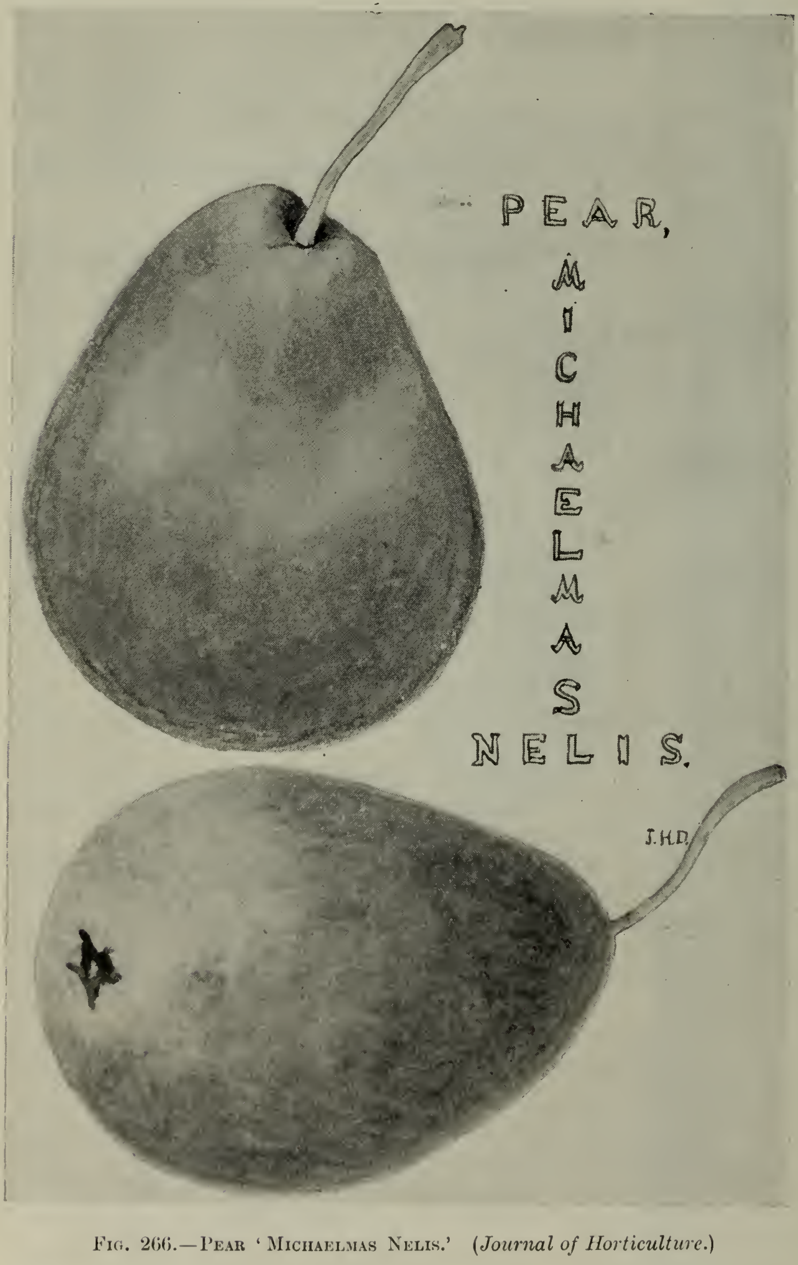


FIG. 266.—PEAR 'MICHAELMAS NELIS.' (*Journal of Horticulture.*)

Messrs. Hobbies, Dereham, sent fruits of Strawberry 'St. Antoine de Padoue.'

Mr. L. Healey, Old Field, Hampton, brought a very curious Onion :

out of a large bulb on the ground level a stout stem had grown up 3 inches, which was surmounted by another bulb also of large size, both bulbs being firm and well-matured Onions. (See fig. 260.)

Fruit and Vegetable Committee, October 21, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and seventeen members present.

Awards Recommended :—

Gold Medal.

To R. W. Hudson, Esq., Danesfield, Marlow (gr. Mr. J. Gibson), for a wonderful collection of Vegetables.

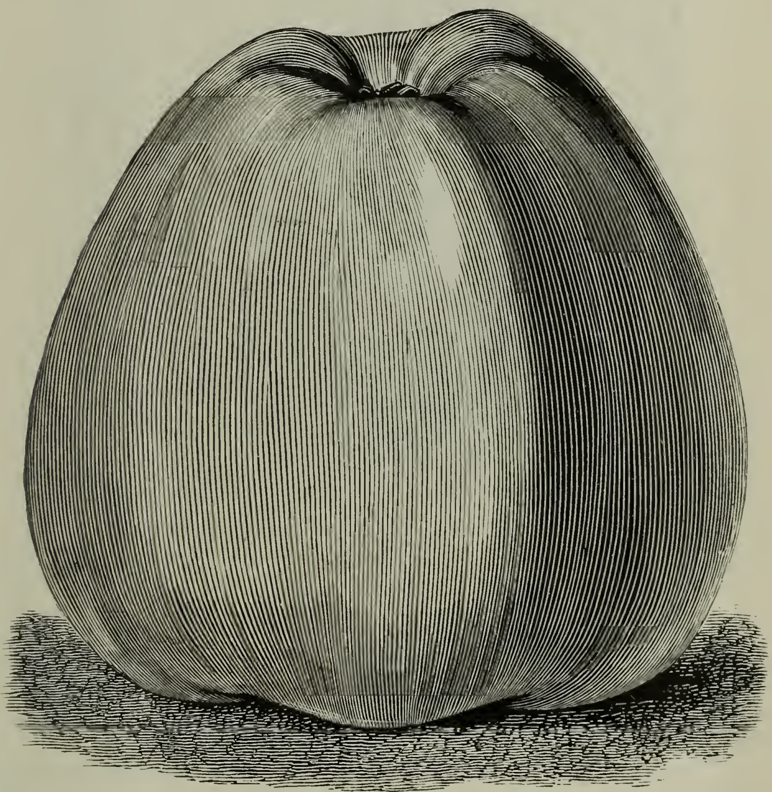


Fig. 267.—Apple 'Lord Derby.' (*Journal of Horticulture.*)

Silver-gilt Knightian Medal.

To Major Bythway, Warborough, Llanelly (gr. Mr. W. Wilkins), for 70 dishes of Apples.

Silver Knightian Medal.

To Messrs. Cannell, Swanley, for a collection of Vegetables.

Bronze Banksian Medal.

To Mrs. Arnold, The Lodge, Dedham, for a collection of Apples.

Award of Merit.

To Apple 'Coronation' (votes, unanimous), from Mr. H. C. Princep, gr. to The Hon. H. B. Portman, Buxted Park, Uckfield. Fruit of medium size, very similar in appearance to 'Cox's Orange Pippin,' but quite distinct in flavour; stalk thin and about 1 inch in length, inserted in a moderately deep russety even cavity; flesh short, crisp, and of excellent flavour. The tree is stated to be of compact habit and a good cropper. (Fig. 268.)

Fig. 268.—Apple 'Coronation.' (*Journal of Horticulture.*)

Cultural Commendation.

To Mr. J. Hudson, V.M.H., gr. to Leopold de Rothschild, Esq., for very fine fruits of Raspberry 'Belle de Fontenay,' an excellent autumn-bearing variety.

Other Exhibits.

T. P. Brand, Esq., Brook Hall, Long Melford, sent a seedling Apple, which the Committee desired to see again with particulars as to growth of the tree.

R. V. Mather, Esq., Abbey View, Kelso-on-Tweed, sent Melon 'Lilburn Favourite,' not quite ripe. The Committee considered it a very promising variety, and desired to see it again earlier next year.

Mr. H. Morse, Eaton, Norwich, sent Pear 'Fascination,' a pretty variety that should be valuable for market purposes.

Mr. J. Crook, Forde Abbey Gardens, Chard, sent very good pods and haulm of Pea 'Gladiator' which had been sprayed with 'Spimo.'

Lord Hastings, Melton Constable (gr. Mr. W. Shingler), brought a seedling Grape raised from 'Lady Hastings' × 'Gros Colmar.' Bunches of good size, with large round berries of a deep blue-black colour. The flavour would have been better a fortnight later. It should prove a good market Grape.

Mr. J. Williams, Whitbourne Hall Gardens, Worcester, sent Apple 'Williams's Challenger.'

Messrs. Bunyard, Maidstone, staged 'Burbanks's Giant Prune.' The fruit is very large for a Prune, long, oval, dark red, with yellow flesh clinging to the stone, and of good flavour. As a late fruit it should prove

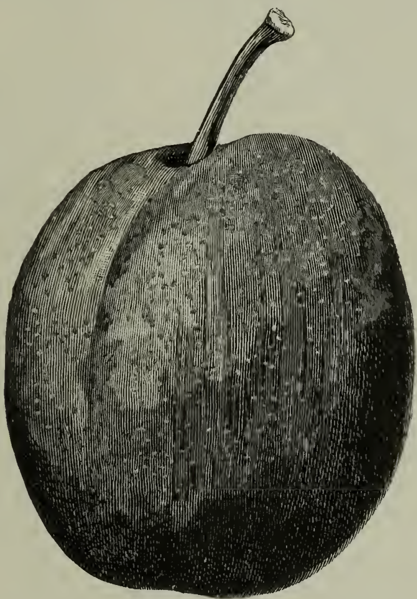


FIG. 269.—PLUM 'RIVERS'S PRIMATE.' (*Journal of Horticulture.*)

a valuable acquisition. The tree is said to be a free grower and bearer, and the fruit hangs well without splitting or rotting.

FRUIT AND VEGETABLE COMMITTEE, NOVEMBER 4, 1902.

Mr. GEO. BUNYARD, V.M.H., in the Chair, and eighteen members present.

Awards Recommended :—

Hogg Medal.

To H. M. The King, Windsor (gr. Mr. A. Mackellar), for a collection of splendid Pineapples.

To the Duke of Rutland, Belvoir Castle, Grantham (gr. Mr. W. H. Divers), for 100 dishes of Apples and Pears.

Silver Knightian Medal.

To the Horticultural College, Swanley, for a collection of Fruit and Vegetables.

Silver Banksian Medal.

To the Hon. W. F. D. Smith, M.P., Greenlands, Henley-on-Thames (gr. Mr. H. Perkins), for ripe Strawberries in pots and punnets.

To J. G. Romovil, Esq., Longville Court, Jersey, for 13 huge 'Uvedale's St. Germain' Pears, the heaviest weighing 3 lb. 11 oz.

To Messrs. Harrison, Leicester, for a collection of Onions.

To Lady Warwick, Hostel, Reading, for a collection of bottled Fruits and Vegetables which had been preserved in a new form of steriliser invented by Miss Edith Bradley, the Warden of Lady Warwick's Hostel, for the purpose of still further perfecting and facilitating the process of preserving fruits in ordinary households. (Fig. 270.)

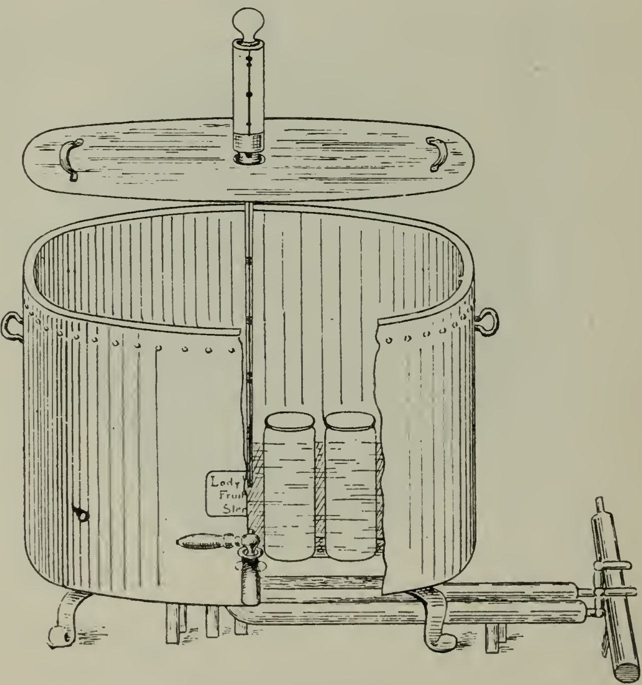


FIG. 270.—STERILISER.

Award of Merit.

To Grape 'Imperial Black Seedling' (votes, 10 for, 6 against), from Mr. J. H. Goodacre, gr. to the Earl of Harrington, Elvaston Castle, Derby. Bunch of medium size, rather long and shapely, berries large, oval, deep black, flesh firm, crisp, and of good flavour. The variety is said to be a good grower, and very free setter. (Fig. 265.)

To Rhubarb 'Sutton's Christmas' syn. 'Topp's Winter' (votes, unanimous), from Messrs. Sutton, Reading, and Messrs. J. Veitch, Chelsea. This variety has been grown for 10 years by Messrs. Sutton, and for two years at the Society's Gardens, and while remaining practically dormant all the summer, it has invariably thrown up its leaf-stalks in October, and, if protected from frost, continues to throw up a mass of its medium-sized bright red leaf-stalks. It is an Australian variety.

To Raspberry 'November Abundance' (votes, unanimous), from Messrs. J. Veitch; raised from Raspberry 'Catawissa' ♀ crossed with 'Superlative' ♂. Fruit large, in great clusters, dark red, and of excellent flavour for so late in the season.

To Apple 'Tamplin' (votes, unanimous), from Mr. J. Basham, Bassaleg, Newport, Mon. This is exactly similar to 'American Mother' in shape and colour, but is later, and quite distinct, the flesh being more

Fig. 271.—'Langley Bullace.' (*The Garden.*)

solid, and with a pleasant acidity in the flavour. It should prove a useful dessert variety. It was raised by a Mr. Tamplin, of Malpas, Mon., 150 years ago, and is known also as the 'Cissy Apple.' The tree is stated to be a slow grower, of pendulous habit, and a great bearer.

To Bullace 'Langley Bullace' (votes, unanimous), from Messrs. J. Veitch, from 'Farleigh Prolific Damson' × 'Orleans Plum.' Fruit very large for a Bullace, blue-black, round, and most abundantly produced on the strong sturdy growths. The flavour is not pleasant raw, but is excellent when cooked. (Fig. 271.)

Cultural Commendation.

To A. W. Sutton, Esq., Woolhampton, Berks, for very large fruits of Strawberry 'St. Joseph.'

Other Exhibits.

Mr. C. Ross, Welford Park Gardens, Newbury, sent Apple 'Berks Pearmain.'

Mr. H. Becker, Jersey, sent Apple 'Raspberry Pippin' syn. 'Devonshire Queen.'

Fig. 272.—Pear 'President Barabé.' (*Journal of Horticulture.*)

Mr. W. Messenger, Woolverstone Park Gardens, Ipswich, staged fruits of Plum 'Woolverstone Orange,' very similar to small fruits of 'Coe's Golden Drop.'

Messrs. W. J. Brown, Peterborough, sent Apple 'Wadlow Pride.'

Messrs. J. Veitch, brought Pear 'Beurré Spæ' grown under glass. The Committee asked to see it again grown outside.

Mr. W. H. Divers, Belvoir Castle Gardens, sent Apple 'Dewdney's Seedling,' past its best.

Fruit and Vegetable Committee, November 18, 1902.

Mr. Geo. Bunyard, V.M.H., in the Chair, and fifteen members present.

Awards Recommended :—

Silver Banksian Medal.

To Messrs. Peed, West Norwood, for 150 dishes of fruit.

Other Exhibits.

Mrs. Evans, Forde Abbey, Chard (gr. Mr. J. Crook), sent a fine dish of Pear 'Winter Nelis.'

W. Foster, Esq., Brockhampton Court, Ross (gr. Mr. S. Lovelock), sent a Pear for identification, somewhat like 'Brown Beurré.' The Committee asked to see fruit, wood, and foliage next year.

Mr. C. Osman, Sutton, Surrey, staged Potato 'Up-to-date,' lifted in 1901 : they were much shrivelled, and forming a mass of small tubers.

Messrs. J. Veitch, Chelsea, exhibited a very fine collection of Borecoles, also 'Langley Crab,' and Raspberry 'November Abundance.'

Mr. C. Webb, Kendal, sent jam made from fruits of the Strawberry-Raspberry (*Rubus palmatus*), very sweet and good, and similar to Raspberry jam in flavour.*

A. W. Sutton, Esq., V.M.H., Bucklebury Place, Woolhampton, sent Melon 'Seedling Winter,' very good in flavour for so late in the year.

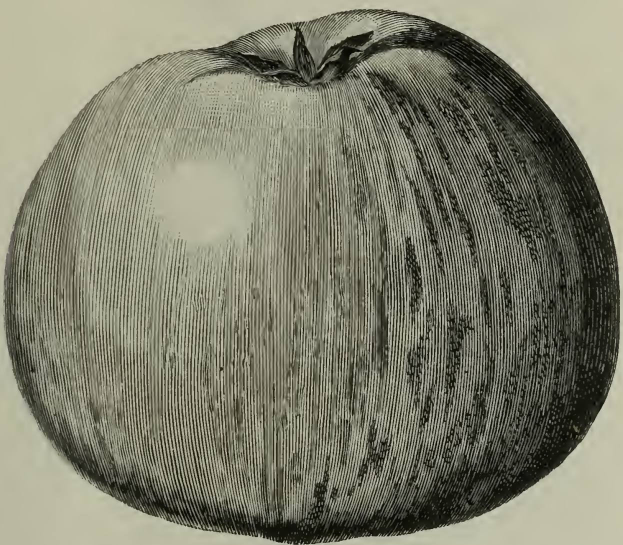


FIG. 273.—APPLE 'ALLINGTON PIPPIN.' (*Journal of Horticulture.*)

Mr. W. Edwards, Weybridge, staged Vegetable Marrows 'Defiance' and 'Defiance Improved.' Both were of medium size, green and yellow in colour, the latter the larger.

Mr. R. W. Wallace, Colchester, sent two exceedingly fine dishes of 'Allington Pippin' Apples. (Fig. 273.)

Sir Walter Gilbey, Bart., Elsenham Hall, Essex (gr. Mr. W. Plester), sent Tomato 'Italian Wonder.' This variety is better known as 'Semper fructifera,' and produces its small dark-red pear-shaped fruits in enormous clusters.

Mr. G. Reuthe, Hanworth Road, Feltham, brought two very large fruits of Quince 'Imperial.'

* Professor L. H. Bailey appropriates the name of Strawberry-Raspberry to *R. rosæfolius.* It is further possible the jam in question may have been made of *R. phœnicolasius*, the Japan wineberry (fig. 274) which is sometimes erroneously called the Strawberry-Raspberry.—ED.

Fruit and Vegetable Committee at Chiswick, December 5, 1902.

Mr. H. Balderson in the Chair, and ten members present.

The Committee had ten stocks of Potatos cooked, viz.:

Alderman
Dalmeny Beauty
Marfield
Professor Walker

Fig. 274.—Japanese Wineberry. (*Journal of Horticulture.*)

Dobbie's Favourite
Earl Roberts
Henry Fincham
Shamrock II.
Springfield
Victoria Improved.

Awards Recommended :—

Award of Merit.

To Potato 'Victoria Improved' (votes, unanimous), from Messrs. Sharpe, Sleaford.

FRUIT AND VEGETABLE COMMITTEE, DECEMBER 9, 1902.

Mr. H. BALDERSON in the Chair, and seventeen members present.

Awards Recommended :—

Silver-gilt Knightian Medal.

To Messrs. Rivers, Sawbridgeworth, for a collection of magnificent Apples grown on pot trees.

FIG. 275.—APPLE 'NORFOLK BEAUTY.' (*The Garden.*)

To Mr. R. M. Whiting, Credenhill, Hereford, for 45 dishes of Apples.

Silver Knightian Medal.

To Messrs. Cheal, Crawley, for 90 dishes of Apples.

To Messrs. Cannell, Swanley, for 100 dishes of Apples.

First-class Certificate.

To Apple 'Norfolk Beauty' (votes, 16 for, 1 against), from Mr. W. Allan, Gunton Park Gardens, Norwich. This excellent cooking variety received an Award of Merit October 15, 1901. (Fig. 275.)

Award of Merit.

To Pear 'Gris de Chine' (votes, 13 for, 4 against), from Mr. H. H. Raschen, Sidcup. Fruit of medium size, bluntly obovate, skin brownish yellow, nearly covered with russet, eye small, with no segments, in a small deep funnel-like basin. Stalk $\frac{3}{4}$ inch long, thin, and inserted on a blunt end. Flesh very juicy, melting, and of very good flavour. The tree is said to be a good bearer, and to be of Belgian origin, where it is

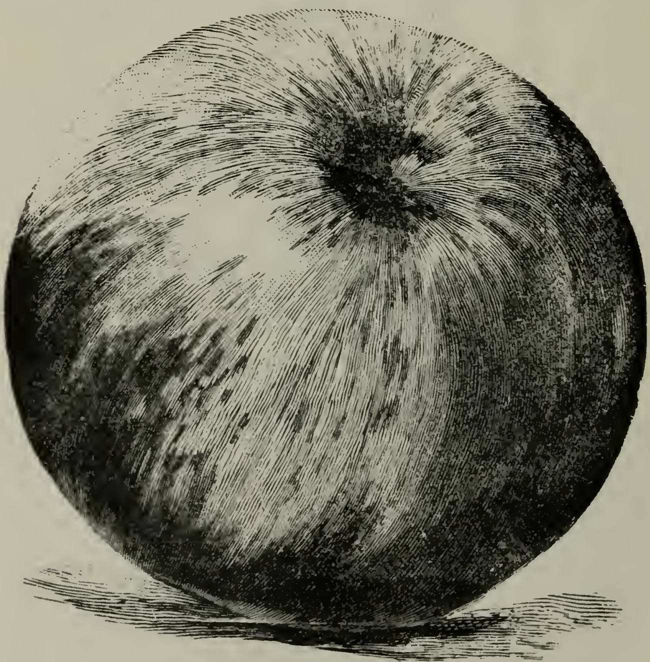


FIG. 276.—APPLE 'NEWTON WONDER.' (*Journal of Horticulture.*)

said to have been grown for 30 years. A very useful addition to December Pears.

Other Exhibits.

W. J. Thompson, Esq., J.P., Hippington Grange, Sevenoaks (gr. Mr. H. Crawley), sent a new Grape 'Hippington Grange Seedling,' raised from 'Black Alicante' crossed with 'Black Prince.' The Committee desired to see it again next year in a riper condition.

Messrs. R. Hartland, Cork, sent a supposed distinct local Apple, which proved to be 'American Mother.'

W. J. Clarke, Esq., The Manor House, Binbrook, Market Rasen (gr. Mr. J. Burnside), sent very large fruits of Apple 'Belle Dubois,' syn. 'Gloria Mundi.'

Mr. J. Hamlin, Gordon Road, Worthing, sent a highly coloured dish of Apples unnamed, raised from 'Newton Wonder' (fig. 276) crossed with 'Devonshire Quarrenden.'

Mr. W. H. Patterson, University College, Reading, brought fruits of *Sechium edule* (Chocho). The fruits are of medium size, rough, and somewhat like a small Gourd. When cooked the flesh is more solid than the Vegetable Marrow, and has the flavour of boiled Chestnuts. This Cucurbitaceous plant is common to the tropics, where it is used for cattle-feeding. In 'Nicholson's Dictionary of Gardening' the root is mentioned as large and fleshy, weighing nearly 20 lbs., resembling a Yam in appearance and of similar flavour when cooked.

ARCTOTIS GRANDIS. (*Journal of Horticulture.*)

FLORAL COMMITTEE.

September 23, 1902.

Mr. W. Marshall in the Chair, and twenty-one members present.

Awards Recommended :—

Gold Medal.

To Messrs. Burrell, Cambridge, for a grand collection of Gladioli.

Silver-gilt Flora Medal.

To Mr. Prince, Longworth, Berks, for Roses.

Silver-gilt Banksian Medal.

To Messrs. Cheal, Crawley, for Dahlias and sprays of ornamental hardy trees and shrubs.

To Messrs. Frank Cant, Colchester, for Roses.

Silver Flora Medal.

To Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.), for twenty-seven varieties of autumn-blooming Roses.

To Messrs. Hobbies, East Dereham, for Dahlias.

To Messrs. Blackmore and Langdon, Twerton-on-Avon, for Begonias.

To Messrs. W. Paul, Waltham Cross, for Roses.

Silver Banksian Medal.

To Mr. Ching, Forth Hill, Enfield, for Ferns.

To Mr. Forster, Nunhead Cemetery, S.E., for early-flowering Chrysanthemums.

To Messrs. Paul and Son, Cheshunt, for herbaceous plants and Roses.

To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

To Messrs. Wallace, Colchester, for hardy flowers.

Bronze Banksian Medal.

To Mr. West, Brentwood, for Dahlias.

First-class Certificate.

To *Polypodium conjugatum* (votes, 10 for), from Messrs. Bull, Chelsea. A very handsome Australian Fern sometimes met with under the names of *P. coronans* and *Drynaria conjugata*. Its general appearance reminds one of *P. Heracleum*; its fronds are from 4 to 5 feet long, and 1 foot to 18 inches broad with deep green leathery lobes or pinnæ cut to the rachis or midrib.

Award of Merit.

To Show Dahlia 'A. M. Burnie' (votes, unanimous), from Mrs. St. Pierre Harris, Orpington (gr. Mr. H. Blundell). Large well-formed buff-coloured flowers passing to yellow.

To Cactus Dahlia 'Lucifer' (votes, unanimous), from Percy Tulloch, Esq., New Church Road, Hove. Large orange-coloured flowers tinged with crimson, borne on rather slender stems.

To *Lilium Brownii Chloraster* (votes, 8 for, 3 against), from Messrs. Veitch, Chelsea. A handsome variety with large white trumpet-shaped flowers heavily stained with yellow in the centre.

To Japanese Chrysanthemum 'Carrie' (votes, unanimous), from Messrs. Wells, Redhill. An early free-flowering decorative variety, with shapely rich yellow flowers.

To Japanese Chrysanthemum 'Gertie' (votes, 9 for, 2 against), from Messrs. Wells. Another early-flowering decorative variety of bushy habit with an abundance of bronzy yellow short-petalled flowers suffused with salmon.

To *Liatris graminifolia dubia* (votes, unanimous), from Messrs. Wallace, Colchester. A very fine autumn-flowering border plant, with long spikes of small rosy purple flowers. It is taller in growth and later in coming into flower than *L. pycnostachya.*

To *Lobelia syphilitica* 'Andrew Barlow' (votes, 12 for, 1 against), from Messrs. Ladhams, Southampton. This distinct hardy variety grows about 2 feet high and bears deep rosy-purple flowers similar in shape to those of the type.

To *Lobelia syphilitica* 'Purple King' (votes, 10 for, 2 against), from Messrs. Ladhams, Southampton. A sturdy-growing variety, 2 feet high, with showy purple flowers.

To *Gaillardia oculata* 'Sulphur Gem' (votes, unanimous), from Messrs. Ladhams. A very pretty dwarf variety bearing sulphur-yellow flowers with a brownish-red centre.

To Decorative Tea Rose 'Madame Antoine Mari' (votes, unanimous), from Messrs. W. Paul, Waltham Cross. The flowers of this variety are of excellent shape, rose pink at first, gradually changing to pale pink or cream.

To Decorative Tea Rose 'Sulphurea' (votes, unanimous), from Messrs. W. Paul, Waltham Cross. A grand autumn-flowering bedding variety with pale sulphur-yellow fragrant flowers and bronze-tinted leaves and stems. A continuous bloomer.

To Cactus Dahlia 'Minnie West' (votes, unanimous), from Mr. West, Brentwood. Large sulphur-yellow flowers with pointed petals tipped with cream white.

To Show Dahlia 'Mrs. W. Treseder' (votes, unanimous), from Mr. West, Brentwood. Medium-sized shapely rosy purple flowers with a raised paler centre.

To Cactus Dahlia 'Albion' (votes, unanimous), from Messrs. Burrell, Cambridge. Lovely white flowers with a yellow centre. The petals are long and incurve beautifully.

To Single Dahlia 'Serita' (votes, unanimous), from Messrs. Cheal, Crawley. Lovely crimson flowers passing to rose near the edges of the petals.

To Single Dahlia 'Snowdrop' (votes, unanimous), from Messrs. Cheal, Crawley. Small shapely white flowers with a yellow base.

To Cactus Dahlia 'Winsome' (votes, unanimous), from Messrs.

Hobbies, East Dereham. Medium-sized flowers with incurving petals touched with cream.

To Cactus Dahlia 'Manxman' (votes, unanimous), from Mr. Mortimer, Farnham. Large orange-scarlet flowers shaded with purple towards the tips of the narrow petals.

To Pompon Dahlia 'Rosea' (votes, unanimous), from Messrs. Keynes Williams, Salisbury. Medium-sized shapely rose-coloured flowers passing to a lighter shade.

To Cactus Dahlia 'Coronation' (votes, unanimous), from Messrs. Keynes Williams, Salisbury. A dainty garden variety with small scarlet flowers touched with crimson near the centre.

To Cactus Dahlia 'Miss T. Cherry' (votes, unanimous), from Messrs. Keynes Williams, Salisbury. Large orange-coloured flowers suffused with purple. The incurving petals are narrow and pointed.

To Cactus Dahlia 'H. J. Jones' (votes, unanimous), from Messrs. Stredwick, St. Leonards. Large canary-yellow flowers with incurving petals.

To Cactus Dahlia 'Eva' (votes, unanimous), from Messrs. Stredwick. Small shapely flowers with narrow white petals touched with primrose-yellow in the centre.

To Cactus Dahlia 'F. H. Chapman' (votes, unanimous), from Messrs. Stredwick. Large flowers with beautifully incurving orange-red petals paler towards the tips.

To Cactus Dahlia 'Etna' (votes, unanimous), from Messrs. Stredwick. Beautifully shaped flowers with narrow rosy-mauve petals touched with yellow.

To Cactus Dahlia 'Vesuvius' (votes, unanimous), from Messrs. Stredwick. Handsome yellow flowers spotted, splashed, and streaked with brownish-crimson.

To Cactus Dahlia 'Raymond Parks' (votes, unanimous), from Messrs. Stredwick. Bright scarlet flowers of excellent form.

To Cactus Dahlia 'Mabel Tulloch' (votes, unanimous), from Messrs. Stredwick. A distinct and pleasing variety with warm rose-coloured flowers with a paler centre.

To Cactus Dahlia 'W. F. Balding II.' (votes, unanimous), from Messrs. Stredwick. Large yellow flowers, the outer petals touched with bronze.

Other Exhibits.

E. J. Johnstone, Esq., Rougham Hall, Bury St. Edmunds, sent immense panicles of *Hydrangea paniculata grandiflora*, a remarkably fine white autumn-flowering shrub. In order to obtain the maximum amount of flowers it is necessary to cut away the previous year's growth to within a couple of eyes of the old wood in February.

From the Rt. Hon. Lord Ardilaun, St. Anne's, Clontarf, Dublin (gr. Mr. A. Campbell), came three very finely grown forms of *Lobelia cardinalis*, the variety named 'Lord Ardilaun' being particularly good.

H. P. Sturgis, Esq., Givons Grove, Leatherhead (gr. Mr. W. Peters), sent Michaelmas Daisies, which were referred for comparison to Chiswick, where there is a large collection on trial.

Miss Bridge, Headley Grove, Epsom (gr. Mr. H. Squelch), sent tree Carnations.

The Earl of Darnley, Cobham Hall, Gravesend, sent flowers of a seedling *Helenium.*

From Mr. M. Buysman, Hortus Plantarum, Middelburg, Holland, came a collection of dried specimens.

Messrs. Jas. Veitch, Chelsea, contributed the most representative collection of sprays (in many cases great boughs), dried specimens, and photographs of Japanese trees and shrubs ever seen at any one of the Society's meetings, many of them being collected and distributed by the exhibitors. (See page 857.)

Messrs. Cutbush, Highgate, sent hardy flowers.

Mr. Pfitzer, Stuttgart, Germany, sent some hybrid *Gladiolus* and *Montbretia* 'Germania.'

Mr. Carter, Willow Bank, Keighley, sent *Populus ontariensis variegata*, a free-growing variety with yellowish leaves.

Messrs. Bull, Chelsea, sent a group of uncommon foliage plants.

Mr. Turner, Slough, sent Dahlias.

Messrs. Thomson, Wimbledon, sent *Gypsophila paniculata fl. pl.*

Messrs. Barr, Covent Garden, sent hardy flowers.

Mr. Baxter, Woking, sent Dahlias.

Messrs. Ladbams, Southampton, sent Gaillardias and Lobelias.

Mr. Shawyer, Cranford, Hounslow, sent Decorative Chrysanthemums.

F. A. E. Samuelson, Esq., Brackenbrough Hall, Thirsk (gr. Mr. G. F. Brotherston), sent flowers of a large pure-white Sweet Pea named 'Phyllis Samuelson.' The Committee asked to see this again next year.

Messrs. Wade, Colchester, sent seedling Heleniums.

Messrs. Stokes, Hilperton Marsh, Trowbridge, sent flowers of *Chrysanthemum* 'W. J. Stokes,' a cross between 'Moonlight' and 'Mrs. Head.'

Mr. Seal, Sevenoaks, sent Dahlias.

Mr. Lowe, Hatton, Warwick, sent Chrysanthemums.

Messrs. Keynes Williams, Salisbury, sent Dahlias.

Messrs. Cayeux & Le Clerc, Paris, also sent Dahlias.

Floral Committee, at Chiswick, September 24, 1902.

Mr. W. Marshall in the Chair, and ten members present.

Awards Recommended :—

Award of Merit.

To :—

1. *Aster* 'Top Sawyer.'
2. *A.* 'F. W. Burbidge.'
3. *A.* 'Dorothy.'
4. *A.* 'Celestial.'
5. *A. lævigatus.*
6. *A. paniculatus* 'Edwin Beckett.'
7. *A. vimineus perfectus*, and to *Phlox* 'Sylphide.'

A report on Asters and Phloxes will be found at pages 638, 649.

Floral Committee, at Chiswick, October 1, 1902.

Mr. W. Marshall in the Chair, and ten members present.

Awards Recommended :—

Award of Merit.

To 1. *Aster Amellus bessarabicus*; 2. *A. ericoides* 'Ophir'; 3. *A. ericoides* 'Sensation.'

For Report on Asters see p. 638.

Floral Committee, October 7, 1902.

Mr. W. Marshall in the Chair, and twenty-two members present.

Awards Recommended :—

Gold Medal.

To Messrs. Frank Cant, Colchester, for a magnificent collection of Garden Roses.

Silver-gilt Flora Medal.

To Mr. Russell, Richmond, for a remarkably fine display of beautifully grown Tree Ivies in pots.

Silver-gilt Banksian Medal.

To Messrs. Hill, Lower Edmonton, for a group of *Asplenium nidus* and *Ficus radicans variegata.*

To Mr. Perry, Winchmore Hill, for hardy flowers.

Silver Flora Medal.

To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

To Mr. Forbes, Hawick, N.B., for Carnations, Phloxes, and Pentstemons.

To Messrs. Ladhams, Southampton, for hardy flowers.

To Messrs. B. R. Cant, Colchester, for Roses.

Silver Banksian Medal.

To Messrs. Ware, Feltham, for Michaelmas Daisies, Chrysanthemums, and Dahlias.

To Mr. Prince, Longworth, Berks, for Roses.

To Messrs. Cheal, Crawley, for Dahlias and Michaelmas Daisies.

To Messrs. Barr, Covent Garden, for Michaelmas Daisies, &c.

Bronze Flora Medal.

To Ronald Keep, Esq., Woollet Hall, North Cray, Kent (gr. Mr. S. Pym), for a group of *Begonia* 'Gloire de Lorraine.'

Bronze Banksian Medal.

To F. A. Bevan, Esq., Trent Park, New Barnet (gr. Mr. H. Parr), for Michaelmas Daisies.

Award of Merit.

To Decorative Japanese Chrysanthemum 'Joseph Lowe' (votes, **11** for, 5 against) from Mr. Shawyer, Cranford, Hounslow. A sturdy, much branched and remarkably floriferous variety, with shapely rich canary-yellow flowers, composed of narrow petals finer than those of the variety named 'Carrie' certificated September 23.

Other Exhibits.

W. J. Woods, Esq., Swathling, Southampton, sent *Rosa polyantha* 'W. H. Lavavasseur.'

J. Bradshaw, Esq., The Grange, Southgate (gr. Mr. G. Whitelegg), sent flowers of *Helianthus* 'Yellow Prince,' said to be a cross between *H. tomentosus* and *H. decapetalus.*

From Mrs. Watson, Coombe Road, Croydon, came flowers of an uncommon plant grown from seed gathered in Uganda, Central Africa. The plant has trifoliate glaucous leaves, set on long petioles, and bears stiff racemes of greenish-yellow flowers reminding one somewhat of an *Erythrina.* It was considered to be probably *Crotolaria Cunninghamii*, introduced from Central Australia in 1869. The specimen was subsequently submitted to Dr. Rendle, who was kind enough to examine it carefully, and afterwards reported : "The resemblance to *C. Cunninghamii* is striking in the plate (*Bot. Mag.* tab. 5770), but less so in the type specimen of the species which we have at the British Museum. . . . Your plant is quite distinct from the Australian. . . . I think it is almost certainly *C. agatiflora*, Schweinf. Material for comparison is not extensive, but points decidedly to the inclusion of your specimen in this species which is also from East Tropical Africa."—A. B. R.

Mr. Bona, Deanscrook, Elgin, N.B., sent Carnation 'Baden Powell.'

Mr. Surman, Bromley Road, Beckenham, sent early flowering Chrysanthemums.

Mr. Mortimer, Farnham, sent Cactus Dahlias.

Messrs. Bull, Chelsea, sent a small plant of *Maranta tigrina.* The Committee asked to see this again with *M. zebrina* for comparison.

Mr. Treseder, Cardiff, sent Pompon Cactus Dahlias.

Mr. Johnson, Wooton, I. W., sent Cactus Dahlias.

Messrs. Veitch, Chelsea, sent a plant of *Aconitum Wilsoni* bearing some resemblance to *A. autumnale.*

Mr. Seward, Hanwell, sent Japanese Chrysanthemums.

Messrs. Cutbush, Highgate, sent Carnations.

Messrs. Peed, West Norwood, sent hardy flowers.

Floral Committee, at Chiswick, October 13, 1902.

Mr. W. Marshall in the Chair, and eight members present.

Awards Recommended :—

Award of Merit to each of the following Asters.

1. *A.* 'Calliope.'
2. *A.* 'Ariadne.'
3. *A.* 'Elsie Perry.'
4. *A.* 'Coombe Fishacre Brightness.'
5. *A.* 'Cordelia.'
6. *A. cordifolius elegans.*
7. *A. acris nanus.*
8. *A. vimineus* 'Delight.'

Highly Commended.

1. *A. vimineus* 'Freedom.'
2. *A semi-plena.*
3. *A.* 'Edna Mercia.'
4. *A.* 'Jessie Crum.'
5. *A. Novæ-Angliæ* 'W. P. Bowman.'
6. *A. cordifolius* 'Ideal.'
7. *A. cordifolius* 'Sweetheart.'

For report on Asters see p. 638.

FLORAL COMMITTEE, OCTOBER 21, 1902.

Mr. W. MARSHALL in the Chair, and nineteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

To Mr. Jones, Ryecroft, Lewisham, for Chrysanthemums.

Silver Flora Medal.

To Mr. May, Upper Edmonton, for *Adiantum farleyense* and Dracænas.

To Messrs. Veitch, Chelsea, for winter-flowering Begonias, and *Dædalacanthus parvus.* (Fig. 277.)

To Messrs. Hill, Lower Edmonton, for Polypodiums.

To Mr. Godfrey, Exmouth, for Chrysanthemums and Carnations.

To Messrs. Cutbush, Highgate, for Michaelmas Daisies and Carnations.

Silver Banksian Medal.

To H. J. Elwes, Esq., F.R.S., Colesborne, Cheltenham (gr. Mr. W. Walters), for seedling Nerines.

To Messrs. Bull, Chelsea, for Tree Ferns.

To Messrs. Cannell, Swanley, for Chrysanthemums.

Bronze Banksian Medal.

To Mr. Russell, Richmond, for Aucubas.

To Messrs. Ware, Feltham, for hardy flowers.

To Messrs. Barr, Covent Garden, for hardy flowers.

To Messrs. Williams, Upper Holloway, for Dracænas.

Award of Merit.

To Japanese Chrysanthemum 'Hon. Mrs. Ackland' (votes, 12 for, 5 against), from the Hon. W. F. D. Smith, M.P., Greenlands, Henley-on-Thames (gr. Mr. H. Perkins). Large rich yellow flowers with a paler reverse.

To *Cimicifuga japonica* (votes, unanimous), from Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.). A very pretty and uncommon hardy plant introduced from Japan in 1879. Its deep green lobed leaves are of similar shape to those of *Anemone japonica*, and its tiny snow-white flowers composed of slender petals appear on spikes 18 inches high, and remain in good condition for a month or more. It is a good plant for a moist situation and may be increased by division. (Fig. 278.)

To *Nerine* 'Miss Carrington' (votes, unanimous) from H. J. Elwes, Esq., F.R.S., Colesborne Park, Cheltenham (gr. Mr. W. Walters). A vigorous variety with large trusses of handsome rose-coloured flowers with a reddish band down the centre of each undulated segment.

FIG. 277.—DÆDALACANTHUS PARVUS. (*Gardeners' Chronicle.*)

To Japanese Chrysanthemum 'Madame Paola Radælli' (votes, unanimous), from Mr. Davis, Framfield, Sussex. A handsome variety with large well-built pale-pink flowers with a paler centre.

To Japanese Chrysanthemum 'Miss Elsie Fulton' (votes, 14 for), from Messrs. Wells, Earlswood, Redhill. A very fine variety, similar to 'Princess Alice de Monaco.' It is vigorous in growth and bears large shapely creamy-white flowers.

FIG. 278.—CIMICIFUGA JAPONICA. (*The Garden.*)

To *Anemone japonica* 'Queen Charlotte' (votes, unanimous) from Messrs. Barr, Covent Garden. A remarkably handsome Windflower of stronger growth than the type. Its bold cup-shaped semi-double flowers are $3\frac{1}{2}$ inches across, of a warm shade of pink or rose and borne in great abundance.

Botanical Certificate.

To *Nerine flexuosa alba* (votes, unanimous) from Messrs. Barr, Covent Garden. This differs from the type by reason of its flowers being pure white.

Other Exhibits.

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain) sent *Polygonum molle*, a Himalayan species, and some peculiarly crested and fringed Begonia flowers.

The Hon. W. F. D. Smith, M.P., Greenlands, Henley-on-Thames (gr. Mr. H. Perkins), sent Chrysanthemums.

J. T. Bennett-Poë, Esq., Holmewood, Cheshunt (gr. Mr. Downes) sent *Nerine* 'Mrs. Harrison,' a variety with large richly coloured flowers.

H. Southall, Esq., The Craig, Ross, Herefordshire (gr. Mr. Davies), sent *Aster* 'Miss Southall.' The Committee requested that a plant might be sent to Chiswick.

From Mrs. Dennison, Little Gaddesden, Berkhamsted (gr. Mr. A. G. Gentle) came a collection of Michaelmas Daisies.

Miss E. Somers, Sparrows Herne, Bushy, Herts (gr. Mr. Cooper), sent a small group of Chrysanthemums.

Hugh Kerr, Esq., Ard-Gowan, South Woodford (gr. Mr. Dunkley), sent a group of nicely flowered Begonias.

From D. C. Guthrie, Esq., East Haddon Hall, Northampton (gr. Mr. H. Trueman), came *Begonia* 'Mrs. D. C. Guthrie,' said to be a sport from 'Gloire de Lorraine.' The plants submitted had tuberous roots, and the large rose-pink flowers, which are borne freely, are also suggestive of a tuberous variety. The Committee asked to see this again.

Messrs. Bunyard, Maidstone, sent *Bigelowia graveolens*.

Mr. Sawyer, Hounslow, sent Decorative Chrysanthemums.

Messrs. Peed, West Norwood, sent foliage and flowering plants.

Floral Committee, November 4, 1902.

Mr. W. Marshall in the Chair, and eighteen members present.

Awards Recommended:—

Silver-gilt Flora Medal.

To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

Silver-gilt Banksian Medal.

To Messrs. Jas. Veitch, Chelsea, for winter-flowering Begonias.

Silver Flora Medal.

To C. B. Gabriel, Esq., Easdale, Horsell, Woking, for Zonal Pelargoniums.

To Mr. May, Upper Edmonton, for Carnations and Ferns.

Silver Banksian Medal.

To Percy R. Dunn, Esq., Brockley Park, Forest Hill, for Chrysanthemums.

To Mr. R. Forster, Nunhead Cemetery, S.E., for Chrysanthemums.
To Mr. J. Russell, Richmond, S.W., for foliage plants.
To Messrs. John Waterer, Bagshot, for Conifers.

Award of Merit.

To Japanese Chrysanthemum 'Harry Shrimpton' (votes, unanimous), from Mr. Seward, Hanwell. A vigorous variety with rather narrow, drooping, bronze-yellow petals with a paler reverse.

To Incurved Chrysanthemum 'Mrs. J. Seward' (votes, 13 for, 4 against), from Mr. Seward. Large shapely canary-yellow flowers.

To Japanese Chrysanthemum 'S. T. Wright' (votes, 13 for, 4 against), from Messrs. Wells, Earlswood. A splendid variety with long, broad, drooping, crimson petals with a golden reverse.

To Tree Carnation 'Duchess of Portland' (votes, unanimous), from Messrs. Cutbush, Highgate. Pale salmon-pink sweet-scented flowers with slightly fringed petals.

Botanical Certificate.

To *Kalanchoë marmorata* (votes, unanimous), from Messrs. Veitch, Chelsea. The plant exhibited was about 4 feet 6 inches high, and consisted of a single stout glaucous stem furnished with thick opposite green leaves mottled with red. The long tube-shaped white flowers similar to those of *Nicotiana sylvestris* are borne in terminal corymbs.

Other Exhibits.

Lady Wantage, Lockinge Park, Wantage (gr. Mr. Fyfe), sent flowers of *Ipomœa rubro-cærulea.* The Committee asked to see it again.

Leopold de Rothschild, Esq., Gunnersbury House, Acton (gr. Mr. Jas. Hudson, V.M.H.), sent Dahlias and *Mesembryanthemum roseum elegans.*

F. D. Lambert, Esq., Moor Hall, Cookham (gr. Mr. J. Fulford) sent a small group of *Begonia* 'Gloire de Lorraine Turnford Hall.'

From Mrs. Lancaster, The Rookery, St. Mary Cray, came large handsome fruits of *Holboellia* (*Stauntonia*) *latifolia*, a free-growing climber, with deep green leathery leaves.

Messrs. Barr, Covent Garden, sent hardy flowers.

Mr. Godfrey, Exmouth, sent Zonal Pelargonium 'Duchess of Cornwall.'

Mr. Barnard, 151 The Grove, Hammersmith, exhibited a splendid selection of coloured photographs of flowers.

Messrs. Bull, Chelsea, sent foliage plants.

Messrs. Peed, West Norwood, sent Begonias.

Chrysanthemums were exhibited by :—

1. Hon. W. F. D. Smith, M.P., Greenlands, Henley-on-Thames (gr. Mr. H. Perkins).
2. J. Colman, Esq., Gatton Park, Reigate (gr. Mr. W. Bound).
3. G. W. Bird, Esq., Manor House, West Wickham (gr. Mr. H. Ridden).
4. H. Hoskier, Esq., Coney Hill, Hayes Common, Kent.

Fig. 279.—Jacobinia (Cyrtanthera) chrysostephana. (*Journal of Horticulture.*)

(*To face page* ccxxxiii.)

5. Messrs. Brown, Peterborough,
6. Mr. M. Silsbury, Shanklin, I.W.
7. Mr. Carpenter, West Hall, Byfleet, Surrey.
8. Mr. J. W. Cole, Peterborough.

FLORAL COMMITTEE, NOVEMBER 18, 1902.

Mr. W. MARSHALL in the Chair, and twenty-three members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To Messrs. Hill, Lower Edmonton, for a grand group of *Platycerium*.
To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

Silver-gilt Banksian Medal.

To Messrs. Jas. Veitch, Chelsea, for winter-flowering Begonias.
To Mr. Jones, Lewisham, for Chrysanthemums.

Silver Banksian Medal.

To Messrs. Cannell, Swanley, for Begonias and Chrysanthemums.

First-class Certificate.

To *Jacobinia chrysostephana* (votes, 16 for), from Messrs. Jas. Veitch, Chelsea. A pretty and uncommon stove or intermediate greenhouse Acanthaceous plant, introduced from Mexico in 1870. It is of sturdy growth, with square stems and deep green opposite ovate acuminate leaves, shaded with reddish-purple on the lower surface. Its orange-yellow narrow tube-shaped flowers are borne in terminal clusters during winter, and remain attractive for about six weeks. It is an easily grown plant, and cuttings struck in spring will, under ordinary care, yield an abundance of flowers the following winter. It is sometimes met with under the name of *Cyrtanthera chrysostephana*. (Fig. 279.)

Award of Merit.

To Decorative Chrysanthemum 'Belle of Weybridge' ('Annie Holden' × 'Framfield Beauty') (votes, 18 for), from G. Ferguson, Esq., The Hollies, Weybridge (gr. Mr. F. W. Smith). A distinct and pleasing semi-double variety, with broad dull crimson petals and a bright yellow disc.

To *Begonia* Agatha *compacta* (*B. socotrana* ♀ *B. natalensis* ♂) (votes, 15 for), from Messrs. Jas. Veitch, Chelsea. A very dwarf, compact, floriferous variety, with pink flowers similar to those of 'Gloire de Lorraine.'

To Japanese Chrysanthemum 'F. S. Vallis' (votes, unanimous), from Messrs. Wells, Earlswood, Redhill. Flowers large, with long, narrow, drooping, canary-yellow petals.

To Japanese Chrysanthemum 'Leila Filkins' (votes, 15 for, 4 against), from Messrs. Wells, Earlswood. Flowers of good size and substance, colour lilac pink or pale purple, with a paler reverse. An improvement on 'Viviand Morel.'

To Tree Carnation 'Viscount Kitchener' (votes, 17 for), from Messrs. Cutbush, Highgate. A distinct variety, with large shapely white flowers, edged and freely streaked with red.

To Incurved Chrysanthemum 'Miss E. Seward' (votes, 13 for, 2 against) from Mr. Seward, Hanwell. A shapely golden-yellow flower, touched with old gold.

Other Exhibits.

Lady Tweedmouth, Guisachan, Strathglass, Beauly, Inverness-shire, sent some very fine Malmaison Carnation flowers.

E. Mawley, Esq., Rosebank, Berkhamsted, sent a nice collection of outdoor Roses.

Mr. Schneider, 17 Ifield Road, Fulham, sent Violet 'Armandine Millet,' a variety with variegated leaves.

Messrs. Barr, Covent Garden, sent hardy flowers and four cases of wax models of Daffodils.

Messrs. Cutbush, Highgate, sent Carnations.

Messrs. Bull, King's Road, Chelsea, sent the delicately tinted *Epiphyllum delicatum*. (Fig. 280.)

Chrysanthemums were exhibited by :—

1. Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain).
2. Hon. W. F. D. Smith, M.P., Greenlands, Henley-on-Thames (gr. Mr. H. Perkins).
3. The Rev. Marquis of Normanby, Mulgrave Castle, Whitby, Yorks. (gr. Mr. J. Corbett).
4. G. W. Bird, Esq., Manor House, West Wickham (gr. Mr. H. Ridden).
5. G. Ferguson, Esq., The Hollies, Weybridge (gr. Mr. F. W. Smith).
6. Mr. Hill, Station Road, Preston Park, Brighton.
7. Messrs. Garroway, Durdham Down, Clifton.

Floral Committee, December 9, 1902.

Mr. H. B. May in the Chair, and twenty-one members present.

Awards Recommended :—

Silver Gilt Banksian Medal.

To Messrs. Jas. Veitch, Chelsea, for winter-flowering Begonias and *Jacobinia chrysostephana.*

Silver Flora Medal.

To Messrs. Wells, Earlswood, Redhill, for Chrysanthemums.

Silver Banksian Medal.

To Mr. May, Upper Edmonton, for Carnations and foliage plants.

To Messrs. Rochford, Turnford Hall, Broxbourne, for Begonias.

To Messrs. Cannell, Swanley, for Zonal Pelargoniums.

Bronze Flora Medal.

To Count Seilern, Frensham Place, Farnham, Surrey (gr. Mr. W. J. Prewett), for Chrysanthemums.

Award of Merit.

To *Primula obconica semi-plena* (votes, 17 for), from Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain). Flowers semi-double, rather deeper in colour than those of the type and borne on strong stems.

Fig. 280.—Epiphyllum delicatum. (*Gardeners' Chronicle.*)

To *Bouvardia* 'King of Scarlets' (votes, unanimous), from Mr. Robson, Altrincham. A vigorous growing variety with great clusters of large substantial bright red flowers, not quite so clear as 'President Cleveland,' which is considered to be the best of its colour. The new variety was raised by Mr. G. H. Kerslake, Sydney, and *B. Humboldti corymbiflora* seems to have been one of its parents.

Other Exhibits.

Sir Trevor Lawrence, Bart., Burford, Dorking (gr. Mr. W. Bain), sent flowers of *Lilium Wallichianum superbum.*

A. Seth Smith, Esq., Silvermere, Cobham (gr. Mr. Jas. Quarterman), sent *Freesia refracta alba.*

G. Ferguson, Esq., The Hollies, Weybridge (gr. Mr. F. W. Smith), sent single Chrysanthemums.

From Miss Easterbrook, Fawkham, Kent, came a beautiful basket of Chrysanthemums.

Mr. G. Carpenter, West Hall, Byfleet, sent Chrysanthemums.

Messrs. Cutbush, Highgate, sent Carnations.

Messrs. Barr, Covent Garden, sent Roman Hyacinths.

Messrs. Bull, Chelsea, sent a group of Cycadaceous plants and *Hydrangea Hortensia nivalis*, a pretty greenhouse variety with broad cream-white leaves irregularly margined with deep green. The Committee asked to see the last-named again.

ORCHID COMMITTEE.

SEPTEMBER 23, 1902.

Mr. HARRY J. VEITCH in the Chair, and twenty members present.

Awards Recommended:—

Silver Flora Medal.

To the Hon. Walter Rothschild, M.P., for an interesting collection of Masdevallias, Restrepias, Pleurothallis, &c.

To Messrs. Jas. Veitch, Chelsea, for a group of hybrid Orchids.

To Messrs. Hugh Low, Bush Hill Park, for a group of Orchids.

Silver Banksian Medal.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To Messrs. Stanley, Ashton, Southgate, for a stand of *Cattleya aurea*, &c.

First-class Certificate.

To *Cattleya* × 'Iris,' 'Charlesworth's variety' (*bicolor* × *Dowiana aurea*) (votes, 13 for, 1 against), from Messrs. Charlesworth, Heaton, Bradford. The third of this fine hybrid to receive an award, and the best. Flower large, sepals and petals bronzy yellow; lip dark rose crimson, the front lobe broad and crimped at the margin.

Award of Merit.

To *Lycaste* × *hybrida* (*Deppei* × *Skinneri*) (votes, 13 for, 1 against), from Messrs. Charlesworth. A better form of the plant known as *L. Deppei punctatissima*, and a natural hybrid. Flowers white uniformly spotted with rose purple.

To *Cattleya Grossii* (votes, 15 for, 1 against), from Messrs. Hugh Low. A supposed natural hybrid of *Cattleya bicolor*, but resembling *C. elongata* (*Alexandræ*). Several varieties were shown varying from those with greenish unspotted sepals and petals and rose-coloured labellum, to forms with the segments spotted with brown, and dark rose lip.

Other Exhibits.

Messrs. Charlesworth, Heaton, Bradford, showed a good collection of new hybrid Orchids.

Messrs. Sander, St. Albans, staged a group of Orchids.

Col. Brymer, M.P. (gr. Mr. Denny), sent *Cypripedium* × *Umlauftianum* 'Brymer's variety.'

Mr. J. Cypher, Cheltenham, staged a selection of showy Orchids.

M. A. A. Peeters, Brussels, sent three hybrid Lælio-Cattleyas, &c.

Sir F. Wigan, Bart. (gr. Mr. W. H. Young), showed *Cypripedium* × Muriel Hollington.'

Mr. Ed. Kromer sent *Epidendrum floribundum*.

M. Ch. Beranek, Paris, showed *Lælio-Cattleya* × 'Lutetia' (*C. velutina* × *L.-C.* × *elegans Turneri*).

H. T. Pitt, Esq., Stamford Hill (gr. Mr. Thurgood), showed a small collection of Orchids.

Francis Wellesley, Esq. (gr. Mr. Gilbert), showed *Lælio-Cattleya* × *Schilleriana* 'Westfield variety,' and other Orchids.

Orchid Committee, October 7, 1902.

Mr. Harry J. Veitch in the Chair, and fifteen members present.

Awards Recommended :—

Silver-gilt Flora Medal.

To H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood), for an extensive group of Orchids.

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a group of late-flowering hybrid Lælio-Cattleyas, &c.

To Walter C. Walker, Esq., Winchmore Hill (gr. Mr. Geo. Cragg), for a group of *Odontoglossum crispum*.

Silver Banksian Medal.

To Messrs. Charlesworth, Bradford, for a group of hybrid Orchids.

First-class Certificate.

To *Lælio-Cattleya* × 'Madame Chas. Maron' (*C. Warscewiczii* × *L. Digbyana*) (votes, unanimous), from Baron Sir H. Schröder, The Dell, Egham (gr. Mr. H. Ballantine). A fine large flower with rose-coloured sepals, petals, and front to the finely fringed lip.

To *Sophro-Lælia* × *heatoniensis* (*S. grandiflora* × *L. purpurata*) (votes, unanimous), from Messrs. Charlesworth, Bradford. Flower purplish red ; lip veined purple. (Fig. 281.)

Award of Merit.

To *Lælio-Cattleya* × 'Isis, Rosslyn variety' (*C.* × *Marstersoniæ* × *L. pumila*) (votes unanimous), from H. T. Pitt, Esq., Rosslyn, Stamford Hill (gr. Mr. Thurgood). Flower formed like *C. Loddigesii*, which, crossed with *C. labiata*, produced *C.* × *Marstersoniæ* ; but larger, bright rose with claret-crimson marking on the lip.

To *Cattleya* × 'Firefly' (*Dormaniana* × *Bowringiana*) (votes, 10 for, 3 against), from Messrs. Hugh Low, Bush Hill Park. Sepals and petals rose, lip elongated, purple, with very small side lobes clipping the base of the column.

Cultural Commendation.

To Mr. Jas. Hudson, V.M.H., gr. to Leopold de Rothschild, Esq., Gunnersbury House, Acton, for a finely grown plant of *Dendrobium* *formosum giganteum*, with growths two feet in length, and fifteen large flowers—an example of the beauty of many similar specimens at Gunnersbury.

To Mr. Geo. Cragg, gr. to Walter C. Walker, Esq., Winchmore Hill, for a group of 25 finely grown *Odontoglossum crispum* in flower. The plants were potted, one crock only being used, then one third of the depth of Bracken-rhizome. Afterwards the plants were loosely filled in with rough peat to within an inch of the rim, and finished with a surfacing of Sphagnum Moss. The bulbs were of extraordinary size, and the flower-spikes very fine.

Fig. 281.—Sophro-Lælia × heatoniensis. (*Journal of Horticulture.*)

Other Exhibits.

Sir Frederick Wigan, Bart. (gr. Mr. W. H. Young), sent the yellow-flowered *Lælio-Cattleya* × 'Constance Wigan' (*L. xanthina* × *C. Rex*); and *L.-C.* × 'Ira' (*L. longipes* × *L.-C.* × *Schilleriana*).

Francis Wellesley, Esq. (gr. Mr. Gilbert), sent *Cypripedium* × 'Chas. Canham *majus*'; and *C. Charlesworthii* 'Westfield variety.'

De B. Crawshay, Esq. (gr. Mr. Stables), showed *Odontoglossum* × *Hallio-crispum roseum.*

Messrs. William Bull sent *Cypripedium* × *Charlesianum* 'Sybil.'

Mr. H. A. Tracy showed *Liparis tricallosa.*

Orchid Committee, October 21, 1902.

Mr. Harry J. Veitch in the Chair, and twenty members present.

Awards Recommended :—

Silver Flora Medal.

To J. Bradshaw, Esq., Southgate (gr. Mr. Whitelegge), for a group of Orchids.

To Messrs. Jas. Veitch, Chelsea, for a collection of hybrid Orchids.

Fig. 282.—Odontoglossum crispo-Harryanum delicatum. (*Journal of Horticulture.*

To Messrs. Charlesworth, Bradford, for a selection of hybrid Cattleyas, Lælio-Cattleyas, &c.

Silver Banksian Medal.

To J. Gurney Fowler, Esq., Glebe-lands, South Woodford (gr. Mr. J. Davis), for a group of excellently well cultivated Orchids.

To Walter C. Walker, Esq., Winchmore Hill (gr. Mr. G. Cragg), for a group of *Odontoglossum crispum* and *Dendrobium Phalænopsis.*

To Messrs. Hugh Low, Bush Hill Park, for a group of Orchids.

To Messrs. Sander, St. Albans, for a group of Orchids.

First-class Certificate.

To *Odontoglossum* × *crispo-Harryanum* (*crispum* × *Harryanum*) (votes, unanimous), from Baron Sir H. Schröder, The Dell, Egham (gr. Mr. H. Ballantine). A very fine variety with large white flowers slightly tinged with green on the sepals and spotted on the inner halves of all the segments with purple. (Fig. 282.)

Fig. 283.—Lælio-Cattleya × bletchleyensis, 'Fowler's Variety.' (*Journal of Horticulture.*)

To *Lælio-Cattleya* × *bletchleyensis* 'Fowler's variety' (*L. tenebrosa* × *C. Warscewiczii*) (votes, unanimous), from J. Gurney Fowler, Esq., Glebe-lands, South Woodford (gr. Mr. J. Davis). Flowers large, sepals and petals beautifully tinged and veined with rose purple. Lip dark ruby-red with purple margin. (Fig. 283.)

Award of Merit.

To *Lælio-Cattleya* × 'Mrs. Chamberlain' (*L. Digbyana* × *C. chocoensis*) (votes, unanimous), from the Rt. Hon. Joseph Chamberlain, M.P., Birmingham (gr. Mr. Mackay). Flower large, lip fringed. Sepals and petals white with a slight blush tint. Disc of lip greenish-yellow; front pale pink.

Cultural Commendation.

To Mr. W. H. White, gr. to Sir Trevor Lawrence, Bart., Burford, for a fine plant of the rare East African *Angræcum Kotschyi*, cultivated at Burford since its introduction in 1880.

To Mr. J. Gilbert, gr. to Francis Wellesley, Esq., Westfield, Woking, for a fine plant of *Cattleya* × *Maroni* (*velutina* × *Dowiana aurea*) with nine flowers on a spike.

To Mr. Walters, gr. to H. J. Elwes, Esq., Colesborne Park, for *Habenaria carnea.*

Other Exhibits.

Baron Sir H. Schröder (gr. Mr. H. Ballantine) showed the original plant of *Odontoglossum* × *Wattianum* with a very fine spike of flowers.

Norman C. Cookson, Esq. (gr. Mr. H. J. Chapman), sent *Lælia pumila præstans* 'Oakwood variety'; white slightly tinted with lavender and with a slate-blue front to the lip.

Mr. Jas. Douglas sent *Lælio-Cattleya* × *Gottoiana* 'Edenside variety.'

Mr. H. A. Tracy showed *Lælio-Cattleya* × 'Proserpine' (*L. Dayana* × *C. velutina*).

H. J. Elwes, Esq., showed *Stenoglottis longifolia* 'Colesborne variety.'

Messrs. B. S. Williams showed *Lælio-Cattleya* × 'Henry Greenwood, and *Cypripedium* × *Goweri.*

A. Heygate, Esq., Milford-on-Sea, sent *Cypripedium* × 'Francis Heygate' (*Charlesworthii* × *Mastersianum*).

Orchid Committee, November 4, 1902.

Mr. Harry J. Veitch in the Chair, and eighteen members present.

Awards Recommended :—

Silver Flora Medal.

To Messrs. Jas. Veitch, Chelsea, for a collection of hybrid Orchids.

To C. H. Feiling, Esq., Southgate (gr. Mr. Stocking), for a large collection of Cypripediums.

To J. Bradshaw, Esq., Southgate (gr. Mr. Whitelegge), for a group of *Cattleya labiata*, &c.

Silver Banksian Medal.

To J. Gurney Fowler, Esq., Glebe-lands, South Woodford (gr. Mr. J. Davis), for a group of Orchids, one specimen of *Cattleya labiata* having thirty-six fine flowers.

To the Hon. Walter Rothschild, M.P. (gr. Mr. E. Hill), for a collection of rare and curious Orchids.

To Captain G. L. Holford, C.I.E., Westonbirt (gr. Mr. H. Alexander), for a group of fine specimens of *Vanda Kimballiana* and other Orchids.

To Sir F. Wigan, Bart., Clare Lawn (gr. Mr. W. H. Young), for a group of Orchids.

To Messrs. Charlesworth, Bradford, for a collection of hybrid Orchids.

To Jeremiah Colman, Esq., Gatton Park (gr. Mr. W. P. Bound), for a group of Orchids.

To Messrs. Sander, St. Albans, for a group of Orchids.

To Messrs. Hugh Low, for a group of Orchids.

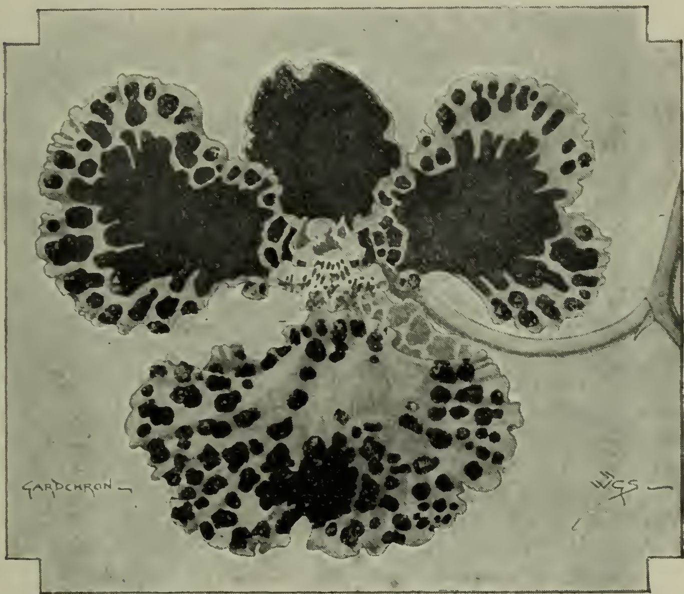


FIG. 284.—ONCIDIUM × MANTINII SUPERBUM. (*Gardeners' Chronicle.*)

Award of Merit.

To *Cypripedium* × 'Thalia' (*insigne Chantinii* × Baron Schröder) (votes, unanimous), from Messrs. Jas. Veitch. A very fine hybrid. Petals and lip yellow tinged, and marked with dark purple. Upper sepal large, white with green base and bearing showy purple lines and spots.

To *Oncidium* × *Mantinii superbum* (votes, unanimous), from Francis Wellesley, Esq., Westfield, Woking (gr. Mr. J. Gilbert). Flowers large, yellow marked with red brown. (Fig. 284.)

To *Cattleya* × 'Mrs. Pitt' (*Harrisoniana* × *Dowiana aurea*) (votes, unanimous), from H. T. Pitt, Esq. (gr. Mr. Thurgood). Flowers rose-pink with orange-coloured disc to the labellum.

To *Cattleya labiata Amesiana* (votes, 11 for, 4 against), from J. Bradshaw, Esq., and Messrs. Hugh Low. Flowers white with a lilac rose tint on the lip.

To *Cypripedium* × 'Transvaal superbum' (*Chamberlainianum* ×

Rothschildianum) (votes, unanimous), from Messrs. Sander, St. Albans. Upper sepal and extended petals pale green marked with dark purple. Lip rose with yellowish upper margin. (Fig. 285.)

To *Cypripedium* × 'Evelyn Ames superbum' (*Leeanum giganteum* × 'Calypso, Oakwood var.') (votes, unanimous), from Messrs. Sander. Flowers resembling *C.* × *Leeanum giganteum.* Base of dorsal sepal green, upper part white with a purple line up the middle.

Botanical Certificate.

To *Cynorchis purpurascens* from Messrs. Sander. Leaves long and fleshy. Flowers in fine upright heads, pale purple. Madagascar.

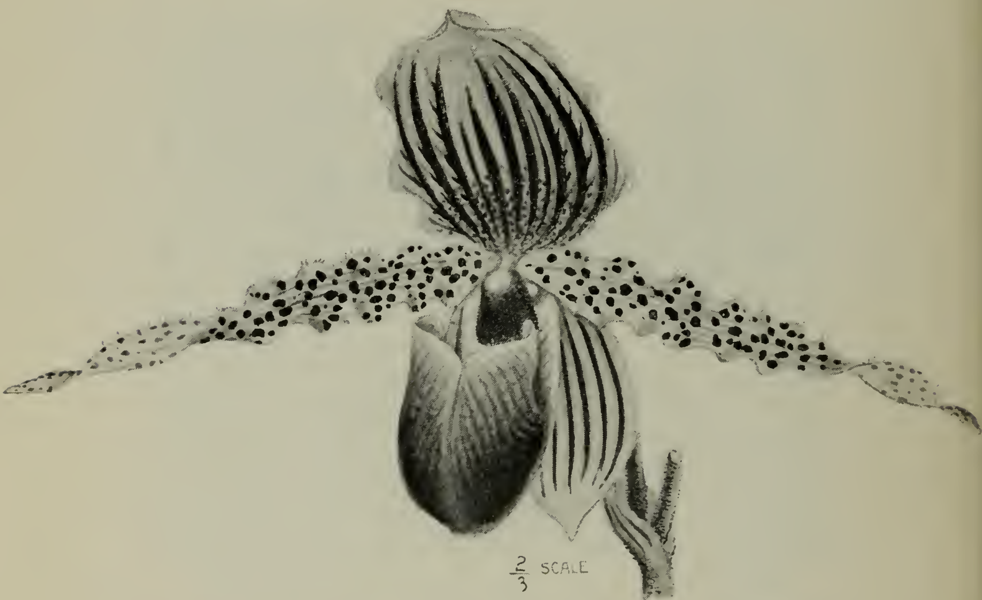


Fig. 285.—Cypripedium × Transvaal superbum. (*Journal of Horticulture.*)

Cultural Commendation.

To Mr. H. Alexander, Orchid Grower to Captain G. L. Holford, C.I.E., for a noble plant of *Dendrobium formosum giganteum* with sixty flowers.

Other Exhibits.

Sir Jas. Miller, Bart. (gr. Mr. J. Hamilton), sent *Lælio-Cattleya* × *Hamiltonii* (*C. bicolor* × *L. Dayana*).

Mr. Jas. Cypher staged a group of Orchids.

Mr. H. A. Tracy showed *Cattleya labiata cærulea.*

De B. Crawshay, Esq. (gr. Mr. Stables), showed *Odontoglossum crispum Poultonii.*

R. I. Measures, Esq. (gr. Mr. Smith), showed the yellow *Cypripedium insigne* 'Miss Corbett.'

M. Otto Frœbel, Zurich, sent *Vanda Sanderiana Froebeliæ* a fine variety.

Orchid Committee, November 18, 1902.

Mr. Harry J. Veitch in the Chair, and nineteen members present.

Awards Recommended:—

Gold Medal.

To Captain G. L. Holford, C.I.E., Westonbirt (gr. Mr. Alexander), for a very fine group of Orchids extending the whole length of the

Fig. 286.—Cypripedium insigne Holfordianum. (*Gardeners' Chronicle.*)

staging in the Hall, very noticeable being his magnificent *Cypripedium insigne Holfordianum* (fig. 286), and the equally beautiful *Cypripedium Charlesworthii.* (Fig. 287.)

Silver-gilt Flora Medal.

To Mr. J. Cypher, Cheltenham, for a large group of Cypripediums, &c.

Silver Flora Medal.

To Messrs. Jas. Veitch, for a group of hybrid Orchids.

Silver Banksian Medal.

To Norman C. Cookson, Esq., Oakwood, Wylam-on-Tyne (gr. Mr. H. J. Chapman), for a group of Orchids.

To Messrs. Sander for a group of Orchids.

First-class Certificate.

To *Lælio-Cattleya* × *Thorntonii grandiflora* (*L. Digbyana* × *C. Gaskelliana*) (votes, unanimous), from Messrs. Jas. Veitch. Flower

FIG. 287.—CYPRIPEDIUM CHARLESWORTHII. (*Journal of Horticulture.*)

large, bright rosy-lilac with greenish-primrose disc to the fringed labellum.

Award of Merit.

To *Calanthe* × *triumphans* (parentage unrecorded) (votes, unanimous), from N. C. Cookson, Esq. (gr. Mr. H. J. Chapman). Flowers ruby-red with nearly white sepals.

To *Lælio-Cattleya* × *Statteriana superba* (*L. Perrinii* × *C. labiata*), (votes, 8 for, 3 against), from Messrs. Jas. Veitch. Flowers bright rose; front of lip reddish purple.

To *Lælio-Cattleya* × 'Clive var. *Sanderæ*' (*L. pumila alba* × *C.*

Dowiana aurea) (votes, unanimous), from Messrs. Sander. Sepals and petals blush white. Front of lip rosy crimson.

To *Cattleya* × *Fabia Vigeriana* (*C. Dowiana aurea* × *C. labiata flammea*) (votes, 11 for, 4 against), from M. Chas. Maron, Brunoy, France. Flowers rose-crimson darkest on the front of the lip, which has yellow lines at the base.

Botanical Certificate.

To *Bulbophyllum Ericssonii*, from the Hon. Walter Rothschild, M.P. An extraordinary species from New Guinea, with umbels of large greenish flowers spotted with purple, and cream-white lip marked with claret colour.

Cultural Commendation.

To Mr. H. Alexander, grower to Captain G. L. Holford, for a fine specimen of *Cattleya Bowringiana* with ten spikes bearing one hundred and ninety-six flowers, the largest spike having twenty-six.

To Mr. Alexander, for *Cypripedium* × *Leeanum giganteum* with fourteen flowers.

Other Exhibits:—

Baron Sir Henry Schröder, Bart. (gr. Mr. H. Ballantine), showed fine forms of *Odontoglossum* × *Rolfeæ* and *O.* × *crispo-Harryanum.*

J. Gurney Fowler, Esq. (gr. Mr. J. Davis), again showed *Dendrobium Wardianum Fowlerianum*, which was given an Award of Merit Jan. 28, 1902. The variation consists in the lower sepals being coloured and, in a measure, shaped like the lip. It proves constant.

Francis Wellesley, Esq. (gr. Mr. J. Gilbert), showed *Lælia* × *Gilbertii*, imported with *L. tenebrosa*, and a fine *Vanda cærulea* &c.

W. P. Burkinshaw, Esq. (gr. Mr. Barker), sent Cypripediums.

The Right Hon. J. Chamberlain (gr. Mr. Mackay), sent *Lælio-Cattleya* × *Mariæ* (*L. Digbyana* × *C. Warneri*).

Dr. Misken showed *Cattleya* × *Hardyana*, var.

Mr. H. A. Tracy sent *Cypripedium insigne Tracyæ.*

Orchid Committee, December 9, 1902.

Mr. Harry J. Veitch in the Chair, and twenty members present.

Awards Recommended:—

Silver Gilt Flora Medal.

To O. O. Wrigley, Esq., Bridge Hall, Bury, Lancs. (gr. Mr. Rogers), for a very fine collection of Cypripediums.

Silver Flora Medal.

To W. E. Budgett, Esq., Henbury, Bristol, for a fine group of Cypripediums.

To Messrs. Jas. Veitch, for a group of winter-flowering hybrid Orchids.

Award of Merit.

To *Cypripedium Lawrenceanum* (votes, unanimous), shown by Messrs. Linden, March 25, 1902. The Award had been withheld, on account of the flower not being available for painting according to the Society's rule, but a blossom having now been furnished by Francis Wellesley, Esq., of Westfield Common, Woking, it became possible to confirm the Award.

Cultural Commendation.

To Mr. Rogers, gr. to O. O. Wrigley, Esq., for a fine plant of *Cypripedium* × *Arthurianum.*

Other Exhibits :—

W. Thompson, Esq., Walton Grange, sent *Cypripedium insigne* 'Babette'; and *Odontoglossum* × *loochristyense* 'Annie.'

Norman C. Cookson, Esq. (gr. Mr. Chapman), showed *Cypripedium* × *Leeanum Clinkaberryanum,* and *C. Actæus punctatissimum.*

F. A. Bevan, Esq. (gr. Mr. Parr), sent *Odontoglossum crispum guttatum.*

H. S. Leon, Esq. (gr. Mr. Hislop), sent *Cattleya* × 'Barbara' (*Bowringiana* × *Trianæi*).

C. H. Feiling, Esq. (gr. Mr. Stocking), sent two Oncidiums of the *O. prætextum* class, said to be natural hybrids.

G. W. Law-Schofield, Esq. (gr. Mr. Shill), showed *Cypripedium* × 'Evelyn Ames.'

J. Gurney Fowler, Esq. (gr. Mr. Davis), sent the fine yellow *Lælia* × 'Mrs. Gratrix, Fowler's variety.'

ELECTION AND PRIVILEGES OF FELLOWS AND TERMS OF SUBSCRIPTION.

Anyone interested in Horticulture is eligible for election as Fellow, and is invited to join the Society.

Candidates for election are proposed by two Fellows of the Society. Forms for proposing new Fellows may be obtained from the Office, 117 Victoria Street, Westminster. Ladies are eligible for election as Fellows of the Society.

A Fellow subscribing 4 guineas a year (or commuting) is entitled—

1.—To One Non-transferable (personal) Pass and Five Transferable Tickets admitting to all the Society's Exhibitions, and to the Gardens on any day except Sundays.

2.—To attend and vote at all Meetings of the Society.

3.—To the use of the Libraries at the Society's Rooms.

4.—To a copy of the Society's Journal, containing the Papers read at all Meetings and Conferences, Reports of trials made at Chiswick Gardens, and descriptions and illustrations of new or rare plants, &c.

5.—To purchase, at reduced rates, such fruit, &c., as is not required for the experimental purposes of the Society.

6.—To a share (in proportion to the annual subscription) of such plants as may be available for distribution. Fellows residing beyond a radius of 35 miles from London (by the A B C Railway Guide) are entitled to a double share.

7.—Subject to certain limitations, to obtain Analysis of Manures, Soils, &c., or advice on such subjects, by letter from the Society's Consulting Chemist, Dr. J. A. Voelcker, M.A.

8.—To have their Gardens inspected by the Society's Officer at the following fees:— One day, £2. 2*s.*; two days, £3. 3*s.*; *plus* all out of pocket expenses.

9.—To exhibit at all Shows and Meetings, and to send seeds, plants, &c., for trial to the Society's Gardens at Chiswick.

10.—To recommend any lady or gentleman for election as a Fellow of the Society.

A Fellow subscribing 2 guineas a year (or commuting) is entitled—

1.—To One Non-transferable Pass and Two Transferable Tickets.

2.—To the same privileges as mentioned in Nos, 2, 3, 4, 5, 6, 7, 8, 9, 10, as above.

A Fellow subscribing 1 guinea a year (or commuting) is entitled—

1.—To One Transferable Ticket (in lieu of the non-transferable Personal Pass), and the privileges mentioned in Nos. 2, 3, 4, 5, 6, 7, 8, 9, 10, as above.

N.B.—Each Transferable Ticket or Non-transferable personal Pass will admit three persons to the Gardens at Chiswick on any day *except* days on which an Exhibition or Meeting is being held, when each Ticket or Pass will admit One Person only. The Gardens are closed on Sundays.

An Associate subscribing 10s. 6d. a year is entitled—

1.—To One Non-transferable Pass, and to privileges as mentioned in Nos. 3, 4, and 9

N.B.—Associates must be *bonâ fide* Gardeners, or employees in a Nursery, Private or Market Garden, or Seed Establishment, and must be recommended for election by Two Fellows of the Society.

COMPOUNDING FOR SUBSCRIPTION.

Any Fellow wishing to commute his annual subscription may do so by making one payment of **Forty Guineas** in lieu of a £4. 4*s.* annual subscription; of **Twenty-five Guineas** in lieu of a £2. 2*s.* annual subscription; or of **Fifteen Guineas** in lieu of a £1. 1*s.* annual subscription; such commutation entitling the Fellow for life to all the privileges of the corresponding annual subscription.

Local Horticultural and Cottage Garden Societies may be Affiliated to the Royal Horticultural Society on application.

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS.

(*Applicable only to the case of those Fellows who are not engaged in any Horticultural Trade, or in the manufacture or sale of any substance sent for Analysis.*)

The Council have fixed the following rates of charges for Chemical Analysis to Fellows of the Society being *bonâ fide* Gardeners or Amateurs.

These privileges are applicable only when the Analyses are for *bonâ fide* horticultural purposes, and are required by Fellows for their own use and guidance in respect of gardens or orchards in their own occupation.

The analyses are given on the understanding that they are required for the individual and sole benefit of the Fellow applying for them, and must not be used for the information of other persons, or for commercial purposes.

Gardeners, when forwarding samples, are required to state the name of the Fellow on whose behalf they apply.

The analyses and reports may not be communicated to either vendor or manufacturer, except in cases of dispute.

When applying for an analysis, Fellows must be very particular to quote the number in the following schedule under which they wish it to be made.

No.		
1.	An opinion on the purity of bone-dust (each sample)	2*s.* 6*d.*
2.	An analysis of sulphate or muriate of ammonia, or of nitrate of soda, together with an opinion as to whether it be worth the price charged	5*s.*
3.	An analysis of guano, showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, together with an opinion as to whether it be worth the price charged	5*s.*
5.	An analysis of superphosphate of lime, dissolved bones, &c., showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime and ammonia, together with an opinion as to whether it be worth the price charged	10*s.*
6.	An analysis of bone-dust, basic slag, or any other ordinary artificial manure, together with an opinion as to whether it be worth the price charged	10*s.*
7.	Determination of potash in potash salts, compound manures, &c.	7*s.* 6*d.*
8.	An analysis of compound artificial manures, animal products, refuse substances used for manure, &c.	from 10*s.* to £1
9.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.	Complete analysis of a soil	£3
12.	Analysis of any vegetable product	10*s.*
13.	Determination of the "hardness" of a sample of water before and after boiling	5*s.*
14.	Analysis of water of land-drainage, and of water used for irrigation	£1
15.	Analysis of water used for domestic purposes	£1 10*s.*
16.	Consultation by letter	5*s.*

Letters and samples (postage and carriage prepaid) should be addressed to the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, 22 Tudor Street, New Bridge Street, London, E.C.

The fees for analysis must be sent to the Consulting Chemist at the time of application.

Instructions for selecting, drawing, and sending samples for analysis will be found on pages 26–33 of "Arrangements, 1903," or can be obtained on application to the Society's Office, 117 Victoria Street, S.W.

NOTICES TO FELLOWS.

APRIL 1903.

FRUIT.

Figs, Peaches, and Nectarines will be ready from about the second week in June and onwards. Fellows can purchase the same by writing to *The Superintendent, R.H.S. Gardens, Chiswick, W.* Prices will vary according to the size of the fruits. If sent by post carriage will be charged extra.

LETTERS.

All letters on *all* subjects (save above) should be addressed—The Secretary, R.H.S. Office, 117 Victoria Street, Westminster, S.W.

TELEGRAMS.

"**HORTENSIA, LONDON**," has been registered, and is sufficient address for all telegrams.

JOURNALS WANTED.

The Secretary would be very greatly obliged for any of the following back numbers:—Vol. VII., Part 2; Vol. VIII; Vol. X; Vol. XIII., Part 1; Vol. XVI., Parts 2 and 3; Vol. XVII., Parts 1 and 2; Vol. XVII., Parts 3 and 4; Vol. XIX., Part 1; Vol. XIX., Part 2, Vol. XX., Part 3; Vol. XXII., Part 3; Vol. XXII., Part 4; Vol. XXV., Part 3; Vol. XXVI., Part 4.

LIST OF FELLOWS.

A list of all the Fellows of the Society was sent out the last week in January. Fellows are requested to look at their own names in it, and, if in any way these are incorrect or the address insufficient, they are requested to inform the Secretary at once. Another use which all Fellows might make of this list is to consult it with reference to their friends' names, and if any of them are not found recorded therein they might endeavour to enlist their sympathies with the Society and obtain their consent to propose them as Fellows forthwith. A condensed statement of the Privileges and Subscriptions of Fellows will be found on page ccxlix of this present volume.

SUBSCRIPTIONS.

All Subscriptions fall due on January 1 of each year. To avoid the inconvenience of remembering this, Fellows can *compound* by the payment of one lump sum in lieu of all further annual payments; or they can, by applying to the Society, obtain a form of instruction to their bankers to pay for them every January 1. Fellows whose subscriptions remain unpaid are debarred from all the privileges of the Society; but their subscriptions are nevertheless recoverable at law, the Society being incorporated by Royal Charter.

Several Fellows, in paying their Subscriptions last year, made the mistake of drawing their cheques for Pounds instead of for Guineas. Kindly note that in all cases it is Guineas and not Pounds.

DISTRIBUTION OF PLANTS, &c.

Fellows are particularly requested to note that a list to choose from of all the plants available for distribution is sent every year to every Fellow, enclosed *in the "Report of the Council,"* in the last week in January of each year, and a ballot for order of being served is made on March 1. The distribution begins on March 2. Fellows having omitted to fill up their application form before May 1 must be content to wait till the next distribution. The work of the Gardens cannot be disorganised by the sending out of plants at any later time in the year. All Fellows can participate in the Distribution in the March *following* their election.

Plants cannot be sent to Fellows residing outside the United Kingdom, owing either to length of time in transit or to vexatious regulations in some foreign countries; but the Council will at any time endeavour to obtain for Fellows living abroad any unusual or rare seeds which they may have been unable to procure in their own country.

FELLOWS' PRIVILEGES OF CHEMICAL ANALYSIS, &c.

Full instructions are contained in "Arrangements" for the current year, and an epitome thereof will be found on page ccl of this volume.

PLANTS CERTIFICATED.

A list of all the Plants, Fruits, Flowers, Vegetables, &c., certificated by the Society up till January 1, 1900, has been published, price 5*s.*, now reduced to 2*s.* 6*d.* The section devoted to Orchids, interleaved with lined foolscap and bound in cloth, can be obtained for Fellows by special order, price 5*s.*

The compilation of this volume has entailed an enormous amount of labour and research, and it is hoped that many Fellows will purchase a copy, not merely for the value of the information it contains, which, however, is very great, but also in order to take a small share in the very considerable expense necessarily incurred in the publication of such a work. It can be obtained by Postal Order from the Society's Office, 117 Victoria Street, Westminster, S.W.

NEW FELLOWS.

The Centenary of the Society in March 1904 is fast approaching, and the Secretary is most anxious to double the number of Fellows before that eventful date. Will every Fellow assist him by sending in the name of at least one new Fellow during the coming year ?

LECTURES, &c.

Any Fellows willing to lecture in 1904 or to communicate Papers on interesting subjects are requested to communicate with the Secretary.

MEETINGS AND SHOWS.

1903 (remaining)—May 5, 19, English Tulip Show; Temple Show, May 26, 27, 28; June 9; Holland House Show, June 25, 26; July 7, 21, Carnation Show; August 4, 18; September 1, Dahlia Show, 15; British Fruit and Vegetable Show at Chiswick, September 29, 30, October 1; October 13, 27; November 10, 24; December 15. **1904**—January 5, 26. All the above are at the Drill Hall, Buckingham Gate, excepting Temple Show, Holland House Show, and Chiswick Show.

A reminder of every Show will be sent in the week preceding to any Fellow who will send to the R.H.S. Office, 117 Victoria Street, S.W., a sufficient number of halfpenny cards *ready addressed* to himself.

THE TEMPLE SHOW.

May 26, 27, 28. Fellows of the Society are admitted free on **showing their tickets.** *N.B.*—Each *Personal Pass* is strictly non-transferable, and will admit only the Fellow to whom it belongs and no one else. Fellows' *Transferable Tickets* are available for themselves or their friends. The general public are admitted by purchased tickets:—On Tuesday, May 26, from 12.30 to 7 P.M., 7*s.* 6*d.* On Wednesday, from 9 A.M. to 7 P.M., 2*s.* 6*d.* On Thursday, from 9 A.M. to 6 P.M., 1*s.*

To avoid the inconvenience of crowding, tickets may be obtained beforehand at the Society's Office, 117 Victoria Street, S.W., or at the Treasurer's Office, Inner Temple.

The Society's Offices at Westminster will be closed on the days of the Show, and consequently no letters should be addressed there on the previous day.

On the days of the Show, tickets will only be on sale near the entrance to the Gardens (Thames Embankment Gate).

Members of Affiliated Societies and *bona fide* gardeners may obtain 2*s.* 6*d.* tickets for 1*s.*, which will admit them to the exhibition on Wednesday. These tickets *can only be obtained* on or **before** May 23 *from the Society's Office,* 117 Victoria Street, S.W., and a large stamped and directed envelope must be sent with Postal Order in every case. Members of Affiliated Societies *must* apply *only through the Secretary of their own* Society if they wish to take advantage of this privilege.

Exhibitors are warned that some alterations have been made in the Rules (see *Arrangements*, 1903, page 66).

HOLLAND HOUSE SHOW.

June 25, 26.—By the kind permission of the Earl and Countess of Ilchester the Holland House Show (which last summer was so sadly marred by the sudden illness of the King taking place on the very day) is to be repeated, and the Council hope that Fellows will try and make this Show a great success by inducing all their friends and acquaintances to visit it.

The Show will be open to Fellows (**showing their tickets**), and to others showing Fellows' transferable tickets, at 12.30 on Thursday, June 25, and at 9.30 A.M. on Friday, June 26.

N.B.—*All annual tickets must be shown at the Gate, and all other tickets given up.* The public will be admitted on Thursday, June 25, at 2 P.M. on payment of 7*s.* 6*d.*, and at 9.30 A.M. on Friday on payment of 2*s.* 6*d.* The Grounds will be cleared of visitors at 8 P.M. on Thursday, and at 6 P.M. on Friday, when exhibits may be removed. The **only entrance** to the Show is by the Great Gate in Kensington High Street, and the **only exit** by a gate leading into Melbury Road, where carriages may be ordered to wait.

To avoid crowding at the Gate, the public are earnestly requested to obtain their tickets on or before the 24th at the Society's Office, 117 Victoria Street, S.W.

Ways of reaching Holland House :—

Kensington High Street is the nearest Station on the Metropolitan and District Railways from Liverpool Street, King's Cross, St. Pancras, Euston, Paddington, Cannon Street, Charing Cross, and Victoria.

Addison Road is the nearest from Waterloo, Clapham Junction, Willesden, and Richmond.

Earl's Court is the nearest from Wimbledon, Putney, Fulham, Acton, Ealing, and Windsor. It is convenient to change at Earl's Court for Kensington High Street.

From Notting Hill Gate on the Central London Electric frequent omnibuses run past the gate.

All Hammersmith and Turnham Green omnibuses pass the Gates, and are available from Liverpool Street, Bank, King's Cross, St. Pancras, Euston, Charing Cross, and Hammersmith.

Notice to Exhibitors :—

The Prizes offered for **Roses** will be found on p. 73 of *Arrangements*, 1903.

The Show will be managed on the same general lines as the Temple Show. All classes of Plants, Flowers, and Fruits may be exhibited. Application for space to exhibit miscellaneous groups of any kind must be made to the Secretary, 117 Victoria Street, not later than Thursday, June 18. Single plants, flowers, fruits, &c. shown for certificate may be entered on the morning of the Show, but **only before** 10.30 A.M. The Rules for the Temple Show on page 66, *Arrangements*, 1903, will apply unless otherwise ordered.

DRACÆNAS.

The Superintendent, R.H.S. Gardens, Chiswick, W., would be greatly obliged for any old plants of Dracænas, however old and leggy. Please shake out all the earth from the roots and send direct.

SHOW AT CHISWICK OF BRITISH-GROWN FRUITS AND VEGETABLES.

September 29, 30, October 1.—The Fruit Show hitherto held at the Crystal Palace will this year be combined with a Show of Vegetables, and will be held at the Society's Garden at Chiswick. The schedule of prizes may be obtained from the Society's Office 117 Victoria Street, Westminster, by enclosing one penny stamp. There are prizes for all kinds of Fruits and Vegetables, and also for bottled and preserved fruits and jams, &c. Fuller particulars will be given in the next issue of the Journal.

AFFILIATED SOCIETIES.

Secretaries of Affiliated Societies can now obtain on application a specimen copy of a new Card which the Council have prepared for the use of Affiliated Societies wishing to have a Card for Certificates, Commendations, &c. It can be used for Fruit or Flowers, and is printe in two colours—art shades of deep blue and green. Price 3*s.* 6*d.* for 10 copies, 5*s.* 6*d.* for 20, 11*s.* 6*d.* for 50, 20*s.* for 100.

The Council have also struck a special Medal for the use of Affiliated Societies. It is issued at cost price in Bronze, Silver, and Silver-gilt—viz., Bronze, 5*s.* 6*d.*, with case, complete; Silver, 12*s.* 6*d.*, with case, complete; Silver-gilt, 16*s.* 6*d.*, with case, complete.

BINDING THE JOURNAL.

There are three separate issues of Vol. XXVII.—Part 1, September 1902; Parts 2 and 3 (in one), December 1902; and the present Part. The Title-page and Table of Contents will be found enclosed in the present issue, and should be placed at the commencement of the whole volume. Then should follow the parts of the JOURNAL proper, which is paged in figures from 1 to 1204. After this should come the parts of "Extracts from the Proceedings," which are paged in letters from i to cclxxiv, ending with the three Indices.

ADVERTISEMENTS.

Fellows are reminded that the more they can place their orders with those who advertise in the Society's publications the more likely others are to advertise also, and in this way the Society may be indirectly benefited. An Index to the Advertisements will be found on page 34.

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FIGURES AND ILLUSTRATIONS.

INDEX No. II.

FUNGOID PESTS OF THE GARDEN

IN VOL. XXVII.

BY M. C. COOKE, M.A., LL.D., V.M.H., A.L.S., F.R.H.S.

This Index has been most kindly compiled by Mrs. A. Stuart, F.R.H.S.


E. WHIMPER. Sc

INDEX No. III.

OR

GENERAL INDEX.