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ORIGINAL COMMUNICATIONS.

I.—*Gärtner's Observations upon Muling among Plants.* By the Rev. M. J. Berkeley.

(Second Notice; see Vol. V., p. 172.)

In prosecuting experiments on muling, it becomes important to inquire what is the effect of alternating the sexes of the plants under examination, making that species the subject of hybridization which before supplied the male element. The term crossing, which is used by English authors in a very wide sense, is confined to this especial phenomenon by Kölreuter and his followers. Such experiments are by no means universally successful; but the point of interest is that, where impregnation is perfected, the resulting hybrid is in either case precisely the same. Amongst a number of individuals a few slight variations as to size and colour of the flowers or foliage may exist, but only such as occur wherever a multitude of plants are raised immediately from pure species.

This result of cross-impregnation is the more remarkable, since it is directly contrary to what takes place in the animal kingdom, as the well-known crosses between the horse and ass obviously prove. And not only so, but where many individuals are the result of a single act of impregnation, as in the case of the dog and wolf, there is by no means a constant type prevalent through the whole litter. This difference is explicable by the greater unity of type in plants, as regards sexuality, whether absolutely coincident, as in the case of hermaphrodites, or scarcely modified where the sexes are confined to distinct individuals.

There are indeed a few cases amongst plants where the sexes are separate, and the typical form different, as in *Lychnis diurna* and *vespertina;* but the mules derived from counter-impregnation present no such striking differences as occur amongst animals, and slight variations of type under like circumstances have been observed in the genus *Digitalis*. *D. lanato-ochroleuca*, for instance, has short large blossoms, with the upper lip smaller and its margin waved: *D. ochroleuco-lanata* has a proportionably longer, thinner, and more cylindrical blossom, with a smaller distinctly three-toothed upper lip, and a sharp point in the centre of the lower lip. Other examples might be brought forward in the same genus.

It is to be observed, however, that many futile attempts at crossing in the genus *Digitalis* may be expected, though success will most probably repay repeated experiments. It has been lately ascertained that moistening the stigma with the honey secreted by the flowers promotes the fecundation of the ovarium of these plants, and, doubtless, since no impregnation can be effected before the separation of the lobes of the stigma, because the pollen adheres to it in consequence of such treatment until the division takes place.

Though, however, the influence of the sex of the parent is not in general exhibited, as in animals, by any outward signs, yet there is often a great difference in the inward constitution of the plants produced by cross impregnation. It is, for instance, by no means a matter of indifference whether *Nicotiana rustica* be impregnated with the pollen of *N. paniculata*, or the contrary. In the former case the mule is more fruitful than in the latter, and other similar instances might be adduced.

In intermediate impregnation, however, it appears to be of no consequence whether the male or female be the intermediate species. *Nicotiana chinensis*, for instance, produces the same mule with *N. rustico-paniculata* that it does with *N. paniculato-rustica*.

The author very justly considers this identity of type in the mules arising from counter-impregnation as a very strong argument against Schleiden's notion of the production of the embryo from the extremity of the pollen tube. Two different kinds of pollen could scarcely be expected, if such were really the case, to produce two perfectly identical plants. And the same inference may be drawn from the fact that in the production of double blossoms, it is a matter of indifference whether the pollen be taken from a double or single variety, provided the flower of the matrix is double.

It is not necessary to go through the facts adduced in the chapter relative to the normal types produced by impregnation between two pure species, as those of most importance have been already mentioned incidentally. Slight changes occur from time to time; but this is nothing more than takes place in raising seedlings from the pure species themselves without any cross whatever. The grand point in all experiments is to secure the parent plants in as pure a state as possible; and where practicable, to select species from the woods and fields, and even these as near the normal form as may be. Where proper pains are taken, exceptional forms are very rare, perhaps one only from the produce of many capsules. Some genera and species seem to have a greater disposition to produce such forms than others, as for instance *Dianthus*, *Digitalis*, *Lobelia*, *Passiflora*, *Nicotiana*, and *Verbascum*, and sometimes this tendency is confined to a single species of a genus. When, however, numbers of such exceptional plants spring from the same seed, as from *Verbascum phœniceo-austriacum*, *Dianthus arenario-pulchellus*, &c., or when, on repeated experiments with the same species, the exceptional type occurs either singly or in numbers, the individuals have as complete a resemblance amongst each other as the normal mules; no variations or transitional forms occur, as is the case where the parents are hybrids: they are for the most part decided types. It is observed too, that neither the male nor female element has an exclusive influence in the formation of such exceptional types, though they exhibit usually a decided predominance either of the character of the male or female parent, the unusual potency of the one or the other having given rise to the abnormal form. Most of them are absolutely sterile, a point which makes the study of them extremely difficult and vexatious; and even where they are fertile, as in *Dianthus arenario-pulchellus*, there is a tendency, like that so well known amongst animals, and to which the term Atavism has been given, to revert to the ancestral type.

Occasionally, however, especially in plants which have been long cultivated, or amongst species which at the same time have a very intimate elective affinity, and are so closely allied to each other that they seem merely marked varieties, such as *Matthiola annua* and *glabra*, *Malva sylvestris* and *Mauritiana*, *Lychnis diurna* and *vespertina*, *Primula elatior* and *officinalis*, differences of form and colour occur amongst the typical hybrids which have no constancy, and which cannot be obtained with certainty on repeated experiments. These differences are generally such as are manifest only in the living plant, as in the degree of roughness, undulation, viscidity, &c. It is supposed by Mr. Herbert, that variations of this kind arise from the application of a quantity of pollen insufficient to produce a real typical mule, though potent enough to effect slight changes. To this notion, however, the author is opposed, on the ground that experiment seems to show that the completeness or incompleteness of impregnation influences merely the perfection of the fruit and seeds, and that a quantity of pollen insufficient for the impregnation of an ovarium produces only imperfect fruit and seeds, but gives rise to no distinct type; for unless a proper quantity of pollen be applied, the seeds are never perfected, or the embryo is inert. Direct experiments also show that the time of impregnation, whether early or late, be the state of the stigma what it may, has no influence on the produce.

No such deflections from the normal type of the mules have occurred to the author in plants brought immediately from the woods or fields, but only amongst individuals which have been long under cultivation.

It appears from experiment, that where impregnation takes place between two pure species, it is an universal rule, "that the characters of the parents never remain pure and unaltered in the formation of the hybrid." In general every part of the new production is modified, so that it presents a decided difference from either of the parents, though resembling the one more than the other. In no case, however, are anomalous forms generated bearing no resemblance to either. At the same time they are not produced according to mathematical formulæ and ratios; their differences are mingled in unequal proportions, and may be arranged under three heads, viz. intermediate, mixed, and decided hybrids, of which mention will be made presently. And it is to be observed, that the change does not always take place in the whole of the plant, as though the principle on which it depends penetrated into the intimate structure of the whole plant; but even in the most decided hybrid types, as *Nicotiana paniculato-vincæflora*, and *vincæfloro-Langsdorfii*, as well as in the mixed forms, particular organs undergo only a very slight modification, while others are materially changed.

It was remarked, that no instance has occurred in which the characters of the parent remain perfectly unaltered in the hybrid. An apparent exception, however, to this rule requires notice. In 1846 *Lychnis flos-cuculi* was treated with the pollen of *Cucubalus Behen*. Amongst many normal plants of the former, a single example occurred, which differed as to habit and blossoms not the least from the female parent, but the leaves in form and in their glaucous appearance, especially the root-leaves, agreed completely with those of the male. Repeated attempts to reproduce this form were unsuccessful. The author, however, does not regard the partial alteration of form and substance of the leaves as the effect of the strange pollen; but believes that all the plants produced arose from an impregnation of the *Lychnis* with its own pollen after the attempted hybridization with that of the *Cucubalus*, especially since all of them, whether normal or exceptional, were as fruitful as the mother-plant.

In *Nicotiana suaveolenti-Langsdorfii* and *vincæfloro-Langsdorfii* the change is very slight, consisting merely in a trifling alteration of colour in the blossoms, in the violet or blue colour of the anthers, and in a partial separation of the stamens from the tube of the corolla: in other respects the resemblance to the female parent is very close, insomuch that doubts as to their being really hybrids might be entertained, were they not completely barren. Unfortunately it is impossible to reverse the experiment in these cases, as *N. Langsdorfii* is not fertile except when impregnated with its own pollen.

Various notions have existed, both in the animal and vegetable kingdom, with respect to the degree of influence which the sexes have in the production of hybrids: according to one authority, the male, in animals, giving origin to internal qualities, the female to external; to another, the former to the cellular system, the latter to the nervous, &c. Amongst plants, the difference of opinion is as great; but the truth appears to be, that no general rule can be laid down—in *Digitalis* the influence of the female parent being predominant, in *Nicotiana* that of the male, and the differences exhibited by individual species are no less decisive against any universal law. And this is no less true as to comparative degrees of fruitfulness. Indeed, the identity of the produce, when the sexes are reversed, is a sufficient proof of its non-existence.

In the occurrence of exceptional types it is probable that the difference arises from some peculiar constitution of the individual ovule, rather than from any different condition of the pollen.

It is curious that the specific difference of nearly allied species appears more distinct in the hybrids to which they give rise than in the pure species. For instance, *Lobelia cardinalis*, *fulgens*, and *splendens*, than which no species can well be more intimately allied, give totally distinct hybrids when united with *L. syphilitica;* and many other instances might be brought forward: while on the contrary *Nicotiana magnifolia*, *macrophylla*, *marylandica*, and *petiolata* give identical hybrids when impregnated with *N. glutinosa.* The obvious conclusion is, that the supposed species are in reality mere forms, and that hybrid types depend entirely on the specific distinction of species, and not on any external influences. If such were the case, exceptional types would be of more common occurrence.

One of the most singular effects of hybridization is that which is sometimes produced on the cotyledons of the mule in the first generation. It often happens that in a given genus there is a strong general resemblance in the form of the cotyledons. But this is not always the case. In *Dianthus* they vary considerably, and there is a corresponding variation in the hybrids, as is also the case with *Nicotiana quadrivalvis*, in which the cotyledons differ greatly from those of other species.

The general type of a hybrid is preserved throughout the whole life of an individual. Mr. Herbert found this to be the case in hybrids of Camellia. The blossoms, however, do not always remain so constant, especially in hybrid varieties, as the florist knows to his cost.

Different degrees of resemblance to the parent types are exhibited by different hybrids, insomuch that though, as Mr. Herbert says, a well-skilled florist may guess the result of any particular experiment with tolerable accuracy, yet as the forms are not fashioned according to strictly mathematical laws, but after some vital energy which we can only estimate by its effects, we can form no absolutely certain anticipation.

It was said above that hybrids may be divided into intermediate, mixed, and decided types. These divisions, however, are far from being strictly definite. Each of these heads may be briefly considered.

First, then, hybrids occur in which the characters of the parents are so intimately blended, that it is impossible to say to which there is a greater resemblance. Something in such cases must depend upon individual judgment, and the degree of aptitude in tracing accurately differences and points of resemblance. Sometimes the result as to the number of organs, where differences exist in the parents in this respect, is curiously intermediate: as, for instance, from the three stigmas of *Cucubalus* and five of *Lychnis*, arise the four of *Lycnicucubalus*.

The second class is that of mixed hybrids. In these, one part or other of the hybrid approaches the paternal or maternal form, though the characters of the parents never pass altogether pure into the new organism. Melons are a familiar instance; or, to take one more special, in *Lychnis vespertino-diurna* there is no perfect diurnal sleep, as in *L. vespertina*, but the petals roll back slightly when the sun shines, or the weather is hot. The hybrid resembles *L. vespertina* in its smaller leaves, *diurna* in the vital phenomena—*vespertina* in the larger flowers and straight blunt stigmas, *diurna* in the pubescence—*vespertina* in the more pyramidal fruit, as also in the size and colour of the seeds.

Thirdly, we have the decided hybrids—viz. those in which the resemblance to one of the parents, whether male or female, is so decided, that the agreement is at once perceptible and beyond all doubt. It might be supposed that in this case the predominance of one of the parents might prevent alternate crossing, it being scarcely probable that when the parents were reversed, the result under such circumstances could remain the same. In some instances, indeed, of decided hybrids, alternate crossing does not succeed; but this is far from constant, and in some most decided types the parents may be successfully reversed. *Lobelia cardinali-syphilitica* is a case in point. There are some species, producing decided hybrids, which, when united with several others successively, always predominate in the resultant types. These species have usually some strong peculiarity about them, but it cannot be asserted *à priori* what species are likely to exercise such an influence, and there are other species, again, which prevail even over these. For instance, *Dianthus barbatus*, which communicates its type, as regards leaves and general habit, to *D. Armeria*, *prolifer*, and *Carthusianorum*, is in its turn overcome by *D. caryophyllus* and *superbus*. These species have been called, but not very happily, generic types. These predominating types show clearly that the ratios of the potency through which the union of two pure species takes place must be unequal, and that there can be no question about equivalence of factors. Even in the intermediate hybrids, where the formative powers are so intimately blended, there is still generally some particular organ which shows the prevalence of the one factor over the other.

We cannot trace the origin and development of the different vegetable forms, from the simple cell to the complete development of the perfect vegetable, through all its phases; much less can we distinguish the connection between the changes wrought by hybridization, and normal vegetable metamorphoses. It is very doubtful, indeed, whether vegetable anatomy, improved as it may be, will ever be in a condition to estimate such vital processes. We must rest content, therefore, with the knowledge of the mere facts of the case. New characters sometimes arise in hybrids entirely distinct from those existent in the parents, so that they might reasonably be taken for distinct species. Hybrid forms of *Mirabilis* exhibit such changes in a very surprising degree, as does also the genus *Rhododendron*, and curious instances may be adduced of marked alterations of form and condition in almost every organ.

In few characters is the influence of muling more striking than in the size and colour of blossoms. In many closely allied species, which differ but little in habit or foliage, the colour of the corolla is of great importance. In a wild state it is for the most part constant, and is often indicative of distinct groups or species. In other groups, on the contrary, it is extremely variable, and is notably different at different periods of growth. Where, however, colour is the most constant and distinctive, union is often practicable, and in general the consequence of hybridization is a complete derangement of the laws on which such constancy of hue depends. Neither are the hues resulting from the union necessarily intermediate. Blue and yellow, for instance, do not produce green, as is proved by *Verbascum phœniceum* and *phlomoides*. *Gladiolus cardinali-blandus* exhibits the less brilliant hue of the male parent rather than the splendour of the mother; and in some cases the tone of colour of one of the parents is exhibited under a more brilliant tint, as in *Nicotiana suaveolenti-glutinosa.*

Sometimes the change of colour is exhibited in an increase of the number of typical forms arising from any particular union. *Geum canadensi-coccineum*, for instance, gives a larger number of hybrids with ample orange-coloured flowers, mixed with a small proportion of pale yellow. Mr. Herbert raised from *Rhododendron ponticum* and *Azalea pontica* two specimens with yellow scented flowers like those of the *Azalea*, one with lemon coloured, and one with a chestnut-brown tint intermediate between the purple and yellow of the parents. In reversed impregnation, though the forms are identical, whichever parent be male or female, and the colours generally the same, a change in this respect does occasionally take place. Mr. Herbert's notion, therefore, that the male parent gives the tone to the colouring of the mule is certainly untenable.

In mixed mules, where the pure species is also the female parent of the mule with which it is impregnated, the change of colour is so variable, that scarcely two plants from the same seed exhibit the same colouring. This, consequently, is the most fruitful source of the florist's varieties. In compound bastards, where there are three parents, the mules generally assume the tone of the new male parent.

Not unfrequently flowers of different hues occur in the same plant, as in *Mirabilis* and *Dianthus barbatus.* It has been supposed that this arose from the influence of strange pollen on the blossoms and ovaries; but as the blossom is expanded before the access of the pollen, this cannot be the case. The cause of this variety of colour is at present altogether obscure.

The colours of the capsules and seeds are often altered by hybridization. We have already said that *Pisum* appears to be the only genus in which the tint of the seeds is immediately affected by impregnation, alterations in general not being apparent till the succeeding generation. The common Maize exhibits, after hybridization with forms possessing differently coloured seeds, not merely differently coloured spikes, but spikes bearing variously coloured seeds. No immediate alteration, however, was effected as in *Pisum*, and the same may be said of *Lychnis diurna* and *vespertina*, of which the former has reddish brown, the latter cinereous seeds. These facts confirm the general law, that the influence of the strange pollen in hybridization makes no alteration in the peculiar form and external peculiarities of the fruit and seeds of the mother plant, but merely produces in the embryo, after germination and in the course of its development, a capability of producing a mixed product from the concurrence of the two factors.

As in the case of flowers, party-coloured or differently coloured fruits exist sometimes on the same stem. Such phenomena do not appear, however, to be the effect of hybridization, but to be ascribable to the tendency of plants to produce varieties. With regard to the fructifying organs, the male are affected more than the female. The number is often increased, but their fertility impaired or wholly destroyed. The stamens, though externally perfect, are often diseased and disposed to fade prematurely; and this not in a few blossoms only, but in all equally, while the anthers are well formed, but for the most part sterile. Sometimes, indeed, they are smaller than in pure species, shrivelled and discoloured, and contain no perfect granules, but merely an inorganized mass; or the pollen is scanty and white, and no dehiscence takes place. The fertility of the pollen cannot, indeed, always be determined either by external appearance or from direct experiment, as impregnation does not always take place even with pure pollen; and some plants are more easily fecundated with pollen taken from another individual of the same species than with their own. In almost all fertile bastards, the normal pollen grains are mixed with many that are smaller and imperfectly organized; and, as a general rule, the colour is less vivid than in the parent species. Sufficient attention does not appear at present to have been paid to the protrusion of the pollen tubes in hybrids as compared with that in pure species, nor to the contents of the pollen grains.

The number of styles is also frequently increased in the blossoms of hybrids, especially those which open first. It is, however, far more difficult to form any judgment as to their fertility than with respect to the stamens. This may, indeed, be sometimes anticipated from their preternatural elongation, the far rougher surface of the stigma, or the increased time during which the stigma remains moist, or in other cases by its speedy discoloration. The ovules too, though often perfect externally while they are really barren, are frequently shrivelled and abortive; and even in fertile hybrids the number of ovules capable of impregnation appears to be small, whatever quantity of pollen be applied to the stigma.

The greatest change in the fructifying organs takes place in the union of diœcious and hermaphrodite plants, affecting, however, as in animal hybrids, the male organs first, and to a greater degree.

We are obliged to pass without notice several chapters relative to the fruitfulness of hybrids under various points of view, though far from uninteresting. We proceed to consider very briefly a few phenomena exhibited by the impregnation of hybrids.

Those presented by the corolla and female organs are just those which take place on the impregnation of a plant with strange pollen. If the mule is tolerably fruitful, the corolla falls off at the usual time; but if it is only very sparingly fertile or entirely sterile, it remains longer, or the whole blossom falls. The stigma continues moist long after the anthers have lost their pollen, and the whole course, from the perfecting of the stigma to its fading, is longer than in natural fructification.

Even where there are a few perfect pollen grains in the anthers, impregnation does not always take place in mules with their own pollen, probably in consequence of the good grains not being sufficiently numerous to ensure success. Many fertile mules, therefore, require artificial impregnation, and that frequently repeated, to produce fruit: and in general typical mules appear to become less fruitful as they recede from their original stock—a fact exactly contrary to what is exhibited by varieties. The more fruitful hybrids retain their typical form after many generations, such as *Aquilegia atropurpureo-canadensis*, &c.; the greater part, however, yield forms deviating more or less from the normal type, the variations being chiefly confined to the flower. *Hippeastrum Johnsoni* (*regio-vittatum*) was observed by Mr. Herbert, when fertilized with its own pollen, to have less beautiful and smaller blossoms. Differences, however, of general habit, or of other especial organs, occasionally take place. In cases where impregnation is not effected with their own pollen, mules are often capable of fertilization with the parent pollen, for which in general they exhibit a greater elective affinity than for their own, and the same may sometimes be said of certain pure species. Of the two kinds of pollen, that from the male and that from the female parent, the greater elective affinity appears to reside with that parent to which the hybrid bears the closest resemblance. The impregnation of fertile mules with their own pollen is a very fruitful source of florists' varieties, as well as that of the female parent with the pollen of the mule.

When the hybrid is impregnated by the original male parent, the result is much the same as in simple hybrids self-fertilized, both in respect of the types produced and the degree of fertility. Various forms are raised from one capsule, and the different individuals do not present the same degree of susceptibility for impregnation. Different capsules, too, offer very different results. When these mules are in turn self-impregnated, either naturally or artificially, they are commonly more fruitful than they were after the first impregnation. As might be expected, the seedlings approach nearer to the paternal type: when the original simple mules in their second generation and the paternal hybrids of the second degree exhibit a return to the type of the maternal ancestor, such a return is never perfect, but only partial.

The tendency of varieties to return to the maternal type seems to be a peculiarity general to the vegetable kingdom, especially if left to themselves, free from the trammels of cultivation. This return, however, in the second generation of simple hybrids, or of paternal mules of the second degree, is always effected by fructification, and not by any other mode of propagation. It seems also more easy than the approach to the paternal type, though in neither case does it take place to a considerable extent, nor does it take place in all genera, and when it does occur the produce is less fertile. Mr. Herbert believed that such deviations from the normal type might arise, when the proper pollen was insufficient for impregnation, from the access of the pollen of some nearly related species; but this contradicts the laws which have been established as to elective affinity.

In very fruitful hybrids no such deviations or different types have been observed; it should seem therefore that the integrity and force of the organs of fructification prevent the occurrence of such deviations. It appears, too, that the paternal element is of greater power to produce variations of form than the maternal.

When hybrids are impregnated a third or fourth time with the pollen of the original male parent, they gradually approximate more and more to the male type, and at last are not distinguishable from it, except perhaps in a less degree of fertility, though this negative sign vanishes sooner or later. There is no certainty as to the number of successive impregnations necessary to produce this complete change. Different species exhibit in this respect very different results. *Nicotiana rustico-paniculata*, even in the fifth degree, is occasionally completely sterile either as to the stigma or anthers, but especially as regards the latter.

Mules, however, may be also impregnated with the pollen of the mother plant. The maternal type is of course prevalent in such mules, which may account for the greater fertility of maternal than paternal hybrids. A greater number also of different types is formed than in the second generation of simple hybrids, and the second degree of paternal bastards, where they are at most two or three, insomuch that if the colour of the blossoms be taken into the account, they amount in *Dianthus chinensi-barbatus* ♀ *chinensis* ♂ to fifteen. All bear a greater or less resemblance to the maternal type. In the next generation, whether fertilized with their own or with the pollen of the original mother, most of the plants have completely reverted to the mother type.

Thus by the means of hybridization one species is changed gradually into another, though the hybrids themselves through the whole period of their existence preserve their proper type. The simple hybrid reverts to the mother type by repeated impregnation with the maternal pollen, or when the paternal pollen is applied, goes forward to the type of the father: the conversion of the mother into the father is, however, seldom synchronous with the contrary change. *Nicotiana rustica* was changed in this manner by Kölreuter into *N. paniculata*, and similar changes have been effected by others. The experiments require much care and time, and great caution to avoid error; but there is not the least reason to doubt the truth of the fact, as has been done by some impugners of the sexual theory. It is obvious that to ensure success, species must be chosen which are pre-eminently disposed to hybridize, and whose mules are fertile, otherwise the experiment will be stopped in some of its stages by the sterility of the hybrids. The predominance of fructiferous power must also be on the female side, as the pollen of the pure species is to be used. The subjoined table shows the number of impregnations requisite to complete the changes: the results of experiment, however, are not always the same.

Aquilegia atropurpurea	became	*A. canadensis*	in 3	generations,
——— *canadensis*	”	*atropurpurea*	4	”
——— ———	”	*vulgaris*	4	”
Dianthus arenarius	”	*caryophyllus*	5—6	”
——— ———	”	*pulchellus*	5—6	”
——— ———	”	*chinensis*	5—6	”
——— ———	”	*superbus*	5	”
——— *Armeria*	”	*deltoides*	5—6	”
——— *barbatus*	”	*Carthusianorum*	3—4	”
——— ———	”	*chinensis*	5	”
Geum urbanum	”	*rivale*	4	”
Lavatera pseudolbia	”	*thuringiaca*	4	”
Lychnis diurna	”	*vespertina*	4	”
——— *vespertina*	”	*diurna*	3	”
Œnothera nocturna	”	*villosa*	4	”
——— *villosa*	”	*nocturna*	4—5	”
&c.		&c.		

This change, be it observed, is totally different from those supposed effects of external circumstances in converting one species into another of a very different structure, as oats into rye, rye into *Bromus secalinus*, *Bromus sterilis* into *Hordeum murinum*, *Brassica rapa* into *Thlaspi arvense*, or this latter into *Camelina sativa* and *Capsella Bursa pastoris*. That all these supposed changes are mere illusions we do not doubt for an instant, and the curious case figured in the 'Gardeners' Chronicle' for 1849 is an instance of one mode in which delusion may have occurred. The effects of grafting are far more interesting, but in reality are little connected with our subject, and we the rather pass them by, as so much has been said on the subject in Mr. Herbert's valuable memoir in this Journal.

We regret that we have no room for any notice of the author's remarks on the Classification of Bastards, though something has already been said on the subject; and we must also pass over his observations on varieties and their mules, as also on the occurrence of wild hybrids. There is, too, a long chapter of sixty pages on the distinctive marks and peculiarities of hybrids, but it contains little that has not been already noticed.

We conclude with a short abstract of his last chapter, which treats of the practical uses which landowners and floriculturists may derive from the production of mules.

The peculiar tendency of hybrids to luxuriance in their stem and foliage, and the facility with which they are propagated by cuttings, layers, &c., is obviously of great consequence to agriculturists.

Little has been done at present in the hybridizing of cereals, but Mr. Herbert believes that more useful varieties than at present exist of wheat, oats, and barley might be produced by combining the fruitfulness of one variety with the hardiness of another, to both of which might be added the thin skin and consequent superior weight of a third. Knight's wrinkled peas are a proof of what may be done by hybridizing, and it is probable that much might be effected in beet, cabbages, carrots, celery, &c., by especial attention to this point.

Amongst woody plants also there are instances of peculiarly luxuriant growth, such as *Lycium barbato-afrum.* Varieties therefore might be produced, of much more rapid growth, which for some purposes might have their value, though the quality of the timber would probably suffer.

Another peculiarity of hybrids is their precocity, of which advantage may be taken where early fruit is desirable, or where the summers are not long enough to ripen the later fruit.

A very important quality of hybrids is also their power in very many cases of enduring a greater degree of cold than the pure species from which they are derived, and hence the acclimatisation of many useful plants by means of hybrid forms or varieties may be effected. The hybrids, for instance, of *Nicotiana* are far less susceptible of frost than their pure parents, a circumstance of very great importance if the cultivation of tobacco were to be materially extended.

The great fruitfulness of many hybrid varieties is also a material point as regards their useful qualities, especially in orchards and vineyards, and where ornament, effect, or what the Germans call æsthetic botany in its various branches is concerned, hybrids supply an endless subject of experiment.

And lastly, the longer duration of many hybrids and their more persistent larger blossoms make them especial objects of favour and delight.

The great difficulty in the way of experiment is the frequent want of fertility in the seeds of hybrids, and their tendency to wear out, wherever there is a possibility of impregnation from neighbouring varieties.

An appendix is subjoined to the work, containing an account of the manipulations of which the author made use in his experiments, and a list extending to above forty pages of all the species which have been submitted to experiment.

II.—*On Transplanting Trees.* By Joseph Holmes, Gardener to the Marquess of Winchester, Amport House, near Andover, Hants.

(Communicated November 30, 1850.)

The accompanying memoranda refer to a number of trees which were transplanted in an enlargement of the park at Amport. Being elevated and seen from every part of the park, it was desirable that the ground should be planted so as to give immediate effect; and with this view, toward the latter end of September, 1847, and without the trees intended to be transplanted having had any previous preparation whatever, operations were commenced with a machine, consisting of a pair of wheels, and a strong ash pole, 15 feet in length, similar to the contrivance used by Sir Henry Stewart of Allanton. Very few trials, however, were sufficient to show that the machine referred to was in many respects objectionable, and incapable of doing the work required, as the obtaining a good ball of earth along with a tree thus lifted was next to impossible; and notwithstanding every care in packing and tying, it was very rarely that a tree could be lifted without the hole of the machine barking it; and then the time occupied in the work was another objection, to say nothing of the risk of barking a tree, which in other respects might be well managed.

The following description of the machines used in transplanting the Amport-park trees will, from their great simplicity, both in construction and use, be readily understood, even in the absence of any drawing of them. They were found to answer the purpose exceedingly well, and quite to supersede the contrivance first used, which I call a "truck" or "sledge." It differs from the latter only by its running upon a roller, instead of the bottom being dragged upon the ground. It consists of a strong framework, 5½ feet long by 4½ feet wide, flat boarded at the top, and running upon a roller 10 inches in diameter, and the same width as the truck, having at one end a strong ash pole or handle, acting as a lever power to balance the tree in travelling. This pole is 15 feet long, and fixes into a socket similar to the pole of a carriage, and is made to take out as required. The roller has iron axles, with corresponding "bush" or socket inserted in the side of the frame of the truck. There are two strong rings, one on each side, near the pole end of the truck, by which to fasten the tree. The end of the truck opposite the pole end is *tapered*, so as to get well under the ball of the tree to be removed. The general appearance of this machine when in use is that of a ponderous shovel running upon a roller, and carrying the tree upright upon what may be called the shovel, and having one or two men, as occasion may require, at the end of the handle or pole, holding by a cross piece let in at the end of the pole. This is merely to balance, steady, and turn the machine, as may be necessary.

In using the machine, a good trench is first made round the tree, sufficiently far from the stem to retain all, or as many as can be got, of the young roots. These are tied in bundles, and taken great care of. Then with the fork and pickaxe the ball is reduced to such a size as can conveniently be managed, *i. e.*, from 4 feet to 6 feet in diameter, according to the height of the tree, and state of the roots. Having worked well under the ball until the tree is loose (or previously), a man is sent to tie a rope to the stem, at about two-thirds the height of the tree. If necessary, this rope is afterwards used as a guy rope, and if the tree is tall or heavy headed a second guy rope is employed. The tree is then pulled over on one side, until the top touches the ground, and the ball is on edge. A roadway for the truck having been made, sloping from the natural ground to the bottom of the hole, the tapered end of the truck is then pushed under the ball, the tree having been pulled over to allow the truck to be pushed under, as far as possible. The ball of the tree is then let gently down upon the truck, and a chain is fastened from the rings of the latter, round the bottom part of the stem, a mat or old sack being placed so that the chain shall not injure it when the latter is tightened, which is done by a short lever, which twists it as tightly as possible, to prevent the ball from slipping. This being done securely, the horse or horses draw the tree out of the hole, a horse being fastened near each corner of the truck, to a strong "eye" or "drail," similar to that by which at any time a second horse is put to a cart. The tree being fairly on level ground, the pole is put into the socket at the end of the truck, and fastened by an iron pin, and in the mean time the horses are yoked to the tapered end of the truck, both ends being furnished with fastenings; and thus the tree is conveyed where it is destined to stand.

In placing the tree on its new site, nothing more is necessary than to have a good hole made a foot or more wider every way than the roots extend. A roadway for the truck is cut from the natural surface to the bottom of the hole, and on the opposite side means are afforded for the horses to get out of the hole. The truck being in the middle of the latter, loosen the chain, take out the pole, bring down the head of the tree so as to allow the edge of the ball to touch the bottom of the hole, then draw out the truck, and should the tree not have got quite an upright position, pull the ropes to render it so, at the same time packing the ball with fine soil until it stands upright of itself. Every root that has been injured in taking up should now be cut smooth, and every one laid out as straight and natural as possible, resembling the rays of a circle, great care being taken to pack fine soil firmly round the ball, and to surround every fibre with the best and finest soil, until every root is covered.

The machine just described was found to perform its work expeditiously, and to be capable of even effecting more than was anticipated ; and hence it was tested to a greater extent than was previously intended, until one disadvantage discovered itself; but this was easily obviated.

In using the machine for trees with very large balls, I found, in some instances, that the weight could not be got sufficiently to the pole-end of the truck, so as to be balanced by two or three men ; I therefore had a moveable false bottom made, resembling a second top to the truck. Three iron rods, three-fourths of an inch in diameter, were fixed lengthwise on the under side of this moveable bottom, and upon the original truck were fixed three grooved or pulley wheels to each rod, corresponding in size, and acting as a sort of railway, so that the original bottom made a platform for the new top, which could be let up or down at pleasure. Between the two there was a cavity of an inch, and in order to attain the desired object, two common strong screws, such as are used in various mechanical operations, each two feet long, and, including the *thread* of the screw (which *thread* is of the square projecting form, and each *thread* one-fourth of an inch apart), two inches in diameter, were fixed at the pole-end of the truck. In using these screws, we will suppose the tapered end of the truck to be placed to the tree, as before, but by winding down the false bottom it projects nearly two feet more, and thus it is pushed as far under the ball as possible ; then by screwing this false bottom up, and at the same time tightening the chain, we get the ball of earth two feet nearer the pole-end of the truck, so that two or three men can balance the tree, which previously could not have been done by several more, to say nothing of the strain upon the machine. By this means very large balls of earth were removed with trees, the machinery for which *appeared* inadequate. No. 31 Beech was the largest tree removed by this mode : but this machine, excellent as it was for trees up to a certain weight, was found incapable of removing the largest ; for as the autumn advanced, successive rains rendered that part of the park recently laid down in grass unfit for a roller so small in diameter, and with several tons in weight upon it, although upon old turf it answered well, and left no mark ; and also tall heavy-headed trees and windy weather rendered more force necessary at the guy ropes—a force, by the way, not always to be depended on, and not well placed, as it will be seen that the guy ropes were the only means of keeping the tree upright ; and in the case of a very tall heavy-headed tree, though it rested firm and secure at the bottom, with nothing more than a chain to brace it firmly to the top of the truck, the wind was apt to displace it, if the force at the guy ropes was inadequate.

It was in consequence of the state of things above referred to that I adopted the following mode for removing the largest trees.

By this plan a little more time was necessary; but by it men at the guy ropes were dispensed with. The preparations for removal having been arranged as before, *i. e.*, the ball being well worked under, and a good roadway made out of the hole, a common strong timber carriage is brought up. The fore wheels are separated from the hind ones; the former are run backwards down the roadway, towards the tree, and the hind wheels on the opposite side (a more abrupt way having been cut for them, as it is of no further use as a roadway), so as to place the tree to be removed in the middle, and so that the ball and roots clear the wheels. Instead of the pole belonging to the carriage when used for timber being retained, a pole with a slight curve in the centre, so as not to come in contact with the stem of the tree, is used, which, together with two strong oak or ash beams, about a foot square, by about 12 feet long, serve to connect the wheels, and sustain the weight of the tree to be lifted, and two short cross-pieces about three feet in length, and from two to three inches thick, are placed at right angles with the beams running lengthwise, the stem of the tree being in the centre of the whole. These cross beams have each a hole cut through, about six inches by two and a half inches, in order to let the *eye* of the screw through, the screws being the same as were used for the truck, with the addition of this *eye*. The top of these cross beams sustains the *plate* in connexion with the screw, which plate is six inches square. Connected with the plate is the *box* or *nut* through which the screw passes. The screws are worked by levers inserted in their heads horizontally; and there is an *eye* at the bottom of each screw, made very strong, for the chain to pass through; it is then braced completely round the ball of the tree, so as to injure the roots as little as possible, and care is taken that each chain has its due share of the ball or weight of the tree, and also that an old mat is placed next the ball, then a piece of plank, and next to this the chain, so that neither ball nor roots may be harmed. A man is then placed to work each screw, which he does by a small iron pin or lever, two feet long. When the men have screwed up as high as the screws will allow, the tree is wedged so as to retain what has been obtained by the screws. For this purpose a few wedges two or three feet long are required, and a few flat boards for the wedges to rest upon firmly. When the wedges are found to sustain the weight, unscrewing is commenced, and the chain tightened. In this way the process of raising goes on, alternately screwing and wedging. If things are well managed, the tree will generally swing at the second screwing up; and in raising a little tact and care are necessary, even in the most trifling matters. Care should especially be taken that the wedges are securely placed before unscrewing; and when the bottom of the ball is high enough to clear the surface of the ground in travelling, the horses are put to, before which it is well to lay a few planks down for the wheels of the carriage to pass over, until upon firm ground. No tying of anything is required, as the pressure upon the screws prevents everything from slipping, and the tree continues perfectly upright during the whole process of removal. A guy rope is attached to each tree by way of precaution; but its greatest use is in placing the tree upright during the operation of transplanting.

When the tree has arrived at its destination, the fore wheels are driven down the roadway, through the hole, till they arrive at an abrupt termination, which is left in order that the tree shall be exactly in the centre of the hole. The ball is then unscrewed until it touches the ground; the chains are loosened; the screws and cross beams are taken down; the hind wheels separated from the fore ones, by pulling out the hind pins or bolts which fasten the beams to the carriage; and lifting the beams, one on each side. and one end only on the ground, the fore wheels are then pulled out, then the hind wheels, leaving the tree standing upright as at first, which concludes the operation, as far as removal is concerned.

When transplanted, each tree is propped with three stakes or poles placed triangularly, and meeting together at from eight to twelve feet from the ground, according to the height of the tree: they are firmly bound together, packing straw between the top of the pole and the tree, the two principal poles being placed as supporters against the south-west winds, which in this elevated and exposed part rendered such precaution necessary.

I consider that the obtaining a good ball of earth along with the tree is a matter of primary importance. I attribute my success more to this than to anything else; and finding that to be the case, every future arrangement was made with reference to this point; and by the above mode of moving much time was saved, and the operation involved no risk. It is in this and other respects that I consider the machinery employed infinitely superior to the principle of Sir Henry Stewart, for example. In transplanting upwards of 200 trees, not one of the number failed, and it was found necessary to sacrifice only one tree. The instance I allude to was that of a fine beech, 42 feet high, removed on Sir H. Stewart's principle. The tree was rooted equally well with any of its contemporaries, but it had no ball; hence it was difficult to rear upright, and notwithstanding every care in propping, the first high wind laid it prostrate, when it was not considered worthy of further trouble.

Immediately after transplanting, every tree was *mulched* with old thatch, as far as the roots extended; and they also had a covering of about half an inch of straw around their stems, from eight to twelve feet from the ground. This was done principally with the view of lessening the demand made upon the tree by evaporation. The straw was found to keep damp a considerable time after every rain. A ridge of soil was also placed around each tree, at the extremity of the roots, forming a sort of cup; and I have frequently seen water standing in these cups half an hour after heavy rain, during the second summer after planting, as by this time, from various causes, the mulch had disappeared, and the surface was firm, owing to the constant treading of sheep which were allowed to feed among the trees during the second summer after planting, and which was no doubt favourable to them.

No further care was bestowed or considered necessary; and no tree was ever watered except during the first three weeks after transplanting, when the water-cart was used to most of the two groups of hornbeam at the time they were in green leaf; and it was thought that thereby an early root action would be induced.

The poles were all removed early in the autumn, after transplanting; and the straw wrapped round the stem of each tree dropped off of itself, after remaining from seven to twelve months.

It should be observed that in many places where the trees were transplanted the soil was very thin, and the subsoil chalk, and over a considerable extent it was a good deep loam. To the former it was necessary to cart soil to cover the roots in transplanting. It was especially thus with Nos. 1, 23, and 24, Beech, and the group of common or horse Chesnut; and I account for the apparent disparity in the growth and general state of the trees accordingly as they were more or less favourably situated in this respect. Their growth, on the whole, is more in favour of the first year after planting; but many favourable circumstances must be considered at the same time: for instance, every tree had a good hole made for it, either of the natural soil or by carting, so as to improve it; in either condition a large quantity of soil was moved, and the roots had the advantage of this, more in the first than in subsequent years. No. 5 Elm was a remarkable instance of this; for its roots had extended beyond where the soil was originally moved. The growing season also of the three years is worthy of remark. The first summer after transplanting may be considered wet. From the beginning of April to the end of September, 1848 (which may be deemed the most growing months), I find the quantity of rain was 15·44 inches; and during the same period in 1849, 12·93 inches; and the same period during the present year 10·35 inches. It may also be worthy of mention, that the trees, as a whole, have retained their leaves three weeks longer the present year than the previous one; and notwithstanding the wet season of 1848, the transplanted trees retained their leaves a fortnight later in 1849 than in the year before that. There is a marked improvement in the appearance of some of the trees since they were transplanted, especially in the elms. Several, when removed, were very mossy, and stunted in their growth, but they are now taking quite an upright tendency, with perfectly clean growth.

MEMORANDA made at the time of Transplanting, and subsequently, respecting the Trees transplanted in the "New" Park at Amport, from September to December, 1847.

No.	Height of each Tree at the time of transplanting, in feet.	Growth of 1848, in inches.	Growth of 1849, in inches.	Growth of 1850, in inches.	Girth of stem at two feet from ground, in inches, 1848.	Girth of stem at two feet from ground, in inches, 1849.	Girth of stem at two feet from ground, in inches, 1850.	Remarks.
				YEW.				
1	13	7	5	5	30	30½	31	
2	18	6	5	4	39	39¼	40	
3	13	7	5	5	19	19½	20	
4	24	3	2	2	38	38½	40	No. 4 removed from a damp, stony soil, and shady situation, to a dry chalky soil and exposed situation.
5	17	4	2	3	27	27½	28	
6	13	3	5	3	23½	24½	25	
7	10	1	2	3	18	18¼	19	
				OAK.				
1	24	9	9	6	14	14½	15	
2	23	5	6	4	18	20	22	
3	25	3	6	3	18	18	18¾	
4	20	6	..	..	13	..	..	No. 4 was taken up during the winter of 1848-49; the roots were found to have grown from 3 to 3½ feet from the time of transplanting.
5	19	2	12	15	13	13	14	
6	17	8	7	4	10	10¾	12	
7	27	5	4	4	32	34	36	
8	25	4	4	4	27	27½	28	
9	26	5	2	3	29	29¼	30	
10	20	6	6	5	13	13½	14	
11	25	5	3	5	20	21	22	
12	17	2	4	5	13	13¼	14	
13	22	3	3	4	21	22	24	
14	16	3	3	12	10¾	11¼	12	
15	24	2	4	8	18	19	20	
16	20	4	4	6	13	14	15	
17	16	1	1	2	24	24	24	
18	25	..	3	4	..	24¼	26	Turkey, planted Jan. 1849.
				BEECH.				
1	34	4	6	3	36	36¼	37	No. 1 planted in very chalky soil.
2	31	10	9	4	22	22½	23	
3	42	12	7	7	26	27	28	
4	32	9	8	4	17	17½	19	
5	43	8	7	6	34	34½	35	
6	43	7	12	6	33	33½	34	
7	48	5	6	6	37	37½	39	

MEMORANDA, &c.—*continued.*

No.	Height of each Tree at the time of transplanting, in feet.	Growth of 1848, in inches.	Growth of 1849, in inches.	Growth of 1850, in inches.	Girth of stem at two feet from ground, in inches, 1848.	Girth of stem at two feet from ground, in inches, 1849.	Girth of stem at two feet from ground, in inches, 1850.	Remarks.
				BEECH—*continued.*				
8	38	5	9	12	37	38	40	
9	36	7	9	6	33	34¾	36	
10	36	5	8	..	36	36¼	37	
11 to 22	25	7	9	12	18 to 26	..	..	Nos. 11 to 22, inclusive, form a group; the numbers give the average growth and girth of the whole.
23	33	3	6	2	40	40	40	No. 23 planted on very chalky soil.
24	36	3	6	6	43	44	44	No. 24 planted on very chalky soil.
25	36	3	5	6	37	38¼	40	
26	34	6	5	4	22	23	24	
27	36	7	6	6	26	27	28	
28	43	4	9	3	37	38¾	40	
29	32	4	6	8	21	22	23	
30	39	7	7	6	37	39	40	
31	38	3	4	3	37	37	37	
32	30	5	12	7	21	23	24	
33	45	4	6	3	30	31	31	
34	32	7	5	4	25	27	28	
35	36	5	7	6	29	33	36	
36	33	7	4	6	24	24¾	26	
37	36	4	3	5	29	30	31	
38	36	4	6	7	29	30	32	
39	36	4	6	4	28	29	30	
40	30	7	6	5	28½	30	31	
41	30	10	5	6	18	19	20	
42	48	8	8	6	24	25	26	
43	25	4	12	6	22	23	24	
44	35	6	6	4	21	22½	24	
45	40	6	5	6	20	21	22	
46 to 49	30	5	6	3	25	27	28	Nos. 46 to 53, inclusive, form a group; the numbers refer to the average growth, &c., of the four larger and smaller.
50 to 53	16	6	4	4	14	14½	15	
54	25	3	3	6	21	22	23	
55	23	7	8	4	34	35	36	
56	35	1	6	4	25	26	27	
57	36	2	3	6	22	23	24	
58	49	4	6	8	30	31	32	
59	45	6	6	4	24	25	26	

MEMORANDA, &c.—*continued.*

No.	Height of each Tree at the time of transplanting, in feet.	Growth of 1848, in inches.	Growth of 1849, in inches.	Growth of 1850, in inches.	Girth of stem at two feet from ground, in inches, 1848.	Girth of stem at two feet from ground, in inches, 1849.	Girth of stem at two feet from ground, in inches, 1850.	Remarks.
				PURPLE OR COPPER BEECH.				
1	35	7	10	6	39	40	41½	
				BIRCH.				
1	42	4	4	6	29	30	30	
2	26	3	3	5	17	18½	20	
3	19	2	8	12	14½	15½	16	
				ELM.				
1	35	3	18	12	34	34¾	36	
2	16	6	6	4	14	15	16	
3	21	4	12	13	14	15½	17	
4	26	9	6	6	16	17	18	
5	27	3	. .	. .	10	. .	. .	No. 5 was taken up Jan. 1849; the roots were found to have grown 8 feet since the time of transplanting.
6	21	4	5	3	18	19	20	
7	19	4	7	7	20	20½	21	
8	21	4	5	16	14	16½	20	
9	19	7	7	6	14	15½	17	
10	19	6	5	18	16	16¾	19	
11	36	3	2	6	40	40	40	
12	28	2	. .	. .	19	. .	. .	Nos. 12, 13, and 14, were taken up Jan. 1849; their roots were found to have grown, respectively, 6, 5, and 4 feet each, since the time of transplanting.
13	25	5	. .	. .	21	. .	. .	
14	23	4	. .	. .	24	. .	. .	
15	29	3	5	6	27¾	29	31	
16	29	3	6	6	23	26	29	
17	29	3	6	7	20	21	22	
18	32	3	2	2	18	19½	21	
19	30	2	3	2	26	28	29	
20	30	2	5	4	25	26¾	28	
21	28	2	3	4	20½	21¾	23	
22	26	8	8	6	24	25½	27	
				LIME.				
1	16	18	5	18	9	10	11	
2	13	18	8	15	10	11	12	
3	36	10	9	2	27	28	28	
4	15	4	3	12	10¾	11¼	12	
5	13	6	6	15	10½	11½	12	

MEMORANDA, &c.—*continued.*

No.	Height of each Tree at the time of transplanting, in feet.	Growth of 1848, in inches.	Growth of 1849, in inches.	Growth of 1850, in inches.	Girth of stem at two feet from ground, in inches, 1848.	Girth of stem at two feet from ground, in inches, 1849.	Girth of stem at two feet from ground, in inches, 1850.	Remarks.
				HORNBEAM.				
group of 17	30	$3\frac{1}{2}$	4	4	24	25	26	Average of the 17 trees. Planted in good loamy soil.
group of 19	30	$3\frac{1}{2}$	6	7	20	21	22	Average of the 19 trees. The group of 19 was planted in chalky soil.
				HORSE CHESNUT.				
1	28	6	12	6	30	31	32	
2	14	6	12	4	9	10	11	
3	15	2	8	4	14	$15\frac{1}{2}$	17	
4	20	2	4	5	19	$19\frac{1}{2}$	21	
5	24	5	4	4	25	27	27	
group of 15	15 to 24	3 to 4	6 to 7	3 to 4	15 to 28	16 to 29	16 to 30	The group of 15 was transplanted on very chalky soil.
21	25	3	4	4	31	32	32	
22	26	4	4	4	28	28	28	
23	33	2	2	3	35	35	36	
24	32	2	3	3	29	31	33	
25	23	3	3	1	34	35	36	
				SYCAMORE.				
1	20	6	4	5	13	$13\frac{1}{2}$	14	
2	30	6	7	4	22	22	22	
3	17	7	5	6	11	12	12	
4	15	4	4	5	12	$12\frac{1}{2}$	13	
5	15	4	6	5	7	$7\frac{1}{2}$	8	
6	25	7	4	4	16	$16\frac{1}{2}$	18	
7	36	7	6	6	25	27	28	
8	30	2	7	2	19	22	23	
9	..	3	4	3	17	18	19	
10	26	3	2	3	$18\frac{1}{2}$	19	20	
11	34	3	2	2	25	26	26	
12	..	3	4	4	18	$19\frac{1}{2}$	21	
13	25	6	2	2	22	23	24	
14	28	3	4	4	22	23	24	

MEMORANDA, &c.—*continued.*

No.	Height of each Tree at the time of transplanting, in feet.	Growth of 1848, in inches.	Growth of 1849, in inches.	Growth of 1850, in inches.	Girth of stem at two feet from ground, in inches, 1848.	Girth of stem at two feet from ground, in inches, 1849.	Girth of stem at two feet from ground, in inches, 1850.	Remarks.
				SYCAMORE—*continued.*				
15	38	3	4	4	24	25	27	
16	37	2	2	3	18	19	20	
17	18	3	3	2	18	19½	20	
18	23	3	2	3	16½	17½	18	
19 to 24	..	..	..	..	..	..	..	Nos. 19 to 24, inclusive, form part of a group, and being smaller trees were not measured.
25	24	2	2	1	22½	23½	24	
26	28	3	4	3	17	18	19	
27	27	2	4	2	24	25	26	
28	32	3	3	2	25	26	27	

Total number of Trees planted 204
" " now remaining . 199

III.—*Report on New Fruits and Vegetables which have been produced in the Garden of the Society, together with some Account of Halliman's Fruit Protectors.* By R. Thompson.

(Communicated December 3, 1850.)

1. SEEDS of Cauliflowers received this year under the following names were all sown, April 9; and subsequently treated alike in every respect:—

1. Mercer's New Pearly.
2. London Particular.
3. New Dwarf Late Cyprian.
4. Epps's Superb.
5. Early Cauliflower.
6. Large Asiatic.
7. Early Leyden.
8. Walcheren.

Nos. 1 to 5, inclusive, appeared to be all the same. That called New Dwarf Late Cyprian was neither dwarfer nor later than the others. The Large Asiatic, from Schertzer of Haarlem, proved, as formerly, an excellent Cauliflower; but the Early Leyden Cauliflower from the same establishment turned out badly, more than one-half being nearly the same as the Drum-head Cabbage. This is the more to be regretted, because in former seasons the Early Leyden from Schertzer was found to be the same as Legge's celebrated Walcheren Broccoli or Cauliflower, true seeds of which are often difficult to obtain. No. 8, Walcheren, from Mr. Cock, was correct. The result of the trial is, that several new names are rendered unimportant; whilst two varieties, namely, the *Large Asiatic* and the *Walcheren*, are found to be those most deserving of cultivation.

2. "Halliman's Fruit Protectors" have been tried for Peaches on the South Wall. They forward the ripening a little; and they are useful for preventing the fruit from falling on the ground. In some cases, however, they are apt to scorch it. On the whole, it cannot be asserted that the advantages resulting from their use would equal the expense. They would not answer the purpose of growers for the market; but gentlemen's gardeners and others would find some of them convenient for protecting any particular sort till it acquired a greater degree of ripeness than it could otherwise attain. The fruit may be left a day in the glasses after it parts from the tree.

3. The Barker Nectarine.

Presented to the Society by Mr. Barker, of Suedia, and received March 31, 1841.

The tree was then a half-standard, with a rough, irregularly-formed top. It was noted as producing leaves with globose glands, large flowers, and *peaches* of little merit. Subsequently one small twig was observed having leaves with reniform glands. Buds from this were taken and worked on a tree against the South wall. Fruit of it has this year been obtained for the first time, and proves to be the Nectarine.

Leaves with reniform glands. Flowers small.

Fruit large obovate, dark red next the sun, pale yellowish green where shaded. Flesh fine, yellowish white, rayed with bright red at the stone, from which it parts freely; rich, in this unfavourable season, but scarcely so aromatic as that of the Violette Hâtive. Stone larger than that of the sort just mentioned, flattish, obovate. Kernel *bitter*. This variety is quite distinct from the Stanwick Nectarine originally obtained from the same gentleman, the one having a sweet, and the other a bitter kernel.

Large fruits are more difficult to ripen than small; and therefore this will require to be grown against a south aspect; and, favoured by a warmer season than this has been, it will doubtless prove a very fine Nectarine.

4. Cos Lettuces.

Waite's White Cos.—A very good lettuce, greener than the White Paris Cos, but not of so dark a green as the Green Paris Cos. Seems intermediate as regards these two; and like them does not readily run to seed.

Common White Cos.—Runs to seed much earlier than the preceding.

Wellington Cos.—Proves to be the same as the Green Paris Cos.

White Paris Cos.—Of all the varieties of Summer Cos Lettuces, this was the *largest*, the *best*, and the *longest in running to seed.* It was sown April 10th, and had not commenced to run July 27th, when all the other Cos Lettuces, sown on the same day, were showing flower.

5. Cabbage Lettuces.

Swedish or Sugar Lettuce.—Received from Schertzer of Haarlem; proved to be the same as the Laitue de Versailles from Vilmorin.

Victoria Cabbage Lettuce.—Worthless; soon runs to seed.

Laitue de Russie, received from Bossin and Co., Paris.—Too soft and loose; does not form a crisp, compact heart.

"*A very handsome Cabbage Lettuce.*"—Received from Mr. Cattell. This appears to be the same as that called by some the Belle Bonne. Leaves fringed, and tinged with reddish brown, and hence objectionable.

Malta—Laitue de Malte, from Messrs. Vilmorin.—Seeds of this have been frequently distributed by the Society. Sown April 10th; it was only running partially July 27th. A good Cabbage Lettuce, larger than the Neapolitan; leaves dentate, their margins not curled.

Neapolitan Cabbage Lettuce.—Laitue Chou de Naples, from Messrs. Vilmorin.—Sown April 10th; still remained in the cabbage form, without running, July 27th. Compact, finely blanched, crisp, and tender. Leaves having the margins dentate and a little curled. As in the last season, so in this, it has proved the best Cabbage Lettuce.

From the investigation of summer Lettuces above detailed, it appears that, for summer use, the White Paris Cos is the best of the Cos Lettuces; that the Malta and Neapolitan are the two best Cabbage Lettuces; and that various others, reputed new and good, are not deserving of cultivation.

IV.—*On Growth and Extension in the Vegetable Kingdom.* By H. F. Link, M.D., F.M.H.S.

(Translated from the German.*)

Vegetable physiology is now in the same state in which human physiology was above two hundred years since. The circulation of the blood from the heart back again to the heart was then unknown; it was even believed that the arteries contained air, and that it was only under peculiar circumstances that any blood penetrated into them. In the same manner we do not yet know through what inner parts of the plant the nutritive matter rises from the earth: some are of opinion that it is through the spiral and other similar vessels, whilst others maintain that these vessels only contain air, because we only see air in them, and that the sap rises through the cellular tissue. So different are the opinions held on one of the most important facts in vegetable physiology. But however this may be, the practical man must direct his attention to these theoretical investigations, were it only to avoid being led astray by them.

I speak here only of those plants in which we recognise distinct organs—stem, leaves, and fruits—which I shall term *Phanerophytes*, because in them everything is open and perceptible. Lichens, therefore, algæ, and fungi are excluded, because in these we observe no distinct organs. We may call them *Cryptophytes*, or hidden plants, because in them their whole vegetable being is hidden from us. I should have adopted the well-known distinction between Phanerogams and Cryptogams, were it not that mosses have distinct sexual organs, which are wanting in the much more perfectly developed ferns; or the division into cellular and vascular plants, but that mosses, with their evident sexual organs, have no vessels. We shall commence with the Phanerophytes; for we must not, as is usually done, judge of palms from the algæ, of the eagle from the earthworm.

Phanerogamous plants are remarkable in this, that they consist in almost all their parts of membranous cells, round (globular) and angular, elliptical (ellipsoid), cylindrical, and prismatic, containing sap or air. In this respect they differ strikingly from animals, in which the principal parts at least do not consist of such cells. A cellular structure has indeed been found in some parts of animals, and it has been conjectured, not without some grounds, that all parts of animals were originally formed from cells; but, independently of the circumstance that this is mere

* The original of this interesting paper is illustrated by microscopical views of various points of vegetable anatomy. The latter having been omitted in this place, the text has been slightly altered in consequence.

hypothesis, a single glance with a microscope is enough to show that the skin, the veins, and the muscles, at least in their perfect state, have an uniform, and for the most part fibrous, texture; whilst, on the contrary, plants in their youth as in old age clearly show their cellular structure.

In order, therefore, to judge of the mode of growth of plants, we must in the first instance direct our attention to the growth and increase of their cells. It will be most convenient to select for that purpose those plants and those parts which increase the most rapidly, as in them the differences are the easiest to observe. We have made use of an easy and simple method, the placing bulbous roots over glasses full of water, where they, under proper treatment, rapidly put forth roots, which soon attain a considerable length, whilst at the same time, though with less rapidity, they shoot out from above their leaves and stalk.

Among a number of experiments of this kind I will refer to one in particular. After the fibrous roots of a hyacinth had attained the length of about an inch, they were marked with cross lines of Prussian blue, as this colour holds much the best in water, and does not injure the tender roots. After some days the fibres had attained a length of 3 inches; and it was clearly shown that the portion next the bulb, for a length of about 10 lines, had not lengthened at all; that the ball-shaped, readily distinguishable apex of the root, about 1 line long, had also remained without lengthening, and thus that the whole increase had taken place in the portion of the root, about 2 lines long, between the base and the apex.

We may now consider the changes which the cells have undergone during the increase, and for that purpose examine them under a magnifying power of 315 diameters. The upper unlengthened portion consists of cells (parenchyma-cells) connected together by their ends, and all shrunk or contracted in length. The adjoining portion consists in the upper part of short cells, which are already lengthened in the lower part. This is most striking in the upper unlengthened portion. It diminishes again, and the lowest cells are similar to those of the root-point. We here speak of the outer cells of the root only: the inner ones are of the same length, only broader. In the centre of the root may be seen the long, narrow cells which are continued from the basis of the root to the commencement of the root-point, but never penetrate into the latter, thus pointing out the root-point as a distinct substantive organ. Amongst these long, narrow cells in the centre of the fibre are placed the spiral vessels, which, however, cease at a considerable distance from the root-point.

The lengthening of the fibres, or rather their growth, commences therefore with the lengthening of the cells. But this lengthening of the cells cannot alone have produced the growth of the fibre, for the cells in the added portions must have been formed before they lengthened. Now as the lengthening proceeded from the part immediately above the root-point, or from the origin of the root-point itself (for the limits of the increase cannot be determined very precisely), consequently the new cells must have been there formed. And in fact it is there that we find a number of small, irregularly crowded, unarranged cells, which without doubt lengthen after they are formed, and continually force onwards the root-point. The growth of the fibrous roots takes place, therefore, much in the same manner as that of nails and hairs in animals; these parts receive nourishment at the base only, and the points are always pushed forward. If the points are cut off the root-fibres, they cease to grow; so it is also if the points are crushed or otherwise injured. They then rot very easily, and it is therefore advantageous to cut the ends of roots in transplanting when there is any reason to believe that they have been injured.

Before we proceed further I would add a few remarks. The root-point is a very curious portion of the plant. It is distinguished externally by its globular shape and lighter colour; internally, as we have already seen, by the circumstance that neither vessels nor the accompanying extended cellular tissue penetrate into it.* This last character has been hitherto overlooked. The lower portion of the root-point consists of rather large angular cells, containing globular grains of starch collected into a mass, and turning blue with iodine. In those root-points of the hyacinth which I have examined, this has always been the case; but in the root-points of other plants the granules in the cells have turned brown with iodine, as occurs also in the upper cells in the hyacinth. The cells of the root-points are round or angular, larger or smaller, and even extended transversely; and there are always to be found on the outside some cells which scale off, and in their place others are produced, which in their turn scale off, thus constituting the well-known *scales* of the root-points. Here these outer cells are long and narrow; in many other plants they are shorter and broader. Many philosophers have believed that the root-points served to suck up the nutritive juices from the soil, and De Candolle on that account called them *spongioles:* but the very accurate observations of Ohlert (Linnæa, 1837, p. 609) prove that this is not at all the case, for plants whose root-points hang free in the air continue to grow, even when these points are cut off and closed with seal-

* The vessels (spiral or porous vessels) are almost always accompanied by long, narrow cells—the extended cellular tissue.

ing-wax, only in that case it is necessary that the roots themselves be in water or in moist earth above the points. It is worthy of remark that precisely at the point where the absorbing surface commences, there also the vessels with their accompanying cellular tissue commence.

It has been said above that the granules in the cells of the root-points turned blue with iodine, and consequently consisted of starch, whilst those in the other cells of the root turned brown with iodine. Granules of the latter kind, from the size of starch granules down to the minutest size, more or less closely crowded or loosely scattered, are very common in the cells of plants. They are usually white, but often coloured red, green, or yellow, and not unfrequently it is to them that is due the colouring matter of the fluid contained in the cells. The *chlorophyll*, or the generally diffused green colour in the vegetable kingdom, is owing chiefly to this cause. These granules of the cells are sometimes evidently hollow inside, and they have on that account been sometimes called also cells, which, however, may give rise to, and has given rise to, a great deal of misunderstanding. When they are collected in masses in a cell, they appear clearly to be enclosed in a special coating, and they represent perfectly formed globules. In the cells they take sometimes one position, sometimes another along the walls. Although they may belong to the general category of cells, yet they must be distinguished from those cells within which they are found, and of which the different parts of plants are formed. We may call them cell-granules.

Leaves also, or at least long, narrow, sheathing leaves, grow in a similar manner. An experiment of this kind is represented in Plate 1 of my Anatomy of Plants. On a young leaf of Amaryllis (Sprekelia) formosissima I had marked with threads ten intervals of four lines each, the lowest thread being likewise four lines distant from the base of the leaf in the bulb. After two months the lowest thread was 4 inches 8 lines distant from the base, the first interval had only stretched to 4½ lines, the others remained unaltered. It was therefore the lowest part of the leaf, immediately above the scales of the bulb, which had grown the most, and had pushed onwards the upper portion of the leaf, with its point, in the same manner as the root-point is pushed forward by the growth of the fibre. It is at that point therefore that the last additional cells must be sought for. And in fact we here find (see the above quoted work, Plate 1, Fig. 4), close above the bulb-trunk,* which is readily known by its

* A root consists firstly, and essentially, of the *bulb-trunk*, a shortened stem, or corm, which is distinguished from the real stem in this, that the

bundles of vessels, a layer of angular cells, distended transversely, of different sizes and crowded without order, filled here and there with small granules, which turn brown but not blue with iodine. Above this layer in the leaf, as well as under it in the bulb-trunk, there appear angular cells considerably larger, not extended transversely, and full of larger granules of starch, which turn blue with iodine. The layer of small, transversely distended cells is therefore clearly the last formed, as it is from this point that proceeded the whole growth of the leaf. The stretching of the cells is here by no means so great as in the roots of the hyacinth, so likewise the growth of the leaf is much slower than that of those fibres. The change in the granules of the cells during the growth of the leaf is curious, first into granules of starch, and then where the leaf becomes green into granules of chlorophyll.

But whence arise these young cells, which have stationed themselves here in a layer between the old ones, or the smaller cells in the root fibres of the hyacinth which have formed above the root-point? Most probably they arise from an exsuded mucilaginous or, at any rate, not a pure water fluid, by means, in my opinion, of a kind of organic crystallization. In favour of this opinion an experiment can be readily made on willow twigs, when they shoot forth roots in water. As soon as the root-points have protruded from the bark of the root, they are seen to be covered over with a transparent mucilage, which under the microscope consists of cells distended in their length ; and these may be observed as they surround the root-points, and afterwards scale off. The cells are rounded at the ends where they are not connected with others ; they often contain cell-granules, sometimes none, and round about may be seen a turbid, mucilaginous, unformed mass. Under these cells, nearer the axis, the cells are shorter, broader in the middle, and narrowed at the ends. Here also cell-granules are often present, though sometimes there are none. Comparing this with the end of the hyacinth root at the point where it scales off, we observe on the surface of the latter also long, narrow, loosened cells, rounded at the ends, and similar to the superficial cells of the willow rootlets grown in water, and most probably generated in the mucilage exsuded from the underlying, very differently formed cells.

bundles of vessels wind through the cellular tissue in various directions, whilst in the true stem they go directly upwards. This bulb-trunk is covered with a thin coating of cellular tissue, like a kind of bark, through which the root-fibres penetrate downwards with their bundles of vessels, and upwards a few single bundles of vessels enter into the scales of the bulb. These scales are the sheaths of the leaves, which persist and become fleshy after the upper portion of the leaf has withered—a phenomenon which it is well known does not occur in other kinds of leaves.

An evident formation in mucilage, and by means of the mucilage, is shown in the mucilaginous exsudations of many fruit-coatings, as is so well represented by Mr. C. F. Schmidt in plate 7 of the 'Anatomy of Plants.' When we moisten with water under the microscope the slender membrane which clothes the caryopses of some species of Salvia, we suddenly see protruded a number of long spiral threads, or rather spirally-twisted threads, such as we see in spiral vessels, surrounded with mucilage, or sometimes with a very fine membrane, so that the exsudation looks like a spiral vessel. Sometimes also granules of starch are scattered in it. It is true that we see already in the dry cells indications of spiral coils, but on immersion a spiral vessel is formed of such a length that it is impossible to assume so complete a pre-existing formation in the cells themselves. At any rate, it strikes the eye that the spiral thread has here been generated in the mucilage.

It is known that in our dicotyledonous trees a new layer is formed every year between the wood and the bark constituting the annual ring. It is an old opinion, that between the wood and the bark a generating sap, the *cambium*, is exsuded, from which the new layer of wood is formed. In fact, we find in spring, when the trees are forming their leaves and in full sap, and the bark separates readily from the wood, that there has exsuded from them a moisture, which is indeed the cause of the bark separating so readily from the wood. It is also probable that this moisture contributes at least to the formation of the new layer of wood, if it does not entirely generate it. It appeared, therefore, advisable to examine under the microscope this generating sap during the time of its formation; but it is very difficult to procure it pure. If a thin slice is taken from the wood, or from the bark, the already-formed portions of wood or bark predominate so much that it is impossible to ascertain clearly what there may be in the generating sap. If we scrape off the sap, the small particles contained in it are thrown into confusion, and crushed together. The only course is gently to press the sap on to a piece of glass, and immediately to moisten it with water, in order that it may not dry up; then under a magnifying power of 600 diameters we see a number of granules, of a form more or less globular, of very different sizes, and all uniform inside. The smallest granules have in water the molecular motion which is observable in all very small and fine granules belonging to organised matter. These granules are more or less densely crowded in different shrubs or trees—very close, and often adhering in rows, in the cambium of the hazel-nut; less crowded in the ash; least of all in the willow. Amongst these granules we see single cells, also of different sizes, but always much larger than the granules, sometimes without a nucleus, but also frequently with an evident larger or smaller nucleus inclosed in a membrane, lying in different positions in relation to the cell, as is the case in fully-formed cells. Sometimes we find in these young cells, as in fully-formed ones, two nuclei in one cell. If the cambium is allowed to dry, it changes entirely into a mass of roundish, irregularly shaped granules, adhering in strings, amongst which are a few larger globules. In the cambium of this willow branch were a few green cellular nuclei; as it dried, the whole mass became green. It is therefore clear that the granules and cells were generated in a mucilaginous mass; that round the granules a membrane is first formed which is the skin of the nucleus; and round this another forming the proper cellular walls; and that all these granules and membranes were in a mucilaginous state.

There can be no doubt that the mucilaginous generative sap proceeded from the adjoining cells, and exsuded through their walls. In the case of the willow roots this was evident, and the cambium lying between the wood and the bark can only have been produced in this manner, either from the wood or from the bark, or from both at once. No mouths of any vessels can be anywhere found from which this sap can have issued. That in the animal kingdom nutrition takes place by exsudation from the finer vessels is now generally acknowledged; but this exsudation is known to be a penetration through invisible fissures or pores.* And the growth of many parts in plants cannot be otherwise explained than by supposing them to enlarge, and that a fluid issues from them, from which are generated specific bodies. Thus the young wood is formed between the old wood and the bark; thus the bast bundles in the bark are enlarged and separated from the other portions; thus also do the single vessels grow in monocotyledons. A distending power must necessarily be ascribed to plants, in order to make room for the new portions, and for the sap which exsudes for their formation; strong

* Schleiden is indeed of opinion (Systemat. Bot., vol. i. p. 286), that the assuming the existence of invisible pores is a superfluous and unsupported hypothesis; that the relation between a membrane and water is the same as that between salt and water, only that the membrane does not become fluid, because it only absorbs a small quantity of water. When we carefully pour pure water over a solution of gum and sugar, the two liquids first remain unmixed, then the dense liquid absorbs the more diluted one, and this lasts until the two are mixed together almost uniformly. But molecules of sugar are not molecules of water, and the former must have taken their places amongst the latter: these places are interstices—are invisible pores, not empty spaces, it is true, but variously occupied. If we put powdered sugar into Seltzer water, we see the molecules of sugar expelling the molecules of carbonic acid, in order to take their place.

roots pierce through and split the tubs of our green-houses; and in quarries we see them at the least forcing up the soil from between the rocks.

From the first period of the mucilaginous fluid in which they are generated, the cells like the other parts of plants are connected together by a kind of glue. Long immersion in water will dissolve this glue, as will also boiling in water, or nitric acid, or the mixture, discovered by Professor Schultz, of muriate of potash and nitric acid, which will separate the strongest woody cells, upon which nothing else will have any effect. The preparation of flax takes place by soaking in water, which dissolves the glue, so that all the looser cells and vessels easily separate from the woody fibres; by boiling, leguminous fruits are so softened that the cells can be readily separated; and in the same manner all the tenderer parts readily separate after steeping in nitric acid. In a natural state this glue dissolves of itself in the berries of many plants. This matter has often been called also intercellular substance; but it is distinguished from it in this, that it is always present in the living plant, although not always visible; whilst the intercellular substance, as distinguished from the adjoining cells, is often wanting.

We must carefully distinguish from the cambium the sap which in spring will flow in great profusion on boring the stems of several trees, especially beeches, and some species of maple. This comes from the outer layers of wood, at a time when the bark still adheres strongly to the wood: it can be only obtained by incision or by boring; that is, by piercing the receptacles in which it is contained. It will begin to flow from the lower part of the trunk at a time when the upper part and the branches when pierced will remain quite dry. It flows much more in warm than in cold weather; and, lastly, it is so much divided by distribution in the smaller twigs and leaves that it will scarcely flow from them. Indeed, in cool weather, the flow will cease in the upper part of the stem, whilst it will continue below. I have often myself had an opportunity of observing this fact, which is, moreover, well known to gardeners. It is the stimulus of heat which excites the vessels and causes the rise of the sap, which issues from the wound because it cannot spread in the upper parts. As the bark is still closely adhering to the wood when the sap flows, the latter cannot contribute to the formation of the new layer of wood: the sap is not cambium.

The cell consists externally of a very fine membrane (the cellulose), which is lined on the inside with the cellular deposit, arranged often in several layers. In certain places only the external membrane remains uncovered by it, or rather it does not form there; and these places remain clear and transparent, so that they were formerly taken for real holes, and thence arose the names of *pores*, *porous cells*, and *porous vessels*. Mohl first showed that they were not holes, but only light spots. The remaining contents of the cells, the scattered granules, and the cellular nuclei are contained in a second membrane (the *inner membrane*), which attaches itself to the outer one at the light points, and thus overlays the cellular deposit. This membrane, which Hartig has called the *falten-haut*, or folded membrane (ptychode), and Mohl the *primordial utricle*, I should simply term the *inner membrane*. It is easy to obtain a good idea of the structure of cells, by making a fine section of some not very dense part, and steeping it in nitric acid, then washing it in pure water, and applying iodine. In a very successful preparation of a slice of a leaf of the leek (Allium porrum), cut parallel to the surface, and treated as above, we see the cellular membrane with the regularly arranged projections on the inner surface (the cellular deposit), and the intermediate thin parts (the so-called pores) not coloured by the iodine. Inside the outer membrane of the cell is the inner membrane, with its contents condensed and coloured brown; and we see plainly that it has extended to the thin parts, and covered the raised parts of the inner surface or cellular deposit. When, as often happens, the nitric acid has not been strong enough to separate the inner membrane from the outer, so that it still spreads over the cellular deposit, this also appears to be coloured brown; but I cannot state for certain whether this matter also does not with age undergo some change, by which it turns brown with iodine. Sometimes the cellular deposit lies in several layers, and these are often so multiplied as to fill nearly the whole cell. They thus become gradually smaller towards the centre of the cell; and the filled-up and hardened cell assumes a regular, almost crystalline, appearance. Such cells constitute the kernel or putamen of stone fruits, and the stony parts in pears; and it is not therefore to be wondered at that cultivation may have influence upon these cells, and diminish their natural cohesion, as in the case of soft-shelled almonds.

That organic as well as inorganic bodies are generated by crystallisation has already been often suggested, not without foundation. But by crystallisation we must understand a natural phenomenon brought about by a symmetrical process, in conformity with a specific plan. The process itself cannot be explained, but serves to explain the chief phenomena in organic bodies. What writers have called disruption, separation, precipitate, in organic bodies, is almost always to be attributed to this power. The crystal forms, according to its nucleus, in a moment. Three weeks are required for the crystallisation of the chicken in the egg; but considering the great number of parts which are there to be formed, we may conjecture that for the generation of a thin layer of wood from the cambium, only a very short time is required. With regard to the rapid formation of crystals, I have made a discovery which, as it appears to me, is not unimportant. When a precipitate of lime is produced by a solution of carbonic-acid-natrum, or kali in nitric acid, and the precipitate is immediately brought under the microscope, the liquid is full of little globules, and therefore to the naked eye, where the globules are thickest, turbid. Soon these globules are changed into rhomboids, the ordinary crystallization of carbonate of lime: it is only when the liquid is rapidly dried up that their form does not change. It is sometimes possible to bring the precipitate of a solution of lime in sulphuric acid under the microscope whilst it is still in the form of globules, but they are rapidly converted into crystals as if by a magic wand. I published these and other experiments in a short memoir 'On the Formation of Solid Bodies,' Berlin, 1841. I have since then caused water to freeze under the microscope, and seen how the water first becomes turbid, probably from globules, and soon afterwards the crystals are formed. This observation is made known in Poggendorf's 'Annals.' *

We must, however, take into consideration the opinions of other writers on the generation and multiplication of cells.

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* Schleiden says, in his 'Elements of Scientific Botany,' vol. i. p. 214,—"In order to prevent false conclusions, I must here remark, that the theory of crystallization proposed by Link, according to which crystals are formed by the union of smaller globules, rests on insufficient observations." I never gave out a theory—I only related my observations, upon which I might rather have been reproached for seeing too much. Again,—"In the first place it would be natural, with a view to observing the generation of crystals, not to choose precipitates for that purpose, which are reckoned by chemists among the so-called tumultuary crystallizations, but to make the first observations on crystals formed by simple deposits in concentrating fluids. Here we may see, for instance, in the case of nitre, ammonio-muriate of platinum, but most beautifully and readily in ammonio-muriate of zinc, &c., that the crystal nucleus appears suddenly, in no appreciable moment of time, in the fluid which is, and remains, perfectly clear, and then grows steadily by additions from without in almost imperceptible pulsations." I have often seen this: the exhibitors who used to go about with solar microscopes showed it; and it is told in several old manuals of physics, but nothing came from it; it was necessary to go to work in some other way. Now Schleiden relates, that when we allow two fluids, which between them form a precipitate, to come together under the microscope, a membrane is produced, which must necessarily consist of crystals. The membrane is a turbid partition, and depends on the nature of the fluids whether the crystals form sooner or later. Whoever makes the above experiments, or those detailed in the memoir above quoted, will find the thing so clear as to leave no doubt. As Schleiden takes the opportunity to rake up this matter, I have thought it allowable to bring him forward on this occasion.

Schleiden supposes the cell-nucleus, which he calls also *cytoblast*, to be formed of several smaller ones, and then says: * "When the cell-nuclei are completely formed, there soon appears around them a thin membrane, which is sometimes extraordinarily fine and soft, sometimes thicker and tougher. This membrane soon rises in the form of a bladder on one surface of the nucleus, then gradually stretches till the nucleus only occupies a very small portion of the cell-wall." There does, it is true, soon form a membrane round the cell-nucleus, but outside of this is formed another, which is the proper outer coating (or wall) of the cell, and with nitric acid the inner membrane which incloses the nucleus may be easily separated from it, and plainly seen: all these membranes are formed of the mucilaginous fluid in which the granules are found, as may be seen in drying it,—therefore membranes over membranes. On the multiplication of cells, Schleiden had already, in Müller's 'Archiv der Physiologie,' 1838, p. 137, announced the following opinion: "The cytoblasts are formed inside a cell, in a mass of mucilaginous granules, and the young cells lie also free in the parent cell, and as they arrange themselves one against the other assume a polyhedral form. At a later period the parent cell is absorbed." In the book quoted below, he adduces (p. 317) as proofs in support of this opinion, the protococcus, the double spores of lichens, the utricles of pezizas, the spore-cells in their parent cells in ferns and equiseta; and in phænogamous plants the embryo sac and the pollen; and at last he adds, "in the point of the bud, in the cambium, we may not unfrequently succeed in seeing the newly-formed cells within the parent cell; almost all hair-formations show the process well." As to the latter cases, we may call the cell-nucleus a cell, but it never comes out, nor is it developed into a separate cell, it only spreads in the form of a granular mass. We may also call cells such organs of generation as Schleiden adduces, as inclosed in membranous envelopes; but to predict of all cells what has been observed of these, would be, as the old philosophers termed it, a sophism, *de genere in genus*.

That every cell is of itself a distinct organ I have long since, and as I believe the first, maintained.† The axiom has since become the common property of the science. The function of ordinary cells is to work on the sap contained in them; for one often sees cells filled with red sap in the midst of others containing green stuff or chlorophyll. Besides these coloured saps

* 'Elements of Scientific Botany,' 3rd edition, vol. i. p. 209.

† See Römer's 'Archiv der Botanik,' vol. iii. part iii. p. 439. Leipzig, 1805. "Quævis cellula sistit organon peculiare, nullo hiatu nec poris conspicuis præditum in vicina organa transeuntibus. Conspicies non raro cellulam rubro tinctam colore inter reliquas virides."

they contain cell-nuclei and granules of different sizes, colourless, or coloured yellow, red, or green; not unfrequently this colour diffuses itself in the surrounding sap; the granules also become granules of starch. The pollen sac and the embryo sac are organs quite different from these, and are often generated from simple cells. The organs of generation of algæ appear in these simply-organized beings to be simple cells; so also the spore-cases of lichens and fungi.

There is no doubt that the outer coating of the cell is formed before the inner, and that one layer after another of the cell-matter is deposited, as Mohl has maintained against Hartig. The deposit of the cell-matter is an act of creation, and not a mere precipitate, otherwise it would be quite inexplicable why particular spots remain uncovered by it, and not unfrequently of equal sizes, and at regular distances. Whether the inner membrane or the outer cell-membrane is first formed, it is difficult to say. It appears to me that they are produced both at once. In the youngest membranous cells in the root points the inner membrane could already be separated, as also in the full grown ones, except where the parts were too hard. In very compact woody parts it is not easy to detach it; but the above-mentioned medium employed by Dr. Schultz of Rostock dissolves the whole contents of the woody cells, and the outer coating of the cell alone remains, showing that the inner membrane has detached itself with its contents. I find this solving medium very good in many cases; but great care must always be taken in making use of similar means, otherwise the whole mass is rather confused than cleared up.

I believe that I have examined the cambium in an earlier state than my predecessors. It is a mucilaginous generating sap, from which the parts of plants are produced by an organic crystallization—a form of expression not incorrectly introduced by some physiologists.

Unger, in the Botanische Zeitung for 1847, p. 289, and even earlier than that, has adduced reasons in favour of the increase of cells by division, and specially by the formation of cross partitions. That such a multiplication occurs in such abnormal plants as algæ, is, however, no conclusive reason why it should be so in other plants. This writer has proved with great exactness the multiplication of cells in the new layers of wood, whence he concludes that the multiplication takes place by division. But it appears to me that it can be equally well explained by an exuded fluid from which the new cells are formed. I have never met with a clear case of increase of cells by division in phanerogamous plants.

Spiral vessels with their varieties, annular vessels, vessels with clear spots, or dotted or porous vessels, which, when the clear spots are larger, have been called scalariform or slit vessels, are nevertheless real cells. They are generally longer than the cells of the parenchyma or of the prosenchyma, but the short-articulated vessels (vermicular bodies, or banded vessels) are small enough; and the woody cells which I have described in my lectures on Phytology, p. 96, and which I might have called cell-vessels, have the ordinary size of cells. But these vessels are very distinct from the cells of the parenchyma and prosenchyma; they lie together in separate bundles; they evidently branch out by the separation of single vessels or small bundles, which pass off into other bundles; they never appear on the surface, but stretch themselves longitudinally through most parts of plants, of which they form the basis, the skeleton as it were, and are almost always accompanied by narrow and long cells. The name of cells is very inconvenient for them, for there are porous cells and porous vessels, spiral cells and spiral vessels. It would be as if we were to call all the outer envelopes of the flowers of grasses *bracts*, which they are indeed really; but such a generalization of the word would occasion great confusion of language, as the use of the word *cells* has already produced. Further, spiral and porous vessels are not formed out of cells, of which the intermediate partitions are absorbed or resorbed. I have often observed them in the earliest stage in buds and in roots, and in the latter case figured them several times, and always without any trace of transverse partitions. Cellular tissue in the roots of hyacinths above the root-points has been taken for the commencement of spiral vessels,* which is a mistake; the spiral vessels end long before the root-points, they go directly downwards, and become at length so slender that the spiral thread can scarcely be distinguished. In this excessively fine state no transverse partitions can be seen, and I do not see why we should assume the existence of what no one has as yet seen. As the transverse partitions are not there, they cannot be absorbed. Possibly transparent cellular tissue seen through them may have been mistaken for transverse partitions. A spiral vessel from the upper part of a fibrous hyacinth root was treated with nitric acid and iodine as above, and by this means the utricle was visible, even in very narrow cells, but the spiral vessel remained uncoloured.

Spiral vessels and their coating belong therefore in their chemical properties to the same series of parts as the deposits on the inner surface of the cell-walls, and are different in that respect both from the inner membrane and from the contents of cells.

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* Origin of Spiral Vessels, by Prof. Unger. Linnæa, vol. 15, p. 385, t. 5.

Malpighi, the discoverer of spiral vessels,* considered them as air-tubes on account of their analogy with the air-tubes of insects, which he also discovered and named *tracheæ*, a name almost universally adopted. As early as the commencement of the eighteenth century (1709), Magnol observed that coloured fluids ascended in cut branches even up to the flowers, an observation repeated by many others, but Reichel in Leipzig first saw (1758) that they only ascended in the spiral vessels. Thence Hedwig was of opinion (1790) that these vessels might be at once air and sap vessels, only that the sap rose merely in the hollow spiral thread. It is, however, not hollow. The thing became doubtful again when it was ascertained that coloured fluids did not ascend in plants which had put forth uninjured roots in the earth or in water. It was therefore thought, not without reason, that coloured fluids only ascended in spiral vessels by capillary attraction, consequently only in the open vessels of cut branches.†

In the bark which consists of parenchyma only, without vessels, the sap does not rise from the earth. Stems and branches of trees can be deprived of their bark all round (ringed), and they only bear the more flowers and fruit, as is well known to gardeners. The sap therefore does not rise directly through the walls of the cells, as many believe, also not through the intervals between the cells—the intercellular passages, as first Treviranus and afterwards De Candolle believed. We see not why, if the sap penetrates so easily through the cells of the parenchyma, it should not rise rather through the bark, of which the texture is so much looser than that of the wood. In spring, when the stems of birches are tapped, the bark remains quite dry, whilst the sap flows copiously from the lacerated wood-vessels.

But in most plants the wood does not consist entirely of vessels, but also of cellular tissue, and it is still a question whether the sap rises through the vessels or through the cellular tissue. In the first place it must be observed, that through whichever it may rise, it can pass sideways through the vascular or cellular tissue as readily as it rises upwards. To prove this we have only to cut a branch through to the pith in a spiral line, so that no single vessel or row of cells remains unbroken from the base to

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* Malpighi first described and figured these vessels. That Grew saw them as soon as he made use of strong magnifying powers was to be expected, but he only described them at a later period than Malpighi.

† Schleiden, indeed, says (System. Bot., vol. i. p. 232), "Do they know what capillary attraction is? Strong walls are necessary for it, not thin membranes in a turgescent tissue." But Schleiden does not think of blotting-paper, in which it is well known that water rises by capillary attraction without strong walls. When it is full of water, it is quite true that nothing more will rise into it.

the top, yet the branch continues to grow. In this case it is clear that the sap must pass laterally into other vessels or cells, in order to resume its right direction upwards.

That the sap rises in the vessels, not in the cellular tissue, I endeavoured to prove by experiments which I related in the Annales des Sciences Naturelles, vol. 23, p. 144. I took Rhagodia Billardieri, Begonia divaricata, Stylidium fruticosum, and Hermannia altheæfolia, and placed each of these plants, with the pots in which they grew, into a trough filled with a solution of red prussiate of potash in 32 parts of water. For eight days they were fed with this solution, in which they appeared to thrive; I then removed the trough, and replaced it by another filled with a solution of sulphate of iron in 32 parts water. After twenty-four hours I examined the plants and found the vessels, the spiral as well as the porous vessels, filled with a blue liquid. I admit that these experiments do not always succeed; many accidents prevent the prussiate of potash from being taken up by the vessels, or from remaining in them; but all the experiments agreed in showing that these solutions did not rise through the cellular tissue of the bark, the wood, or the pith. The experiment can be varied in many ways. I watered some tulips growing in a pot with a weak solution of prussiate of potash—for if the roots themselves are immersed in the solution they will not bear it long—then I cut off the stem, and immersed it in a solution of sulphate of iron, upon which the vessels alone appeared blue on examination, the adjoining cells not in the least so.

Unger has, however, latterly endeavoured to show that the sap really rises in the cellular tissue which surrounds the vessels.* He watered some white-flowered hyacinths growing in a pot with the juice of Phytolacca decandra, and saw that the flowers, the upper part of the stem, and the upper portion of the leaves became tinged with red. A microscopical examination showed that the spiral vessels were not at all coloured, but that the surrounding cellular tissue was coloured red. Unger adds, "The comparison of all the organs showed that the lower ones, the fibrous roots, remained quite free of all colouring matter; the base of the bulb, the lower part of the stem and of the leaves, as well as the scales of the bulb, had a small portion of the colouring matter, and that it was the outer extremities of the flowers and the points of the leaves that held the greatest mass of it, and were consequently the most intensely coloured." In this there is some vagueness. What is the meaning of a smaller portion of colouring matter? Were the cells themselves of a paler colour, or was

* On the Absorption of Coloured Matters by Plants, by Dr. F. Unger. Vienna, 1849.

the colouring matter not in all the cells? His fig. 9 shows that the latter is the meaning intended. Now how does the colouring matter get into the upper cells if it must go through the lower ones? That is to me quite unintelligible. But I can readily understand that the juice rises through the vessels—the spiral vessels—to the top, and then rapidly passes into the adjoining cells here and there, according to the nature of those cells. We have seen how readily the sap spreads laterally even in hard woody tissue, and it must be expected to do so much more readily in the softer parts.

It is not credible that the sap should rise in the prosenchymatous cells, for example, in the birch, and not through the spiral vessels. I have, in my Lectures on Natural History, Plate 2, Fig. 1, figured a longitudinal section of birch wood at the time when it gives out the sap. With age the vessels enlarge, and probably become inactive, and they only appear to become divided by cross partitions, by growing together by their ends. Coloured liquids penetrate through these cross partitions, as I have shown, Plate 5, Figs. 4 and 5 of the Anatomy of Plants. I may add that Conifers are as little injured as other trees by ringing, or taking off the bark in a ring round the stem. Now there is no cellular tissue in the wood of these trees, but it consists entirely of vessels, and the sap cannot rise otherwise than through the latter.

From all this I draw the conclusion that spiral and porous vessels carry the sap over the whole plant, but soon discharge it into the surrounding parts, so that they generally appear empty, and look like air-vessels.

No operation shows more the true mode of action in plants than grafting (including budding*). The plant is a compound organised body, of which every bud can live and be developed independently. The bud may be planted in the earth by cuttings, or on another plant by grafting or budding. In the latter case the graft converts the sap of the stock into its own sap in the same manner as the cutting converts the juices of the earth into its sap. The stock has no other influence on the graft but that which the soil has on a plant; the latter will not grow in a soil which does not suit it, and the graft will only grow upon plants allied to it; the plant succeeds better in one soil than in another, so the graft succeeds better on one stock than on another; the plant is developed earlier or later, according to whether the soil is moister and warmer or drier and colder; the earlier or later shooting of the graft is in some measure regulated

* *Veredeln* of German gardeners, literally *ennobling*, includes both grafting and budding.

by the state of the stock. I have long since expressed the general law of nature relating to this subject in the following terms: the bud propagates the individual, the seed (produced by fructification) propagates the species. A graft of the Borsdorfer apple reproduces Borsdorfer apples; a seed of a Borsdorfer apple will reproduce apple-trees, but these will not generally bear Borsdorfer apples.

The generally received rule, that in grafting, the young wood of the graft must be brought into connection with the young wood of the stock is quite right. By *young wood* is meant the outer layers of wood towards the bark, and it depends on the species of tree how deep the wood may be still called young. I had already made some experiments of this kind, and they have been continued latterly in the Royal Botanic Garden of Berlin, where they have been conducted by the accurate hand of the inspector, M. Bouché. The bark never grew on to the bark, nor did young wood ever grow if brought into connection with bark only. So it is with budding. There must be wood in the middle of the bud or eye, otherwise the bud will not grow, and this wood must always be young wood, and must be fixed on the outer layer of wood immediately under the bark, for the operation to succeed. It was now necessary to examine young grafts which had but just taken and begun to grow, and I selected for that purpose one of the above-mentioned experiments, where Robinia pseudacacia had been grafted on a stock of the same species. The following was the result. The graft had been inserted between the wood and the bark by crown-grafting; it had two buds, of which the upper one was earlier developed than the lower, as is usually the case. In this state a longitudinal section was made through the lower part of the scion. The connection proved to be entirely with cellular tissue, without any trace of vessels, although the layer of tissue is so thin as to be scarcely perceptible to the naked eye. It always takes a considerable time, in this instance two weeks, before the connection is perfected, and the graft begins to shoot. In budded roses I have observed the same connection, through parenchyma, between the bit of bark attached to the bud, on which was also necessarily a portion of wood, and the wood of the stock. When the scion is a year old, the outer wood of the branch passes into that of the scion without the slightest interruption, and the cellular tissue which formed the first connection can no longer be recognised.* In a three-year old scion of a tongue-

* I should have said the cellular tissue had been *resorbed*, had I seen any grounds for employing this expression, almost always used without grounds. If we were carefully to search, we should find the so-called resorbed matter unresorbed.

graft of Prunus nigra on a stock of the same species, we observe the transition of the outer wood of the stock into that of the scion without any interruption ; then the inner wood of the scion partly dead and become brown ; then the central wood of the stock, which has formed no connection whatever with the scion ; and, lastly, the thickened wood of the scion, which begins to grow over the stock. I find it to be the same in all the many grafted stems and branches which have succeeded and grown, which I owe to the kindness of the university gardener, M. Sauer. The interior of the stock has always suffered, although less in old than in young stocks, and has turned brown ; and a stem of Fraxinus pendula, which had been grafted by cleft-grafting on two opposite sides, showed in the centre a portion of the stock not in the least connected with the grafted branch, but enclosed * on every side by the outer wood of the graft. But the specimen is sufficiently instructive to deserve further notice. It had been sawed off from the stem immediately below the graft and also close above it ; below, it is nearly cylindrical, and about 3 inches in diameter ; above, it is enlarged and ellipsoidal, being $5\frac{1}{2}$ inches broad in one direction, and 3 in the other. It was sawed through longitudinally, and showed the original stock very plainly, not in the centre, but on the right-hand side, close under the transverse cut. This stock is half an inch in diameter, is cut clean off at the upper end, and separated from the grafted branch by a fissure with a brown border ; laterally, the fissure shows itself slightly at the upper end, but soon ceases ; in its place a brown line stretching downwards continues to mark out the original stock. One of the grafted branches on the left has in its transverse section the form of an ellipsis of 3 inches by 2, with 4 annual rings of wood ; the other branch on the right has in its transverse section a nearly circular form of about an inch in diameter, with the same number of 4 annual rings, but much smaller, the broader inner ones arching over the stock. Between these branches the space has been filled up with a globular-shaped piece of wood, consisting of several layers arched invertedly. On the left they run parallel to the inclined layers of the grafted branch, but on the right they penetrate irregularly into the layers of the grafted branch. Round these layers are five layers of varying thickness, under a bark a line thick, which encircles the whole. This is therefore an appropriate structure, partly for filling up all vacant spaces, partly to unite the whole into one

* I borrow this expression from M. Goeppert, that the trunk of a felled tree becomes covered with new wood—enclosed by it, when it receives fresh nutriment from a naturally engrafted root-branch of some adjoining tree. Such fortuitous grafting is not uncommon. I have a carrot of which the pointed end of the tap-root has grafted itself on another carrot.

stem. It is a curious circumstance, but not a rare one. that one of the two grafted branches remained so much behind the other in growth: so we find on one side of a tree stronger branches than on the other, which Du Hamel had already attributed to the stronger and better-fed roots of the same side, and which can be easily accounted for by the vessels ascending in a direct line, and being but little branched.

I have before me a branch of Fraxinus excelsior. five years old, according to the rings, and eight lines in diameter. It had been budded with a bud of Fraxinus atrovirens, which had grown into a branch of six lines in diameter, having also five annual rings. Cut longitudinally it appeared as follows: the transition from the stock to the budded branch was here also uninterrupted through the outer layers of wood, but a brown line marks the separation between the summit of the stock and the budded branch. In the centre of this branch is a pith of four lines in thickness, which terminates below towards the stock in a point. The thin layers of wood on the under side of the pith are curved in an undulating manner towards the stock, the layers of the upper side are curved upwards; both originate in the portions of bark which had served to fix the bud on to the stock, and which as usual had borne a small portion of wood on the under side. The interval between the layers had been filled up by a dense mass of wood, in which can still be traced a brown line of loose cellular tissue, showing probably the spot where the inner side of the bud was fixed. Upon the whole, the circumstances appeared the same in this instance as in that of the grafting.

It is then in the outer layers of wood that the vital energies of our trees reside; in them the sap rises in spring; and by their means the increase and overgrowth in the interior of the trunk is effected.

It had appeared to me advisable to examine the growth of grafts in succulent plants, and for that purpose grafted cacteæ appeared peculiarly suitable. In several stems, of many years' growth, I could find no internal distinction between the stock and the grafted branch, till I received a stem, of recent growth, of Epiphyllum Altensteini, which had been cleft-grafted on a stock of the same species.* In a portion of a transverse section of the stem taken at the point where the graft had grown on, we see the radiating woody fibres separated by broad medullary rays, and the pith itself which occupies the greater portion of the stem, and in the woody fibres are seen the large openings of the descending spiral vessels. At the spot where the graft has

* Mr. Reinecke, gardener to Mr. Decker, court-printer, a zealous promoter of horticulture, had kindly grafted it for this purpose.

grown on we see a stripe-like tissue. Here we see plainly that new vessels had formed to effect the junction, and these were, in the first instance, short-jointed porous vessels; then on the left longer so called scalariform vessels; and lastly, farther to the left, wood-cells, or, as I have above called them, cell-vessels. The connecting vessels, therefore, formed rapidly in a perfectly succulent stem, and effected the connection immediately, whilst in hard wood it had been effected through the medium of newly-formed cellular tissue or parenchyma. We see therefore that it is the office chiefly of those parts which we call vessels to continue or to transmit the vital action of plants. In grafting also this action is only fully developed when the connection between the stock and the scion is fully established by means of vessels.

In general, we see in the whole organised kingdom a creative force, which in the vegetable kingdom acts in the first place and essentially symmetrically, and after that, in conformity to special purposes.

V.—*A Note concerning the Varieties of Date-Palm.* In a letter from Mr. James Richardson. Communicated by Viscount Palmerston.

(Received July 31, 1850.)

Mourzuk, May 14, 1850.

My Lord,—The great resource of the inhabitants of the Oases of the Sahara is the Date-Palm. When every other species of food fails, the Date-Palm yields with the returning year its nourishing and powerful fruit, and saves the population of the Desert from perishing with hunger.

Nineteen-twentieths of the population of Fezzan live on dates during nine months of the year. Many of the animals likewise feed on dates the greater part of the year, the Oases being bare of herbage.

It is, therefore, very useful, as well as interesting, to give some account of the various species of this fruit. I have collected from the mouths of the natives of Fezzan the Arabic names of upwards of fifty different species of this precious fruit, cultivated in these Oases, with a brief description of the qualities of each of them.

I have the honour to be, &c.
(Signed) James Richardson.

To Viscount Palmerston, G.C.B.,
&c. &c. &c.

Various Species of the Date-Palm Fruit cultivated in the Oases of Fezzan.

1. *Tàsf`ert*—Long shaped, and longish, red, and of good quality; ripens late.
2. *Moùwee* — Large, round, red, sweet, and good; ripens late.
3. *Am`reer*—Small and round, black, *reteb** (literally, *moist*), or does not become dry so as to be preserved as an article of food; ripens soon.
4. *Tā`lees*—Very long shaped, red, very sweet; ripens late.
5. *El-Kâ`eeb*†—Small and round, sweet and *reteb;* ripens soon.
6. *El-Kokāée*—Small and round, sweet; ripens late.
7. *Sŭbeèr*—Largish and round, sweet; ripens late.
8. *Sălouloù*—Large and round, and sweetly delicious; esteemed the finest quality of all Fezzan dates; ripens late.
9. *Tughā`iàt*—Long and largish, red, very sweet; ripens late.
10. *Fer`tăkou'*—Long shaped and good size, red, very sweet; ripens late.
11. *Săloùm*—Long and largish, red, sweet, ripens soon; partly *reteb.*
12. *Taib-Bĕlah* (*i. e.* good dates)—Small and round, yellow, and very sweet.
13. *El-Kouweèyaf*—Long and smallish, red, *reteb*, and good; ripens soon.
14. *Năfous`h*—Round and large, red, good quality, and one of the species which ripen latest, if not the latest.
15. *Jinfuk`h*—Large and round, red and good; ripens late.
16. *Loùreèk*—Small, thin, and filbert-shaped, yellow, exceeding sweet; ripens soon.
17. *Hăjāb*—Large, round, red, and good; ripens late.
18. *El-Khăthăr*—Long, black, good quality, *reteb*, but hardens a little, sweet; ripens soon.
19. *El-Amzoùgh*—Large and oval, black, sweet, *reteb*, but dries a little; ripens late.
20. *El-Kămār`*—Largish and round, black, good, *reteb;* ripens soon.
21. *Âghleèn*—Small and round, red, sweet, or having "*ripe*" and unripedates: that is, some of the dates never reach ma-

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* A great quantity of dates are *reteb*. Both in the suburbs of Tripoli and in the Isle of Jerbah, nearly all the dates are eaten as soon as gathered, not drying so as to serve for wholesome food, being "*reteb*."

† There is a certain arbitrary use of the Arabic article prevalent in all these countries. As before the names of towns and wells, so also the article is sometimes used before the name of a species of date-fruit.

turity. All animals eat of this kind of Date, and are very fond of them.

22. *Ză`kădāf*—Large and oval, black ; ripens very early, soonest of all.
23. *Nă`fyă`wee*—Long and large, red, good quality ; ripens late.
24. *Măkār`esh*—Large and round, red, very sweet ; ripens late.
25. *El-Fâ*—Large and round, red, good quality ; ripens late.
26. *El-Beeyouth*—Small and thin, of a good quality, but having very large date stones ; ripens with the earliest.
27. *El-Kădeèr*—Small and round, black, *reteb*, good ; mature soon.
28. *El-Hămă`j*—Round and large, red, *reteb*, good ; mature soon.
29. *Arbâ`-ârous*, *i. e.* "Fingers of the Bridegroom"—Long and large, red, moderately good ; mature late.
30. *Loùkă`lee*—Large and round, red, good quality ; mature late.
31. *Touă`tee* (probably from Touat)—Largish and round, good, red ; mature late.
32. *Shûr`ăn*—Largish and round, red, very sweet ; ripens late.
33. *Omm`-ell-Thĕhāb*, *i. e.* "Mother of Gold"—Oval, largish, yellow, *reteb ;* sweeter than any kind of dates ; mature soon.
34. *Tăghĕ`dshah*—Round and very large, very sweet, yellow ; mature late.
35. *El-Hă`fătee*—Large and oval-shaped, sweet, and good, lasts long, eaten by the rich ; mature soon, and of a red colour.
36. *Tă`ëb*—Large size and round, sweet ; mature soon, of a red colour.
37. *El-Sunbilbil*—Largish and round, good for food ; ripens with the greater part, and yellow.
38. *El-Să`mes`kăl*—Large and round, good in every quality ; mature soon, yellow colour.
39. *El-Kerbū`oùwee*—Small and round, black ; mature soon.
40. *Mūkmū`k*—Small and round, yellow, very ordinary sort ; mature late.
41. *Sunûl*—Large and round, red, good quality ; mature late.
42. *El-Kară'fes*—Small and round, red, ordinary quality ; like *Mukmuk*, mature with the greater part.
43. *El-Kărtă'wee*—Small and round, yellow, sweet, and good ; mature with the greater part.
44. *Bor`nee*—Large and very long, yellow, good quality ; ripens in the usual date time.

45. *Thăhăbeè*—Large and long, yellow, has small date stones; ripens early.
46. *Lā̀ghou̇l*—Small and filbert-shaped, red, *reteb*, sweet; soon ripe.

The Arabic of the Names of the Dates.

تاسفت ∴ لغوي ∴ لمرير ∴ اتاليس ∴ لكعيث الكوكا ∴
سبير ∴ سلولو ∴ اتاعيات ∴ الفرتكاو ∴ اسلوم ∴ طيبة ناج ∴
الكياف ∴ انفوش ∴ جنفاخ ∴ لوريف ∴ لغول ∴ لحجاب ∴
الخذار ∴ لمزوغ ∴ الحافض لفنير ∴ اتقداف ∴ انفزاو ∴
مكارس ∴ الفاع ∴ نيوض لكدير ∴ الخماج ∴ اصبح عروس ∴
لوكلى تالوت ∴ طيب ∴ اسنبلبل ∴ تامسكل ∴ كرباوى ∴
مقمق ∴ صنعال ∴ كرافص ∴ كرتاوى ∴ بربى ∴ ذهبي.*

Observation.—In Soudan the Date-Palms have flowers, ripe and unripe dates, *reteb* and *belah*, all at the same time, apparently a vitiated state of growth. Many of the fruit trees of North Africa, as Oranges, have also a diseased growth in Soudan, and bear no fruit.

VI.—*On Coniferous Stocks.* By John Saul, Durdham Down Nursery, Bristol.

(Communicated Nov. 29, 1850.)

Conifers are very largely cultivated in the present day—a circumstance not to be wondered at, if we consider their value as timber trees, or their extreme beauty as ornamental objects either

* By the kindness of an Arabic scholar the following list of the preceding names is given in European characters:—

1. Tasifet; 2. Lughir; 3. Lumreer; 4. Atalees; 5. Lukäib; 6. Al koka; 7. Subeer; 8. Sulooloo; 9. Atäiyat; 10. Al Furtakäo; 11. Assaloom; 12. Teebat-beluh; 13. Al kiaf; 14. Unfoosh; 15. Tinfakh; 16. Loureek; 17. Lufool; 18. Luhjab; 19. Al khadhâr; 20. Lumzoogh; 21. Al Hafiz; 22. Lufneer; 23 Itukdaf; 24. Infuzawee; 25. Mukarus; 26. Al faë; 27. Baiooz; 28. Lukdeer; 29. Al khumaj; 30. Asbâ-âroos; 31. Loukulee; 32. Taloot; 33. Tiyab; 34. Al-sunbilbil; 35. Tamuskul; 36. Kurbawee; 37. Mukmuk; 38. Sanââl; 39. Kurafus; 40. Kurtawee; 41. Burnee; 42. Zuhubee.

in the spacious park or arboretum, or within the more limited precincts of the cottage or villa garden. What can be more majestic or graceful than the splendid Conifers of the Himalayas, their gigantic allies in North-West America and New Zealand; or what more lovely than the foliage and habit of many from the Mexican mountains? It is not, however, my intention on this occasion to notice such as are cultivated for timber, but to point out a few stocks which are used in nurseries for "working" the more rare and valuable varieties upon. It may be asked why "work" them at all? To this I reply, if the species or variety is sufficiently hardy for the situation it occupies, and if seed or seedlings can be plentifully procured, there is no need for "working." This, however, is not always the case; seed of some of the most beautiful and splendid Conifers is only sparingly and not often imported; and hence the necessity of propagating them by grafting; but another reason is, that many Mexican and other Conifers which are scarcely hardy in our climate, will, if worked on a hardy free-growing stock, stand many more degrees of cold than they would do on their own roots. I shall give an instance of this hereafter.

Now as regards a stock for Pinuses, in my opinion nothing equals P. austriaca: it is hardy, robust in growth, transplants well at almost any age or size, and succeeds in any situation; all the Pinuses take and grow freely on it. With this the Scotch Fir (Pinus sylvestris) will not bear comparison; when potted, the latter becomes stunted, it will not transplant freely, and grafts neither take nor grow well upon it. For such Pinuses as Banksiana and its congeners, the Scotch Fir may be found useful; but for the free growing, long-leaved varieties, it must give place to the Austrian Pine, upon which they grow beautifully. When turned out of pots, the mould shaken off, and the roots trained properly out (as they should be), P. austriaca does not appear to suffer from the treatment, but takes to the soil and grows freely, while many sorts "worked" on the Scotch Fir would die. Pinus Strobus (or Weymouth Pine) is sometimes employed as a stock for P. monticola, Lambertiana, and their allies; these however will take as well, and grow infinitely better on P. austriaca; indeed they are valueless on P. Strobus, which is liable to die off even under the best of circumstances: how then can it be expected to make a lasting stock? Many sorts are worked upon it, but I have never yet seen one last long, or make good plants; they invariably perished. Pinus Pinaster forms a good stock for P. Lemoniana, and such like varieties: they take and grow freely on it. These are the kind of stocks generally employed for Pinuses in nurseries. There may be others, such as P. Mughus, &c., but they do not equal the above.

The Red Cedar (Juniperus Virginiana) makes an admirable stock for the better sorts of free growing Junipers; they take and grow freely upon it. To describe its free growth, hardiness, and indifference to soil would be superfluous, it being well known not only to all lovers of Conifers, but also to almost every admirer of hardy shrubs. I have reason to believe that on this stock many Cypresses would take and grow well. When Cupressus thurifera was first introduced into this country a large seedling was planted out of doors in this nursery; it soon grew freely, but perished under seven or eight degrees of frost. A "worked" plant was planted precisely in the same place, and it has now survived several winters, sustaining from fourteen to sixteen degrees of frost without protection, and having only its foliage and branches, which had been growing late, injured. If this plant were in a high dry situation (the locality is low), where it could ripen its wood early and well, I entertain no doubt that on this stock it would be perfectly hardy. What a lesson should this not teach us! In the same way we might cultivate many of the more delicate Pinuses, and many other valuable trees. If our climate will not give them sufficient terrestrial or atmospheric heat, why not treat them as we do our more delicate fruit trees, such as the Peach and Apricot, viz. work them on a stock adapted to the climate? I have reason to know that this to a considerable extent may be effected. Now if Cupressus thurifera will grow, as *it does,* splendidly upon the Red Cedar, why should not many other of the new and rare Cypresses do the same; and how much superior will it not prove to the stock generally employed, namely, C. sempervirens, a plant not perfectly hardy in the northern parts of Britain?

Among Yews there are many beautiful and interesting species and varieties; they may be propagated freely from cuttings, and grafted with facility. The common Yew forms a good stock for all the other kinds, more especially if raised from seed: plants from cuttings are not so suitable. The Irish Yew makes a still better stock; grafts unite and grow more vigorously on it than on the common Yew. It is not, however, often used as a stock, being more valuable than the common Yew.

In conclusion I may remark that it is not my intention to go through the various sections into which Conifers are now divided, or to write a general treatise on all the stocks employed in their culture: my object, as I stated at the outset, is merely to glance at the sections generally, and especially at those most extensively propagated in this way. Other persons may have found other stocks equally good and useful; but I feel confident that for general purposes the above cannot be surpassed.

NEW PLANTS, ETC., FROM THE SOCIETY'S GARDEN.

1. Fortune's Double Yellow Rose.

Brought home by Mr. Fortune on his return from China.

This is a straggling plant, with the habit of *R. arvensis*, but with handsomer though deciduous leaves. The branches are dull green, strongly defended by numerous short hooked prickles, without setæ. The leaves are smooth, in about 3 pairs, bright shining green above, rather glaucous beneath. The flowers are as large as those of the Common China Rose, semi-double, solitary, dull buff, tinged with purple. The petals are loose, and the whole aspect of the flower that of a slightly domesticated wilding. The bush looks like a cross between the China Rose and some scrambling species, such as our European *R. arvensis*. That species being however unknown in Asia, the plant before us must have had some other origin, concerning which it is fruitless to inquire.

In its present state this plant has little claim to English notice; but it may be a good breeder, and would certainly be much handsomer in a warmer climate than ours. Mr. Fortune continues to speak highly of its beauty in China, where it is said to be loaded with buff blossoms; in England, however, its wood is easily killed by frost, and it cannot be regarded as being hardier than a Tea Rose.

2. Lonicera tatarica, *var.* punicea.

Raised from seeds formerly received from Mr. Fischer of Göttingen, and Baron Jacquin of Vienna, under the name of L. tatarica punicea. It has also come up among seeds from Dr. Ledebour.

This plant does not seem to differ in any essential particular from the old Tartarian Honeysuckle, except that its flowers are larger, later, and of a deep rose colour. In these respects it has much more value for Gardens; for it is not so apt to be cut off by spring frosts. If uninjured, the rich tints of its flowers give the bush quite a handsome appearance among early flowering plants.

It is worthy of note, that although this seems to differ from the common Tartarian Honeysuckle in no essential circumstance beyond what has been just mentioned, yet it comes true from imported seeds. It is reported that the berries are yellow, but of this we have no evidence.

Lonicera tatarica, var. punicea.

3. ONCIDIUM LURIDUM; *atratum.*

Collected by Hartweg for the Horticultural Society at Tampico.

Whether or not *O. luridum* is really a mere variety of the Carthagena Oncid becomes more and more doubtful as our knowledge of such plants extends. In the present instance it is unnecessary to open that question, the plant now mentioned being undoubtedly a very fine form of the lurid Oncid, whatever the relation of the latter to the Carthagena Oncid may finally prove to be. With the habit of the common form of the species this combines flowers smaller than usual, very flat, with olive and rose-coloured sepals and petals, and a rich crimson lip furnished at the base with 5 purple-black tubercles, four of which surround the fifth; of these tubercles the central and two anterior

Oncidium luridum; atratum.

are oblong and simple, the two posterior are concave, or almost kidney shaped with the concavity backwards. The wings of the column are oblong truncated fleshy bodies attached by the narrowest end. It is a fine variety, in some respects like the purple lipped Oncid (*O. hæmatochilum*), and requiring the same treatment as *O. luridum* itself.

4. Adenostoma fasciculata. *Hooker and Arnott, Botany of Beechey's Voyage*, p. 139, t. 30.

Raised from seeds collected in California by Hartweg.

A small heath-like bush, with erect weak branches. Leaves linear, sharp pointed, concavo-convex, arising in fascicles from the axil of primordial leaves of the same form, but dying early and leaving behind a pair of spine-pointed stipules; in this arrangement they may be compared to Berberries and similar plants. Flowers white, small, in terminal panicles, with much the appearance of the Alpine Spiræa. The leaves of the cultivated plant continually evince a tendency to become 2 or 3 lobed near the point. It is said to grow 2 feet high, in open exposed places near Monterey.

In point of beauty it is inferior to the worst of the Spiræas, and is a mere Botanical curiosity. Whether it is hardy or not has not been at present ascertained.

5. Consolida Aconiti. Delphinium Aconiti, *Linn. Mantissa*, 77. *Vahl, Symbolæ Botanicæ*, i., p. 40, t. 13. *De Candolle, Systema*, i. 345.

Raised from seeds presented by H. Calvert, Esq., C.M.H.S., of Erzeroum.

A weak erect Annual, about 1½ foot high, with a very slight covering of silky hairs upon all the green parts. The leaves are divided into from 3 to 5 pedate linear taper-pointed lobes. The

Consolida Aconiti.

flowers form a loose straggling somewhat zigzag raceme, the peduncles of which are from 1½ to 2 inches long, with about one awl-shaped bract above the middle. The flowers, which grow singly, are of a deep bluish lavender colour, with the following structure. The calyx consists of 5 coloured oblong sepals, of which 4 hang downwards, the side ones being the broadest, and the fifth, which is turned in an exactly opposite direction, is extended into a horizontal blunt hairy spur with a short narrow ovate acute limb. The corolla consists of two petals united by their back edge into one simple somewhat fleshy spur, enclosed within that of the fifth sepal, and with a hooded limb, having 4 small round lobes at its point, and 2 larger oblong lateral ones. The solitary carpel slightly projects beyond the declinate stamens. De Candolle and others speak of the petaline spur being slit on the upper side, a structure of which I find no trace.

Forskahl regarded this curious plant, it is said, as an Aconitum; Linnæus considered it a Delphinium. In reality it is neither the one nor the other. Its united petals, and long sepaline spur, are at variance with the distinct hammer-headed petals and convex back sepal of Aconite. Its petals being reduced to two, and those completely combined into one, equally remove it from Delphinium. That the petaline body is really composed of 2 parts only seems to be proved by its origin, which looks as if opposite the back sepal in consequence of the union of the two contiguous edges of the lateral petals. But it is completely separated from the front sepals, with which it does not in any degree alternate. These considerations lead to the conclusion that the old genus Consolida should be re-established, and by no means confounded with Delphinium proper.

In a scientific point of view this is a highly interesting species; but its growth is too feeble and its flowers and leaves too diminutive and straggling to give it any horticultural value.

6. Eria acervata.*

Presented by the Honourable Court of Directors of the East India Company; among whose collections it often occurs.

This little Eria is one of a set scarcely known in Gardens, the peculiarity of which consists in the stem when fully formed being nothing more than a pseudobulb. These little pseudobulbs

* E. *acervata;* pseudobulbis compressis uno super alterum cumulatis collo brevi diphyllis, foliis rectis ensatis, racemis axillaribus 2-3-floris, bracteis pluribus super pedunculum ovatis acuminatis revolutis, sepalis petalisq. ovatis acutis, labelli trilobi 3-lamellati lobis acutis intermedio oblongo multò longiore.—J. L.

Eria acervata.

are compressed bodies, in form not unlike a flat flask, and piled one over the other in the singular manner shown in the annexed cut, which represents the plant of its natural size. The flowers are white, smooth, with a slight tinge of green, but otherwise colourless. The lip is 3-lobed, with 3 elevated parallel lines, the middle lobe the longest, oblong and acute. The foot of the column is neither chambered nor toothed.

In all respects this plant is so entirely an Eria that it is referred to that genus, notwithstanding that, in the flowers examined, the number of its pollen masses was only 4, instead of 8. But this may have been accidental. In its 3-ridged lip, and reflexed bracts, it so strongly calls to mind that genus, as to raise a reasonable presumption that the number of pollen masses would, in more perfect flowers, be as usual.

A hothouse plant of no horticultural interest.

7. Oncidium planilabre.*

Received from R. A. Grey, Esq., who obtained it from Brazil and presented it to the Society through Thomas Edgar, Esq.

This plant has the foliage of *O. flexuosum*, and flowers much like those of *O. Suttoni*. The pseudobulbs are thin, sharp edged, and ribbed at the side. The leaves are sword-shaped, lorate, recurved, and shorter than the raceme. The raceme is long and narrow like that of the Sutton Oncid (*O. Suttoni*), and the flowers are as nearly as possible of the same colour; that is to say, the sepals and petals are dull brown tipped with yellow, and the lip is clear yellow stained with cinnamon brown at the base. The sepals and petals are nearly of the same size and form, rhomboid-lanceolate, acuminate, wavy, very distinctly stalked. The lip is three-lobed, with the side lobes nearly as wide as that in the centre, which is slightly stalked, nearly hemispherical, emarginate, and perfectly flat. The crest consists of a broad lozenge-shaped rugged-edged cuspidate process, beneath which, near the point, on either side, are two small unequal tubercles; in addition to which there is a stout blunt tooth which rises in front of the column, forming part of it. The wings of the column are roundish, dwarf, and incurved.

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* O. *planilabre* (Plurituberculata): pseudobulbis ancipitibus tenuibus costatis, foliis ensatis recurvantibus racemo brevioribus, racemo simplici, sepalis petalisq. lanceolatis unguiculatis acuminatis undulatis subæqualibus, labelli laciniis lateralibus oblongis parvis intermediâ semicirculari planâ emarginata, cristâ rhomboideâ cuspidatâ margine erosâ verrucis 2 inæqualibus utrinque versus cuspidem, dente forti obtuso faciei columnæ adnato, columnæ alis brevibus carnosis inflexis.—J. L.

There is no published Brazilian species with which this can be usefully compared. From the Sutton Oncid and similar Mexican forms it differs in the form of the crest, and especially in the strong tooth already mentioned as standing in front of the column.

It is rather a pretty species, of the third class in point of personal appearance.

Oncidium planilabre.

VII.—*General Remarks on the Variations of the Individuals which form the Groups called, in Natural History, Varieties, Races, Sub-species, and Species.* By M. Chevreul, of the Academy of Sciences of Paris.*

(Translated from the French.)

PART I.

§ I.—INTRODUCTION.

THE details into which we have entered, in speaking of the *Ampelography*, are sufficient to make our readers acquainted with the manner in which Count Odart has treated his subject, and we may therefore now proceed to discuss the question of the degeneration of cultivated plants, as we proposed, without the danger of being reproached for having given our own ideas instead of confining ourselves to the statement of the doctrines contained in the work submitted to us for examination. Indeed we shall not cease to treat of *Ampelography* in examining this question in a general point of view; for Count Odart, in giving the former the whole of his attention, has perfectly appreciated the importance of the latter, and in adopting what seems to us the better opinion, has relied upon observations made with sound judgment, and which are consequently capable of throwing light on the general discussion of a subject to which they belong as particular facts.

Count Odart uses the word *species* in the sense usually attached to it in common parlance and garden language, that is, to denote groups of living bodies, called by naturalists *races*, or simply *varieties*. Although, perhaps, there may not be much inconvenience in employing the word *species*, instead of *sub-species*, *race*, *variety*, to mark the different individual modifications of the vine, apple, &c., which are reproduced or multiplied, with their characters more or less well preserved, as the Muscat, Chasselas, Calville, Reinette, &c.; and where the question of the degeneration of living bodies is confined to that of cultivated plants, there is very great inconvenience in so doing when the question is examined from its most general point of view, and from which it is our intention to view it. For this reason we shall, in this part of our memoir, endeavour to define, exactly, the words *species*, *sub-species*, *race*, and *variety*, paying attention to the actually known facts on which the principle of mutation of species can be admitted or rejected. We shall then, in another Part, return and discuss the particular question of the

* These remarks, made by M. Chevreul in a Report to the Royal and Central Society of Agriculture, on the *Ampelography* of Count Odart, will, we expect, be found interesting to all botanists who regard variations in vegetable forms from a high and general point of view.

degeneration of cultivated plants, regarding it from the same point of view as the author of the *Ampelography.*

If there be any one question presented by natural history to the thoughts of a philosopher, and, by the importance of the consequences depending on it, demanding his best attention more than any other, it is the question whether animal and vegetable species have a character so permanent that the individuals representing them cannot be essentially modified without being altogether destroyed, or whether their organization is so *flexible* that they may, in certain cases, undergo such modifications that the individuals representing them may, in time and by a succession of changes, constitute species different from those which the same individuals represented before such modifications took place.

As we have always adopted the strict experimental method of inquiry into scientific matters, so we have always carefully distinguished the conclusions to which we have been led into *positive consequences*, *inductions*, and *conjectures;* and with regard to the question now under consideration, we confess that we cannot understand the great assurance with which it has been decided, by certain writers, sometimes one way and sometimes the other. To affirm that the solution of this question is positively and correctly arrived at and known, is to entertain an opinion that what the holder affirms can never be modified, whatever may be hereafter discovered. What will become, it may well be asked, of experimental science if this mode of thinking gains ground? What will become of the researches into the increase of animals and fecundation of vegetables, the inquiries into the modifications which can be produced by a long-continued diet, or by any influences different from those which exist in ordinary life? Why undertake them if they cannot be expected to throw some light on the subject? Is there nothing more to be learned from the study of the organisation of the lower animals and plants, nothing from the study of the forms covered over with substances which, composed of the débris of organised beings, seem in certain circumstances like yeast in fermentation with sugar, animàted with a sort of life? It is clear that those who, like ourselves, are convinced of the importance of such inquiries, think that in following a path scarcely opened, it is of more importance to make sure of our present knowledge by converting probability into certainty, than to add new proofs in support of an opinion which it may be wished should be triumphant.

Is it possible, it may be asked, for any one holding your opinions to give such a definition of species that it may be precise so far as it at present can be, and yet have such a latitude as to leave to the future the task of defining and fixing what is still vague and uncertain? We think it is, and we shall endeavour to give one by developing the definition of species according to the method in which we examined the same question in the *Journal des Savants* (December, 1840, pp. 715—717), and by paying attention to the beautiful pathological anatomical researches of M. Serres.

§ II.—DEFINITIONS OF SPECIES, SUB-SPECIES, RACE, AND SIMPLE VARIETY.

In a species we regard two things:—

1. *The whole of the mutual relations of the different organs composing an individual, and the comparison of these relations n the individuals representing the species, in order to establish the resemblance of these individuals;*

2. *The whole of the relations of these individuals with the exterior world in which they live, in order to appreciate the influence which they receive from it.*

The exterior world includes light, heat, electricity, atmosphere, water, soil, and aliments, with all the modifications which each of these agents or matters is susceptible of presenting in its manner of acting or of being.

First thing.

Nothing is more simple than the fundamental notion of species in organised beings for a learned and even unlearned man, as soon as the term is understood to include *an indefinite number of individuals resembling each other, more than they resemble any thing else;* and, as it is seen that as individuals which resemble each other most proceed from parents which resemble them, so a *species includes all the individuals sprung from the same being, or from the same two beings, according as the sexes are united or separated.*

This notion of species is perfectly conformable to all that we can observe, when, starting from a late generation of individuals, we go back into the past as far as possible to their ancestors; it is more especially when we compare the animals and plants of our own day with those of which we find remains or figures in ancient Egypt, that the preceding observation acquires visible importance.

On the other hand, if individuals, belonging to two distinct species, can give birth to a living being, then called a *hybrid,* this resembles its parents; it will differ less from them in proportion as they resembled each other: if again two *hybrids* born of the same two species can give birth to other individuals, these will give the same result as the individuals of one and the same species; but it must not be forgotten that hybrids, especially of the animal creation, have little disposition to multiply. Lastly, if it be remembered that reproduction is only possible between closely-allied species, it will be seen that the notion of species deduced from the preceding remarks may be clearly given in the following terms:—

A species comprehends all the individuals proceeding from the same male and the same female; these individuals resemble them as much as possible relatively to the individuals of other species;* they are then characterised by the resemblance of a certain generality of mutual relations existing between the organs of the same name, and the differences which arise out of these relations constitute *varieties* in general.

Varieties are called *simple* if the differences are not perpetuated by generation, or, if they are, then only in a very small number of circumstances which are not identical; they constitute *races* if the differences, taken as a whole, are pronounced, and of such a nature as to be perpetuated by reproduction, and that pretty constantly in a certain number of circumstances that are not identical; they constitute lastly *sub-species*, if the characteristic differences being well pronounced, are perpetuated constantly in all the circumstances in which the individuals composing the species can exist.

If the definition of species which we have offered cannot be literally the object of a rigorous demonstration, *in consequence of the impossibility of proving that there were originally, for each species of living body, but* ONE *or* TWO INDIVIDUALS, in attributing their origin to a period when they acquired the form which we now see, whether they underwent any modifications prior to this period, or whether they were created with their actual form; and if in this respect our definition be somewhat hypothetical, we have adopted it without hesitation, because it sums up our opinion with as much conciseness as clearness, without affording room for any erroneous interpretation; for the foundation of the whole clearly remains, whether each species received its actual form in a single individual or a single couple, or whether it received it in several individuals or in several pairs of individuals.

Of the two things which we regard in a species, the first is the only one which has been studied with any care by the numerous naturalists to whom we are indebted for the description

* In this resemblance we include all the characters; for if we only consider the visible characters, as shape, size, and colour, we may find more resemblance, in these respects, between two individuals of different species than between the individuals of two races of one and the same species. For example, a *mastiff*, variety of dog, resembles a wolf more than a *spaniel*.

of the species of organized beings. Although it is the common opinion that their labours concern the sciences of *pure observation*, we ought to notice the part played by experiment in these same labours, not only because our subject demands it, but for the purpose of justifying the opinion we before advanced (*Journal des Savants*, December 1840, p. 714) as to the real existence of only two classes of sciences, the sciences of pure reasoning and the sciences of reasoning, observation, and experiment. When naturalists, having attained the object of their researches, give perfect descriptions of the species they have examined, their work is then founded upon *that which is based on experiment.* The accuracy of descriptions depends on this, that they relate to species perfectly defined in the mind of the observer *in consequence of the certainty he possesses of studying them in a series of identical individuals issuing from successive generations; now if he were ignorant of the fact of these successive generations of identical beings, this fact had no less precision for him than if it had been the result of his own experience; this proposition is evident on the least reflection.* Every time on the contrary that the true *experimental basis*, of which we are speaking, is wanting to the naturalist in consequence of his observing for the first time one or two individuals of a species foreign to his country, he is exposed to error, because he is apt to take that for a species which is only a variety, or some young or old individual of a species already known; or if the individuals before him are really new, he gives as essential specific characters, those which are exclusively peculiar to themselves.

Second thing.

Setting out with the observation of the differences which distinguish the individuals of one and the same species from each other, or the individuals of sub-species from different races sprung from the same male and female, we are naturally led to the study of the second thing comprised in our definition of species; and here comes the question whether circumstances very different from those which now exist, could formerly have exercised an influence on all, or at least some organized beings, so powerful that they then might have constituted species entirely different from those which the same beings represent now.

At first sight, and looking only at the great modifications which such species as the dog have undergone, and which have afforded such different races as greyhounds, bulldogs, and spaniels, we are, it must be confessed, tempted to answer the foregoing question in the affirmative, and to add that this answer, which leads us to admit only one creation of organized beings, by its simplicity satisfies many more people than are satisfied by the answer given by those who, like M. Cuvier, recognize successive creations of organized beings corresponding to certain revolutions of the globe. But it is as well to observe, that these successive creations are not a necessary consequence of the immutability of species; for M. de Blainville, who entertained this opinion in its fullest extent, only admitted one single creation of organized beings.

Some gardeners and farmers have declared, that good varieties of fruit trees propagated by the *division of an individual*, on having recourse to layers, budding or grafting, degenerate after having lived a certain time, and that plants propagated by scales and otherwise do the same; in support of this opinion they quote the disappearance or death of a great number of varieties of vines, apples, pears, &c., which have been described by Pliny, Olivier de Serres, La Quintinie, &c. This opinion, which, as we have already said, does not appear to us to be founded, at least to the extent to which certain contemporaries, and more especially M. Puvis, have carried it, might nevertheless be true, and yet the mutability of species need not necessarily result from it. To this, however, we shall revert in another Part of this essay, which will, we hope, serve as a supplement to the preceding remarks, and as a justification of the line we have adopted in treating of a subject, the importance of which is only equalled by its difficulties.

However weighty the second thing which we have regarded in a species may be, it unfortunately occupies very little space in the domain of positive science; for we possess scarcely any facts, either of experiment or mere observation, which at all show the exact influence of the external world on the organic constitution of individuals, and the few facts we have, apply to a small number of individuals of a still smaller number of species. And how can it be otherwise when we reflect on the difficulties which must be encountered, and the slowness with which organized beings can be modified in a series of generations which last much longer than the life of the observer? The small number of scientific men who occupy themselves with such inquiries as these, belong to the class of natural physiologists, who, from the very nature of their pursuits, are more inclined to devote themselves to such studies than naturalists, more properly so called.

Conclusions relating to the definition of species.

1. In the actual state of our knowledge, the facts relating to the first thing in the notion of species, and of which the greater part result from the daily observation of the reproduction of animals and plants, are in favour of the opinion of the immutability of species; for, however great the variation observed in indivi-

duals of the same species may be, no one of these individuals has ever been found which belonged to a species different from that of its parents, or which constituted a new species. As we have already stated, *every-day observation and experiment demonstrate*, SO FAR AS THE CIRCUMSTANCES OF OUR OWN DAYS ARE CONCERNED, *the permanence of the types which constitute the species of living bodies.*

2. But is this conclusion sufficient to authorize us to say, that in different circumstances, species which actually exist could never be so modified as to produce individuals which, compared with those we at present know, would form different species? We think not. But, admitting that as the matter now stands, we cannot affirm *that it is absurd to think that a species could not undergo modifications capable of making a new species;* on the other hand, to admit the principle of *mutability of species* would be to derogate from the rules of experimental method, inasmuch as all the facts at present known do not favour this opinion. In short, if the opinion of *the mutability of species, under circumstances different from those under which we now live, does not appear absurd*, to admit the *fact* in order to draw consequences from it, is to depart from the strict principles of experimental inquiry, which never permit us to lay down that as a principle which is matter of mere conjecture.

3. Although we allow the possibility of the mutation of species within certain limits, by circumstances depending on the exterior world, we do not infer either the non-existence of species or the uselessness of the studies of those who attempt to define them: for we adopt the definitions of species given with exactness by those naturalists who believe in their absolute immutability, but who have observed with certainty, in a series of generations, the recurrence of those characters which are essential to each of them; in our view, however, *these definitions are only true, are only exact, for the circumstances in which the species habitually live.*

Having stated the preceding conclusions, we will point out in what way error, or want of precision, may exist in the definition of *species* by botanists and zoologists, taking for the date of their origin the period at which they received the form which we now see, whether in reality they do or do not go further back than that. We think a species is well defined in principle, when the individuals which now represent it resemble their most ancient ancestors.

Errors.

The errors found in the definitions given of *species* may have arisen from the carelessness or want of knowledge of their author, or from the circumstances in which he was placed, and which were not sufficient, at the time, to enable him to give an exact definition of the species described by him. It is clear that the errors of which we have spoken might have been avoided, and that they will in time be entirely effaced from our books: for, thanks to the great number of naturalists, thanks to the many travels undertaken for the purpose of advancing natural science, errors committed by carelessness or ignorance are soon detected, and species established from too small a number of individuals to represent them completely, as has been the case with many exotic species, will be sooner or later properly defined.

Want of precision.

There is a great difference between a *species ill defined*, in consequence of what we call errors, and species which *may be inexactly defined* relatively to the absolute truth, and which we could not know, in our present state of knowledge at least, with respect to the *two things essential to the notion of species;* the want of precision of which we have to speak as *possible*, is very different from errors, for want of precision, even if it be real, as we cannot now prove it, can give us no right to argue as if it were incontestable.

Want of precision in defining a species, not considered by naturalists as ill established, may arise from two opposite causes —*the definition may give the species too great an extent* or *may confine it within too narrow limits.*

First Case.—*Definition too large.*

A definition of a species is too large if it includes as *races* true species, or in other words, if the individuals of these so-called *races* have not all, without exception, proceeded from the same male and same female: for example, those naturalists who make man a *genus* composed of several species, accuse of this fault those who consider man as one *species* comprehending races which, according to them, have all sprung from one father and one mother.

Second Case.—*Definition too small.*

Notwithstanding the existence of the two opinions relating to the *human genus* and *human species*, the want of precision arising from a too confined, appears to be commoner than that which arises from a too extended definition; in our opinion the number of species of which we speak, and which are described among the *species* of botanists and zoologists, will rather decrease than increase, because it might be found that the races now referred to a single species are in fact so many distinct species;

we think therefore that many species now considered well established, may possibly have had a common origin, so that could we go back to their first parents we should find them to be the same male and female.

But if such a result should some day be arrived at, must we conclude that there are no species, and that it is impossible to refer organized beings to perfectly well defined types? We think not; and in our opinion he goes much too far who supposes that what we now call species are only sub-races, because the true species occurs in the family. What would be the consequence of such a supposition? The characters of species would be more general than they are now; one would then probably find that individuals of this species, living under such circumstances, would have undergone modifications by virtue of which there would be as many different sub-species and races as there are at present genera and sub-genera, and in short that one species, whilst always reproducing the same thing, would give rise to sub-races. We conclude then that, whatever may be said, the progress of the sciences of observation demands all the labour which has been bestowed, that we should persevere in our endeavours to define species both of plants and animals, and that teachers, so far from discouraging those occupied in such studies, should persuade and excite them to continue therein, and to collect together facts concerning the modification of the characters of the individuals before them, in order that the anatomist, physiologist, and philosopher may be provided with materials which may throw light upon the causes which modify organized beings. These materials will always form the basis of science, even if subsequent labours show that species should be represented by our actual families, sub-species and races by the genera and sub-genera of these families, and sub-races by the species of these genera and sub-genera. The notion of species will clearly not exist the less, will not be less clearly defined than now; the number of species only will be restricted, and the variations to which the essence of each of them will be subject will extend beyond the limits within which we now restrict them.

PART II.

§ I.—INTRODUCTION.

Having defined the word species as it ought to be defined in the present state of natural science, attention being paid to the correlative terms necessary to the existence of the individuals which it includes, viz., the organization of these individuals and the external world in which they have to live, we proceed to discuss the questions of degeneration and persistence of the varieties of our cultivated plants: but we must first give a short account of the general methods of propagating vegetable species considered, in the individuals representing them, as simple varieties, races, or sub-species.

Propagation of Vegetable Species.

Two methods are usually employed for the propagation of vegetable species:

A. By the simple division of an individual representing a species, sub-species, race, or a simple variety.

B. By sowing the seeds of an individual.

A. *Propagation by Simple Division.*

This goes on by the development of an organized part separated from a living individual either naturally or artificially.

1. *Propagation by Layers.*

A stem or branch in a horizontal position, and partly covered with damp earth or moss, produces roots, but remains attached to the parent plant; if after a time the stem or branch which has rooted be separated from the stock, we have a *layer* representing that stock.

2. *Propagation by Cuttings.*

A stem, branch, or leaf, separated from its parent and placed in earth, produces roots and becomes a living individual obtained by *cutting*.

If the cutting is composed of a young shoot attached to some old wood, it bears the name of *Crossette;* this is very common in vineyards.

3. *Propagation by Grafting.*

Everybody knows that an essential or adventitious bud taken from a living plant and placed upon another in such a way that the youngest and most analogous tissues in each are in contact, the bud and the plant on which it is placed, grow together according to the law of *homœozygy* (*Journal des Savants*, 1840), and the bud, then called a *scion*, is developed with the characters of the plant from which it was taken, by means of the nourishment supplied by the *stock* on which it is placed.

4. *Propagation by Tubercular Buds.*

The stems of most plants produce tubercular buds which can be developed either at their subterranean or aërial part. As an example of the first we have potatoes and the scales of the white lily (*Lilium candidum*), and of the second the bulblets of *Lilium bulbiferum*: these tubercular buds, if placed in earth, will produce individuals identical with their respective parent plants.

There are other methods of propagation by simple division, but it is useless to mention them.

B. *Propagation by Seeds.*

Propagation by seed is capable of producing individuals very different from those obtained by simple division.

Indeed, although we generally find the greatest possible resemblance between a parent plant and one obtained from it by any of the above-mentioned processes of division, this is by no means the case when we come to compare plants with their seedlings: for although the latter have the characters that are essential to their species, it *may*, we will not say *always does*, *happen* that some of the individuals differ more or less from the others.

The consequences of this may be easily seen. Whenever it is desired to propagate any one of the innumerable plants in cultivation, for the purpose of perpetuating any particular quality, recourse must be had to simple division; whilst, on the other hand, if it be desired to obtain *new varieties*, that is, individuals differing in some degree from their parents, recourse must be had to sowing the seeds of the latter.

A very good illustration of the foregoing remarks is afforded by *Robinia pseud-acacia*, var. *spectabilis*. M. Descemet having sown in the early part of the present century some seeds of *Robinia pseud-acacia*, obtained some seedlings without any *spines*;* and it is by the simple division of these seedlings that all the specimens of the variety *spectabilis* have been obtained. A very remarkable fact connected with this subject is, that the seeds of the variety *spectabilis* have always produced spiny plants identical with the common *Robinia pseud-acacia*.

When we mention this fact we do not intend to say generally that all seedling varieties yield seeds, which, when sown, produce plants identical with those from which the seedlings were obtained; but we think we may say that *whenever we wish to reproduce with certainty any given peculiarity in a plant, we must have recourse to simple division; for we cannot* BE CERTAIN *to obtain what we want from the seeds of that plant.*

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* I have called the thorns of this plant *spines* in accordance with the usage of gardeners and many botanists, especially Desfontaines and Poiret; but they are in fact *prickles*, being independent of the wood, and adhering only to the bark.

§ II.—SPECIES OF LIVING BODIES CONSIDERED RELATIVELY TO THE GROUPING OF THE INDIVIDUALS RESPECTIVELY REPRESENTING THEM, ARE THE OBJECTS OF FIVE GENERAL DISTINCTIONS.

As we have already said, a species comprehends all the individuals sprung from the same male and female: those individuals resemble them as much as possible relatively to the individuals of another species; they are characterised by the similarity of a certain number of mutual relations existing between the organs of the same name; and the differences existing without these mutual relations constitute varieties in general.

Varieties are called *simple*, if these differences are not perpetuated at all, or being perpetuated, are so only in small numbers of places, and under circumstances that are not identical; they constitute *races*, if the differences taken as a whole are decided, and capable of being perpetuated by reproduction pretty constantly, and in certain places and circumstances not identical; they constitute, lastly, *sub-species*, if the differences are well defined, and can be constantly reproduced in any places, and under any circumstances in which the individuals composing them can live.

These remarks show the necessity of paying attention to the localities, or, to speak more generally, to all the external circumstances capable of modifying the living beings we may be studying: in no other way can we give the precise value to the modifications produced considered as characters of a species.

We shall reconsider, but in a subordinate way, these definitions in order to render them as exact as possible, noticing in the most general view as regards the species, the subordination of the different groups of individuals which constitute *simple varieties*, *races*, and *sub-species*.

In applying these new considerations to animal and vegetable species taken as a whole, we are led to establish five sorts of distinctions, concerning the mutual relations which can exist between the several groups of individuals constituting *simple varieties*, *races*, and *sub-species*, relatively to the notion of the species to which these groups are allied. We shall distinguish these distinctions by the first five letters of the Greek alphabet.

Distinction Alpha.

When the individuals composing a species resemble each other too closely to allow of their being treated as varieties, and distinguished by separate names, any one of these individuals, or, if the sexes are separate, any two of them may be regarded as the types of the species to which they belong. To species in this condition we shall give the name of *Alpha*.

We distinguish several sorts of differences too slight to constitute varieties to which a special name can be given.

The first sort is the *variation* of botanists, which is not constantly reproduced by generation.

The second sort is the difference of size and vigour of individuals arising from their development in favourable or unfavourable circumstances; although these differences may be transmitted from parents to their offspring where the circumstances are the same, yet as they disappear under other circumstances, they are too unimportant to entitle the individuals in which they are found to distinct names.

In short, after having pointed out the characters common to well developed individuals of a species, it is sufficient to take notice of the variable qualities or variations, and the circumstances capable of producing some modification of size or vigour in the individuals.

Kœlreuteria affords an example of a species to which *Alpha* is applicable.

Common rye (*Secale cereale*) may, according to M. Loiseleur-Deslongchamps, be given as a second example; for it is generally supposed by botanists and agriculturists to have undergone no permanent modification, notwithstanding the long time it has been in cultivation, and the great diversity of soil and climate in which it has been reproduced in endless succession; the only change that has been observed in it is a diminution of size and vigour in poor ground. It was sufficient for Tessier to sow several times in autumn in the same place *petit rye*, *trémois rye*, *marsais rye*, and *spring rye*, to get a plant identical with common rye.

According to M. Agassiz, the pike (*Esox lucius*) and perch (*Perca fluviatilis*) are similar examples in the animal kingdom.

In short, in the species to which the distinction *Alpha* is applicable, every well-developed individual may be taken as the type.

Distinction Beta.

This will not be so if a certain number of individuals belonging to the same species present, under certain circumstances, any remarkable and constant differences. Such is the case with the variety *spectabilis* of *Robinia pseud-acacia*: the spiny individuals represent the species, and the spineless individuals represent a variety of the same species, which variety cannot, as already stated, be propagated from seed.

The origin of this variety being perfectly known, we cannot doubt that the spineless specimens which represent it form a group subordinate to the group of spiny specimens constituting the species, since we are perfectly certain that the latter produced the former.

We may as well add, that there are now at least fifty varieties of *Robinia* obtained from seeds and propagated by division ; but these varieties cannot, it is said, be propagated by seed.

In short, in the species to which the distinction *Beta* is applicable, we find *individual types* and *varieties.*

Distinction Gamma.

Individuals may be found in nature in uncultivated places, which may be considered as types of their species ; such are, for example, specimens of the wild carrot.

Now, by cultivation, plants of the wild carrot may be modified in such a way as to give rise to varieties which may be propagated by seed with a tolerable degree of certainty (at all events under determinate circumstances) so that they may be compared with races.

It is here that the admirable observations of M. Vilmorin will assist us.

If the seeds of a wild carrot are sown in the spring in a garden, an annual, identical with the wild carrot, will be obtained. No appreciable change will be produced if the stem be pinched several times in the course of its growth. If a *sufficient number* of seeds are sown in summer instead of in spring, plants will be obtained, the stems of which will not run to flower, and *the roots of which will be modified by the end of autumn.* If in the following spring the same plants are again put into the ground, they flower and produce seeds ; their roots are by this time very sensibly changed.

If the seeds of the specimens with the most changed roots are again sown, carrots will be obtained still more modified than those of the first generation.

The seeds of the plants of the second generation give a crop of carrots very much modified, and but few of these have run to seed.

The carrots of this third generation differ from common carrots ; the flesh of the former being larger, more compact, a little more dry and mealy, with not so strong a taste but with as much sweetness as in that of the latter. Most of the roots, like those of the first and second generations, are white or lemon-coloured, whilst others are so orange-coloured and have so strong a taste, that M. Vilmorin does not doubt that the seeds of these latter would yield the common carrot ; he preferred, however, to cultivate the white and yellow rooted specimens, as their taste was less aromatic.

We see then how the season of sowing influences plants obtained from the seeds of the wild carrot, and how the modifications resulting therefrom are not common to all such plants; this must be attributed to the fact that the circumstances under which vegetation took place were different, or that the seeds themselves were different, or to both these facts combined; and if the latter, the second of the above facts would have a greater influence than the first, as we shall hereafter see.

M. Vilmorin's researches on the modifications of the wild carrot afford a good example of the great influence a scientific method of cultivation has on the researches into the proximate causes of vegetable modifications, and they at the same time show the possibility of solving the questions relating to the type to which modified individuals belong, and which would always have remained in obscurity had it not been for the powerful aid of experiment.

In fine, in the species to which the distinction *Gamma* is applicable, there are individual *types* and varieties capable of propagation by seed, and that with sufficient certainty to form *well-defined* varieties and even *races.*

Distinction Beta plus Gamma.

This applies to species in which there are types, and in addition—

1. Varieties which can be propagated by division, but not by seed.
2. Varieties which can be propagated by seed with sufficient certainty to be defined and even to form races.

If varieties of *Robinia pseud-acacia* had been really capable of being reproduced by sowing, then the species *Robinia* would have afforded an example of the distinction *Beta plus Gamma.*

Distinction Delta.

It is very far from true that the origin of the different groups of individuals belonging to the same species is as well known in the greater number of cases as they are with respect to the species to which the distinctions *Beta* and *Gamma* apply. There may then be species which present two or more groups of individuals, constituting two or more varieties, without it being possible to consider one of these groups as formed of individual types of the species. We may then correctly say that there is no known individual type of this species, inasmuch as the notion of the latter includes characters which are common to distinct groups without there being any possibility of affirming that any one of these groups contains unmodified individuals.

In short, in the species to which the distinction *Delta* is applicable, there are only varieties, no individual types.

We subjoin several examples of particular cases to which the present distinction is applicable.

Case 1.—*Simple Varieties of a Type.*

Among the specimens of *Prunus Padus* (L.) some may be found with a red fruit, but which are not capable of propagation by seed with sufficient certainty to give rise to two varieties.

If it had been demonstrated that the one proceeded from the other, as it has been shown that the cultivated carrot has proceeded from the wild one, then the species *Prunus Padus* would be comprised in the distinction *Gamma;* but as this is not the opinion of the generality of botanists, we think it better to apply to this species the distinction *Delta* 1.

The species *Helix pulchella* is, according to M. Agassiz, another example of this; there are two varieties of the latter species—

a.—Even.

b.—Ribbed.

Case 2.—*Varieties of Type, and Races derived therefrom.*

What we have already stated is applicable to the Wild Cherry (*Cerasus avium*). In the impossibility which exists in affirming that the type of the species has black, red, or even white fruit, we are compelled to consider the individuals which present these differences as two or three varieties of one type, and consequently to apply to this plant the distinction *Delta.* But the Wild Cherry is not like the *Prunus Padus*, for botanists and gardeners all agree that from the former three distinct races, viz. the Guigne, Bigarreau, and Heaume, have been obtained by cultivation; these races, at least the two first, may be propagated with considerable constancy by seed, and what is very remarkable, each of them includes varieties, the fruit of which, by their black, red, or white colour, corresponds to the three typical varieties.

Case 3.—*Races derived from an unknown or imperfectly known type.*

When a great many varieties, or when many races capable of propagation from seed, have been obtained from a plant cultivated for a long time in countries to which it is not indigenous, it may be very difficult, even in these countries, to point out the type from which these varieties have proceeded, and to ascertain the precise modifications which have been caused by climate and cultivation.

Without pretending to decide whether the Cherry (*Prunus Cerasus*, L.) is indigenous to western Europe, and more especially to France, as Rozier thinks, or whether it is a native of Asia, and more particularly of the neighbourhood of Cerasonte, where it was observed growing wild by Tournefort; without inquiring whether these are not themselves modifications of a type, we may say that the Cherry, in the state in which it is at present found cultivated in France, is represented by races, the type of which is not certainly known; and in this case we may cite it as a third example of the distinction *Delta* 3.

Distinction Epsilon.

Let us take it for granted that the white man and the negro have descended from the same father and the same mother; inasmuch as it never has happened that a negro has been born of white parents, nor a white child of negro parents, the species man is, according to this supposition, represented by two varieties which preserve their essential differences with constancy under the same circumstances. Now as soon as varieties of the same species have become fixed to this extent they may be correctly named *sub-species*, always bearing in mind however that we supposed at the outset that the white man and the negro are not two different species.

In short, the species to which the distinction Epsilon is applicable, contain no individual types of species, but permanent *sub-species*, the number of which may vary.

Four cases present themselves with respect to the sub-species of a vegetable species.

Case 1.

There may be races without varieties.

Case 2.

There may be races with varieties which cannot be propagated by seed.

Case 3.

There may be races with varieties which can be propagated by seed.

Case 4.

There may be races with varieties:

a. Capable of propagation by seed;

b. Incapable of propagation by seed.

Such are, in our opinion, the rational distinctions which may generally be established at the present time between individuals comprised in a given species of living bodies, when it is wished to unite them into different groups, the mutual relations of which, being susceptible of variation in different degrees, give rise to what we have designated *types of species*, or simply *types*, *varieties*, *races*, and *sub-species*. These distinctions express the most general relations of all the individuals grouped into what is at present called a species, independently of any question as to origin, and are simple and concise formulæ which possess the double advantage of giving the naturalist a means of clearly expressing his opinion on the relations which he observes in the individuals composing the species of which he speaks, and of furnishing the critic with a means of communicating his thoughts when he wishes either to cite or discuss the different opinions of naturalists on the subordination of the individuals of a given species.

If the application of one of these five distinctions to any given species should be found impossible, let this fact be expressed by the letter *Omega* attached to the species; no letter should however be annexed to any species until the latter has undergone the examination of which we speak.

The great advantage that will result from the adoption of the above system of notation will be, that all the *species* marked at first *Omega*, or nothing at all, will attract the attention of all observers, who will then know on what points information is required.

§ III.—VEGETABLE SPECIES CONSIDERED WITH RESPECT TO BOTH THEIR PERMANENCE AND TENDENCY TO BE MODIFIED.

In treating, in the First Part, of the definition of a species, we have admitted in principle that known facts do not permit us to consider the actual circumstances, in which organized bodies at present live, as sufficiently powerful to alter their specific essence, because we have no example of individuals of one species giving rise to an individual of another species; and, besides, notwithstanding the extent of the modifications which living bodies have undergone within our own knowledge, they always differ from their parents less than any other individuals of a different species do.

To be able to judge of the use of the definition of species given by us, and founded on experiment, we must see how it stands with respect to the five preceding distinctions, when we take into account the modifications which the different species of living bodies can undergo without losing their respective peculiarities.

If it is evident that the more numerous the parts or distinct organs of a living being are, the more numerous will be the possible modifications, other things remaining the same, still observation shows that plants, which are associated in the natural system, are susceptible in very different degrees of modifications: this is apparent from the permanence of rye, and the numerous variations which wheat undergoes in different climates and under different modes of treatment. The cause of this difference of susceptibility is still unknown, and is one of the finest problems yet remaining to be solved.

However it may be, the modifications undergone by so many individuals of different species being as notorious as the principle of the unchangeableness of their essential characters under the circumstances in which they now live, we think it may be as well to give a comparison that will clearly show our own ideas on the double tendency of individuals in general to preserve their essential characters, and of the possibility of their undergoing some modification.

If a cylinder of wood or any other homogeneous matter be placed on one of its bases on a horizontal plane, the axis of the cylinder will be perpendicular to the plane, and the equilibrium will be as stable as possible; but if a force acting in a plane perpendicular to the cylinder and in the direction of its axis moves it from the vertical position, but not sufficiently to upset it, a new equilibrium will be produced which will continue as long as the force is applied. The cylinder may be made to take every possible position with respect to the horizon, and may be made to describe an indefinite number of cones, the largest and external cone being described by the cylinder when it is as much as possible out of the vertical without tumbling over, and the smallest and innermost cone being that described by the cylinder when inclined in the least possible degree from the perpendicular.

We will now endeavour to explain the distinctions we have established with respect to the species of living bodies by means of the preceding illustration.

1. The normal and most stable position of the cylinder is when it is upright on a horizontal plane, and it then corresponds to the ideal case of a species represented by individuals resembling each other in every respect.

2. When the positions in which the angles made by the cylinder's axis with the vertical are very acute, in consequence of the disturbing force acting but feebly, they then correspond to the differences more or less apparent which distinguish from one another; 1. the individuals of the species *Alpha*; 2. the individual types of the species *Beta* and *Gamma*.

3. The positions in which the cylinder's axis makes larger angles with the vertical than the last positions, correspond to

the differences presented by the typical varieties of the species *Delta*.

4. When the positions in which the angles made by the axis of the cylinder and the vertical are still larger, they correspond to those modifications which are important enough to give distinct varieties, whether they be races or sub-species; they can consequently be applied to varieties of the species *Beta*, to varieties and races of the species *Gamma* and *Delta*, and to sub-species of *Epsilon*.*

Another consequence may be drawn from the comparison which we have just made. As soon as the disturbing force ceases to act on the cylinder, it resumes its normal position; and in like manner as soon as the disturbing causes of modification cease to act on living bodies, the modifications themselves disappear, and the individuals presenting them tend to re-assume the typical form of their respective species. But it must not be forgotten that this is not unexceptionably true; for there can, we think, be no doubt that individuals of certain species remain modified, although removed from the causes and circumstances which gave rise to the modifications; and, moreover, as a general rule, those modifications in living bodies which can be effaced, do not disappear the moment the influences which caused them have ceased to operate.

We proceed to examine these two classes of contradictory facts, and we shall first consider those which by their evidence and importance lead most to general conclusions. We shall then give our attention to the special questions proposed for discussion at the beginning of the present paper relating to Count Odart, in the hope that the details which will have preceded them will be justified by the light they will throw upon the subject.

Article 1.

Stability of Organic Forms.

Our knowledge of the stability of organic forms is derived (A) from a comparison of the individuals of different species of plants and animals in actual existence, with extinct individuals of the same species: (B) from observations on the permanence of one and the same form, made either on the individuals of a series of successive generations, or on individuals of different species of

* As to the races and varieties of the sub-species *Epsilon*, they may be represented by the preceding positions of the cylinder, if we suppose each sub-species to correspond to the case in which the axis of the cylinder deviates very little from the vertical; or, in other words, if we suppose varieties of sub-species to be varieties of a species.

one and the same genus, which have been submitted, in their development, to the influences of identical circumstances.

(A.) Amongst the animals preserved by the ancient Egyptians, some have been found in such a perfect state, that their identity with animals now existing has been conclusively ascertained. Take for example the complete identity found to exist by Cuvier between the Ibis of ancient and modern times. So in plants; M. Loiseleur-Deslongchamps has demonstrated that the wheat of our own day is identical with that found in the ancient Egyptian catacombs, at least 3000, and perhaps 4000 years old. The last named gentleman has shown that wheat does not proceed from any species of *Ægilops*, as has been stated even in modern times, and that it is difficult to place it, as it was by Buffon, among those plants which have been so modified by cultivation, that even if their original type has not disappeared entirely from the face of the earth, at least it has not been recognised among living plants.

(B.) We have not been able to ascertain that any permanent modifications in the annuals constantly raised from seed in botanic gardens have ever been observed. We may mention, that for 30 successive years at least, 150 varieties of grasses were sown by M. d'Albret, of the Royal Gardens, and these varieties constantly appeared with their peculiar essential characters; so with the numerous seedlings raised by M. Pepin, of the Botanic Garden in the same place, they always represented their respective parents, and among these plants were *Ægilops ovata*, *squarrosa*, and *triuncialis*, which had been constantly raised from seed for upwards of twenty years.

As another example of the unchangeableness of specific characters in the same circumstances, we may take *Alchimilla vulgaris* and *A. alpina*, the first of which grows in our plains, and the last on our mountains. So long as they were observed in such different places, a common origin might be attributed to them, their specific differences being explained by the different circumstances under which they grew. But M. Bravais, who at one time entertained this opinion, has abandoned it ever since he found both plants growing together in Lapland, in a place where they had existed probably for centuries, but without in the least losing their respective peculiarities.

Article 2.

Modifications of Organic Forms.

When it is considered how much a living body, with however little complexity of organization, depends on certain conditions of the external world, such as temperature, light, moisture, food, &c., and if a plant on soil; when besides it is remembered how impossible it is that there should be a concurrence of identical circumstances, whether for all the contemporaneous individuals of one and the same species living in different and often widely separated places, or for all the individuals of this species derived through a succession of generations from the same male and same female; if after these considerations we endeavour to ascertain the modifications undergone by organized beings from the influences of which we speak, it is certainly not the extent of these modifications, whether we look at the number of species to which the modified individuals belong, or whether we look at the intensity of these modifications, which surprises us; but the insufficiency of these natural causes to change the essential nature of each species, and which are nevertheless susceptible of modification.

This insufficiency is evident even now where the modifications have been the greatest, that is, where man has done his best to favour the influences of natural agents and of all the circumstances capable of acting on the organization of living beings.

How interesting it would be to know the origin of the varieties and races of plants and animals which have resulted from this treatment, and, assigning their respective age, to ascertain the points of resemblance and difference between them and the varieties we actually have! How much it is to be regretted that the ancients, in speaking of these varieties, have said nothing of their origin, or distinguishing characters, and that we are reduced to mere conjecture on so important a subject!

As man was nourished by fruits before he cultivated the land, fruit-trees were probably the first plants modified by being raised from seed, which would be scattered about as well by man as by those birds which lived upon their fruit.

A great number of our vegetables arose from experiments made in the middle ages by those who attended to their cultivation, and more especially by the monks; the varieties of fruit-trees which date from this period are probably derived from an accidental sowing, but transmitted to us by means of grafting, which was understood in very early times. The taste for flowers, which began to spread at the end of the middle ages over Holland and Belgium, induced gardeners and amateurs to increase the number of varieties by raising plants from seed. There may have been a few persons towards the latter end of the eighteenth century who endeavoured to raise fruit-trees from seed, but if there were, they either, like Hardenpont, kept their experiments to themselves, or, like Duhamel, obtained nothing but negative results; all good varieties were in those days propagated by grafting.

It was not until the end of the eighteenth century that a few people began to raise fruit-trees from seed; the two most celebrated persons of this class were Van Mons in Belgium, and Sageret in France, and of these the former made the experiment on the largest scale, whilst the latter published the most on the subject, having laid before the world all his researches made from the year 1794 down to our own day, in his celebrated treatise *Pomologie Physiologique*, and the memoirs which preceded and followed that remarkable work.

We have mentioned the sowing of several plants as good examples of the distinctions above applied to species, regarded in relation to the subordination of the groups of individuals composing them respectively; we have still to examine how plants may be modified by having their seeds continually sown according to the usual methods practised by gardeners for the purpose of obtaining varieties. It may be as well, however, to explain first of all the exact meaning intended to be conveyed when we speak of the possibility of modifying certain plants in order to obtain varieties by sowing their seeds.

The sowing of seeds is not the essential cause of the modifications which may then be manifested, but it is only an occasional cause, as we shall show hereafter when we review the general causes of these modifications.

There are two periods in the life of plants which, in studying their modifications, require special notice.

The first period commences with the formation of the seed, and finishes the moment it is ripe and can detach itself, or be detached from the organ bearing it.

The second period comprises the germination of the seed, and the complete development of the plant proceeding from it.

After having spoken of general effects, of the causes which act in the two periods of the life of a given individual, we shall treat of the mutual modifications of two organic forms representing a species, when two individuals of different sexes belonging to these species are capable of producing a *hybrid*.

We have then to consider:—

The modifications which take place in individuals of a single species;

The modifications of two organic forms as found in a hybrid produced from two individuals of different species.

1. *Modifications of individuals belonging to a single species.*

a. Modifications which a plant can undergo in the *first period* of its existence.

Seeds taken from an ovary at the same time may, under the same circumstances, so far as the sowing and external agents are concerned, produce individuals sufficiently different to enable us to say that they are not absolutely identical; this being so, we can account for the modifications produced by referring them to the individual organisation or idiosyncrasy of each seed, which is alone sufficient to remove the plant springing from it from other plants which may be taken as the types of the species, sub-species, or race to which they belong.

A striking example of this is afforded by a bed of pinks; for although they may all come from seeds of the same plant, gathered at the same time, and exposed to the same circumstances, they will present such a difference in the colour, as well as in the form of their flowers, that one would almost think there were as many varieties as individuals. However, we must bear in mind that this is not true of all pinks, for we may sow thousands of seeds of some species belonging to the distinctions *Beta*, *Gamma*, *Delta*, without obtaining a single variety, the modifications being such as are found in those plants to which we have applied the distinction *Alpha*.

It would be as well if those who raise plants, especially fruit-trees, from seed with a view to obtain new varieties, would note the number of seeds sown and of those which have suffered any considerable change: they would then see that such experiments really have some value, and that if the advantages of seed-sowing had not been over-rated by some, they would not have been undervalued by others.

That seeds from the same organ do differ is shown by observation; thus the grains at the bottom of an ear of corn are better than those at the top, whilst the contrary is true of melon seeds, for the further they are from the peduncle the better they are. M. Girou de Buzareingues has observed that the seeds at the top of a spike of hemp give more females in proportion to the males than do those lower down.

Thus it appears that, by virtue of organic forces, seeds which are borne by the same plant, under the same circumstances as regards time, soil, climate, if not of exposure, are not necessarily identical, and that therefore we already have one cause of modification in plants proceeding from one and the same sowing.

The following circumstances too may influence these modifications:—

1. The seeds may not be all ripe to the same degree.

2. The seeds, though coming from the same plant, and equally ripe, may be sown at times unequally distant from that at which they were gathered.

3. So far as good quality of fruit goes, the seeds of old fruit trees are better, according to Sageret, than those of young ones.

4. Everything tending to disturb vegetation, without destroying it, may be a cause of modification: it is thus that M. Sageret,

by *torturing* a *Helianthus annuus*, by twisting, cutting, layering, binding, and making circular incisions on it, made it yield seeds which produced plants with variegated leaves: now this result is conformable to what we know of the influence of seeds which have, from some cause or other, lost some of their qualities; the plants they yield are weak, and their leaves are often variegated.

5. A circular incision in many cases favours the production of fruit. M. Sageret having tried it on a Capucine rose, which rarely bears any fruit, at least in Paris, obtained a tolerable quantity, some of which had seeds; one of these seeds yielded a dwarf rose tree with apetalous flowers. A wild Quince, treated the same way by the same gentleman, was so modified that those flowers which were above the incision gave *eatable fruit*.

We will now proceed to the application of the foregoing remarks to the sowing of fruit trees for the purpose of propagating them, or of improving and getting new varieties from them.

It cannot be doubted, after the experiments of M. Sageret and others, that a great number of the varieties of our fruit trees can be raised from seed: we may mention as examples Doyennés, Saint Germains, Reinettes; some sorts of Peaches, especially that called Téton de Vénus; some sorts of Apricots; most of the varieties of Cherry—the Quetsche, Perdrigon blanc, Reine Claude, St. Catherine, Red Damsons, &c., among the Plums; but not to depart from our definition of species, we add that these varieties can only be thus propagated under certain circumstances; we must therefore expect to find situations where these varieties cannot be raised from seed, and also, remembering what we have before stated with respect to the different individuals yielded by seeds of one and the same plant, under similar circumstances, that every seed of a fruit tree will not reproduce the one from which it was taken.

When we want to obtain from seed varieties with any peculiarity, we must take the seed from that plant which possesses the same peculiarity in the greatest degree, supposing always this to be possible. For example, if we want early varieties of a fruit tree, we should sow the seeds of that tree the fruit of which is ripe first; and as far as we can in the same conditions in which this tree itself grows.

This rule is generally true; we therefore think that M. Sageret was more correct than M. Van Mons, who, without being wholly ignorant of it, said what we cannot exactly understand, "I prefer the seed of a fruit less good, but oftener renewed, to that of a fruit less often renewed." According to our notions, for a given number of sowings, we ought to follow the advice of M. Sageret and M. Puvis, and sow the seeds of the best fruit.

We say then in fact, that the best results are obtained by taking the seeds of the best fruit for the purposes of sowing, by collecting the seeds yielded by the first sowing, and by sowing them, and so on, in the most favourable circumstances.

M. Sageret makes an important observation on the influence of the parents on the goodness of the fruit of their descendants; it is that the seeds of a bad melon of a good variety have yielded melons of excellent quality.

It is important to ascertain whether an annular incision which produced such curious modifications in the hands of M. Sageret, would produce the same effects on the fruits of the individuals yielded by the seeds of the modified fruit.

b. Modifications which a plant can undergo in the *second period* of its existence.

If the influence of external agents on the production of seeds, and consequently on such of their qualities as depend on their organization, is undoubted, the influence of the same agents on the germination of the seed and the development of the individual which arises therefrom is much more manifest in this period of the life of the plant than in the first, for the double reason that we observe its effects at every moment, and that we can compare them in the individuals sprung from seeds that are identical, but placed in circumstances which are not so.

To study methodically the effects of external agents, viz. heat, light, electricity, atmosphere, soil, and water, on plants, we must consider them with respect to places and times.

A. *Influence of external agents in the same place to modify seeds that are identical;* (a) *in one and the same time;* (b) *in different times.*

(a) *External agents may act at one and the same time.*

For example, identical seeds may be modified in a place where they have been sown, because there may be veins of earth different from the rest of the soil, and because the water may be unequally distributed over the soil; in such cases each individual will find itself exposed to different external conditions.

Since seeds, having the same origin, may not be exactly identical and yet be so nearly so as to deceive an experimenter, it follows that if, out of a certain number of seeds that are sown, one or more plants are obtained that differ from the others, we can never be certain whether this difference should be attributed to external or to internal influences. To avoid this source of error as much as is, in the nature of things, possible, seeds should be chosen, the origin, external appearance, and conditions of development of which resemble each other the most.

(b) *Influence of external agents acting in the same place at different times.*

Unusual states of the atmosphere produce unusual effects. As examples of this we may mention the following facts communicated by M. Vilmorin :—

"I saw," he says, "in a very hot and damp autumn some time ago, all the York cabbages of the market-gardens of Bercy and the Faubourg St. Antoine run to seed instead of forming heads, to the great loss of their owners."

This example sufficiently shows how important it is for market-gardeners to observe the circumstances which are likely to interfere with their business: they should pay great attention to the organ from which the seeds are taken, the time that is in each individual case the most fit for sowing, the manuring of the sown seeds, water, and heat. "If these things were neglected," says M. Vilmorin, "I think that all our heart cabbages, as well as the better sorts, such as the Savoy, cauliflower, Kohl-rabi, &c., would in a few generations come to the condition of the wild green cabbage."

"Potherbs with curled leaves, such as parsley, cress, &c., even with the greatest care are liable to return to their natural state; they are constantly producing, and sometimes in very considerable quantities, individuals with *uncurled leaves.*

"All cultivated roots, as carrots, beet, turnips, radishes, are in the same predicament. If the seed-bearing organ be ever so little neglected, in the very first year after the sowing plants will be obtained which will run up, and their roots will be without that substance, fleshy and tender quality peculiar to the improved race."

Whilst on the question of *causes acting in the same place but at different times*, we shall refer to the influence which the *time of sowing* may have on one and the same plant, as exemplified in the sowing of the carrot in summer by M. Vilmorin and of the pê-tsai cabbage in August by M. Pépin. The latter gentleman obtained from seed sown in August, plants with large and closely packed leaves and stalks, some of which weighed from 4 to 7 pounds in the months of October or November, and which in the following spring produced flowers on branched stems more than a yard high, whilst spring-sown seeds gave only a single stem with 4 or 6 leaves, which, after growing to the height of about a quarter of a yard, flowered soon after. The sowing is clearly an occasional cause of the modifications of which we speak, for they are owing to the difference of the external conditions to which seeds sown in autumn or spring are subjected. In the first case, cold prevents the plants from running up, and the organized matter necessary for the first development of the stem, instead of getting there, remains in the root.

B. *Influence of external agents in* DIFFERENT PLACES *in modifying the same seeds;* (a) *in one and the same climate;* (b) *in different climates.*

(a) *In one and the same climate.*

Differences in the soil, degrees of exposure, moisture, may affect a plant in different ways in the same climate.

The *Freneuse* turnip is a remarkable example of this. This variety, characterized by a reddish tinge and peculiar taste, is constantly reproduced at Freneuse in a red soil, whilst efforts made in many other places to propagate it from seeds collected at Freneuse have not succeeded, or if they have, plants have been obtained, the seeds of which have, either in the first, or at all events in the second or third generation, lost this property. There are no doubt places where it would grow exactly as it does at Freneuse.

We see by this example why, in certain places where we wish to obtain individuals of certain species having any peculiarity not possessed by those plants which are yielded by seed gathered in the same locality, we are compelled to obtain fresh seed every year from those places where the seeds do yield plants with the desired properties. Thus we get from Brussels the seeds of a cabbage peculiar to that place regularly every year; and these seeds, sown by us in our garden at Hay, give us exactly what we want.

Van Mons, when he removed his establishment from Brussels to Louvain, found the soil at the latter place less suitable for his fruit-trees than that of the former, and that his cherries, but peaches did not lose their qualities so much as his pears and apples.

The following statements from the *Pomologie Physiologique* also illustrate the influence of locality on the quality of fruits: The Besi du Quessoy is in Brittany a good pear, whilst at Paris it is good for nothing; the Bonchrétien d'hiver, though excellent at Paris, is uneatable in Gatinais.

(b) *Influence of external agents in* DIFFERENT CLIMATES.

As we find a mere difference of locality, where the climate is pretty nearly the same, has so great an influence on the development of plants, we should naturally expect to find this influence still greater where the climates also differ, and we shall not be surprised to see what great modifications our common European plants undergo by cultivation in the New World.

In Chili, European vegetables attain a considerable size; there does not appear to have been any tendency in the plants to return to their wild state.

In St. Domingo, on the contrary, cabbages and lettuces instead of remaining short, turnips and carrots instead of enlarging, all run to seed with surprising quickness: they lose their eatable qualities acquired from European cultivation.

In North America there are neither apple-trees, pear-trees, nor peach-trees of the same sorts as our own that have not been introduced there: the Europeans some 300 years ago took over the seeds of these trees; but so far from yielding what they yield us, they produced, at least in Virginia, as a first generation, trees with *wild and austere fruit*, which was not eatable by those accustomed to better things at home. The second generation sprung from the first American seeds was not so bad as the first; each generation was better than its predecessor, but their fruit is still inferior to our own, and what is very curious, the best of them differ from ours in taste and aroma. These facts, collected by M. Poiteau in Virginia five and forty years ago, show what modifications can be produced by a succession of generations in plants derived from the same seed, and they at the same time justify our definition of species; and if it be objected that the seeds of the fruit-trees originally sent to Virginia did not in this country produce such good fruit as they do at present, still the great fact remains, that the seeds, when sown in Virginia, yielded something different from what they then yielded in Europe.

We see then how the new conditions in which fruit trees were placed in North America gave rise to two principal results: 1. By depriving the fruit of the quality it had acquired by European cultivation; 2. By making it undergo, in the course of successive generations, modifications different from those of the fruit cultivated by us.

All that can be expected from modifications of a variety already improved by a change of locality is shown by an observation of M. Sageret: the kernels of some Green-Gage plums, cultivated in Paris, were sown in Auvergne: some excellent fruit was obtained from them. The kernels of the latter being sown in Paris gave a *variety* of the Green-Gage with a rose-coloured and good tasting fruit. Taking into consideration the fact that European fruit trees have already been peculiarly modified in North America, might it not be possible, by recultivating the North American varieties in Europe, to obtain new varieties with new qualities, which might be propagated by grafting, if not from seed?

2. MODIFICATIONS OF TWO ORGANIC FORMS CONSIDERED IN A HYBRID ORIGINATING FROM TWO INDIVIDUALS OF DIFFERENT SPECIES.

Having now considered the principal causes capable of modifying the individuals of one and the same species, we have next to complete our account of the causes which alter organized bodies, and to examine the mutual influence of two individuals differing in sex and species, when they give rise, by the process called *hybridizing*, to a *hybrid* individual.

Hybrids considered with respect to the definition of species and to the importance of their study.

We know that there are individuals of different sexes and species which can generate what are called *hybrids;* we know too that animal hybrids are usually called *mules*. We must bear in mind that the word *species*, as used by gardeners, includes varieties, races, and sub-species; and consequently what they call a hybrid is often nothing more than a cross between two varieties, two races, or two sub-species of one and the same species; the distinction between such crosses and true hybrids must never be lost sight of, and we shall, to avoid all confusion, hereafter denote such crosses by the term *sub-hybrids*.

When we look at hybridizing in its proper sense, in an historical point of view, we find that, like every other new subject, it has been the object of the most unwarrantable generalisations, attributable to the tendency there is in the mind of man to draw inductions and form mere guesses, instead of confining himself to positive conclusions deduced from facts ascertained by experiment; but if it be proved that hybridizing is only possible between allied species, that hybrids are generally, though not universally sterile, we must not run in the opposite direction and undervalue the importance of a study of hybrids, the existence and origin of which are incontestable.

Although hybridizing is confined in narrow limits, when we consider the number of its products, it is not on that account the less valuable in making us acquainted with the influence of ancestors on their descendants.

Hybridizing is completely conformable to the ideas which we have expressed in our definition of species, since it establishes the following truths:—

1. There are but few species among which it can take place, and the organization of these species is exceedingly similar; but all species of which this may be said, do not, as a matter of course, give rise to hybrids; this explains why M. Sageret failed in his endeavour to fecundate an apple tree by a pear tree.

2. The difference between a hybrid and either of its parents is greater than that which exists between an individual and its parents when both belong to the same species: we must not however conclude that a hybrid is a mean between its two parents, or, in other words, that it resembles the one just as much as it does the other.

3. Few hybrids, especially among animals, can be reproduced by generation in the same way as individuals of the same species can.

4. Those hybrids which are not sterile are more inclined to form alliances with one another, and even with their parents, than the latter are with each other; so that hybrids are more liable in a few generations to lose the characters derived from their parents, than are individuals of one and the same species.

5. However intimate the two forms of its parents may be in the hybrid, forms which may be said rather to be merged in one another than to be placed in juxta-position, still there are hybrids and circumstances where the two forms are separated, the one from the other, in the same individual. There is, for example, a hybrid of *Cytisus laburnum* and *Cytisus purpureus*, which occasionally has branches, some of which bear the flowers of its male, and others those of its female parent. It is clear then that the two forms in a hybrid are not destroyed inasmuch as they sometimes appear separately.

M. Sageret gives us a similar example of a hybrid sprung from a female Chinese melon, and in all probability a male Market melon; of two branches exactly opposite each other in the hybrid, one bore nothing but the latter melon, whilst the other branch bore a cross between both melons.

Although as a general rule hybrids have but little tendency to reproduce themselves by generation, or, in other words, are apt to die out in the ordinary circumstances in which organized beings are placed, still there are certain hybrids of which this is not true, and which propagate themselves like other things. We do not therefore reject, as contrary to the laws of nature, M. Sageret's opinion that the Colza, looked upon by most botanists as a species, is a hybrid of the cabbage (*Brassica oleracea*) and turnip (*Brassica napus*); he was led to this opinion by comparing the Colza with a hybrid he obtained from the last two plants.

Although he may be blamed for not having carried his researches on this point further, and proved the hybrid to be what botanists call a species, it cannot be denied that the above experiment is a new proof of the great service of methodical experimental inquiry in the higher questions of natural history. We too side with M. Sageret on the point on which he and Mr.

Knight were at issue: the latter gentleman denied that true hybrids had any power of fecundation, and only admitted it in sub-hybrids; and in carrying his theory out he asserted the Peach to be a variety of Almond, because the Peach-almond, a hybrid derived from the two, could propagate itself by seed.

In the animal kingdom there are most certainly hybrids which have the power of generation; the following examples show this:—

For a long time past sheep-skins, with very long and stiffish wool, furnished by a cross between a he goat and a ewe, have formed a considerable article of commerce in Chili. The hybrid is obtained thus:

One he goat is put with ten ewes.

The male hybrids have a wool very like horse-hair; these skins are not in high estimation where skins covered with hair are wanted.

But these male hybrids breed with ewes, and give a cross with a fine soft horse-hair coat, which is in great demand—what are in that country called *Pellions*, or Chabraques in French.

After a few generations the hair becomes coarse and hard, and then recourse must again be had to a male hybrid of the first generation, for the purpose of getting a cross with hair of the desired quality.

This fact, for which we are indebted to M. Gay, proves that the male cross between a he goat and a ewe is not sterile.

M. Flourens has obtained a cross between a Musimon and she goat, but we do not know whether like the last it is productive or not; he has also obtained a sub-hybrid from a Musimon and ewe.

Again, M. de Lafresnais has presented to the Museum of Natural History a pair of hybrids obtained from a male Guinea Goose and a female Canada Goose, which belong to two entirely distinct species; and it is curious that their hybrids have already bred as many as seven times.

We will answer an objection that may be made to our definition of species, now that we have shown that there are hybrids capable of breeding with certainty.

Being without evidence as to whether a given individual represents a species, we, like common people, defined the latter from the greatest resemblance between individuals of the same origin, or what is the same thing, from the transmission of the same form through successive generations. When this perpetuity of form has once been established by experiment, by going back as far as possible from the young to their progenitors, we conclude that a species exists; and we do not see, whatever may be ultimately found to be the true definition of a species, why the case of which we speak should not be excluded therefrom. Then, if the question should relate to hybrids capable of reproduction through an indefinite number of generations, we shall have a species, not, according to our view, originating with a male and female of different species, but with the first hybrid, because that is in fact the first type of the form found in its descendants.

After these general considerations on hybrids, we will only add, that the study of hybridizing is far too much neglected, notwithstanding the splendid results obtained by those who, like Sageret, Duchesne, Knight, &c , have really paid attention to the subject. Let it not be forgotten that the former gentleman obtained from different species of apple, hybrids, which by their great vigour allow the fruit of one season to ripen whilst the flower-buds of the next are being developed, thus insuring a good crop the following season without any *alternation* or without ceasing to bear for a year or two after every crop ; let it not be forgotten that the same gentleman obtained some very remarkably prolific sub-hybrid apple-trees, and then let not the study of hybridizing be set down as vain, or without any practical or useful bearing.

§ IV.—CONSEQUENCES OF THE FOREGOING FACTS WITH REGARD TO THE QUESTION OF THE FIXITY OF VEGETABLE SPECIES UNDER PRESENT CIRCUMSTANCES.

Although there are living bodies which undergo great modifications from external agents (§ 3), and which preserve them when the causes by which they were produced are removed, it is evident, from the details into which we have entered, that most of such bodies tend to lose their modifications under these circumstances, and to reassume the primitive form of their respective species ; or, what is more correct according to our definition, the most stable form which the living body can take under the circumstances when it has lost its modifications.

Every one who has paid any attention to the modifications of plants, must have been struck with the great stability of a certain form which all the individuals of one species tend to assume ; this fundamental fact, this power of nature to retake possession of plants which by long culture have taken new forms, was especially noticed by M. Vilmorin and M. Poiteau.

Van Mons believes so firmly in the principle of the stability of species, that, in his opinion, the modifications produced in plants by cultivation, only reach those individuals which represent the types of their respective species; for, according to him, each of the groups of plants altered by cultivation to which such names as beurré, bon chrétien, are given, comprise individuals proceeding from a type to be found in nature, and the stability of which is so great, that he is inclined to give it the name of a *sub-species*. He declares that he has found on the hills in the Ardennes *all the possible forms of apples and pears cultivated in Belgium*. He says that the pips of these wild trees, sown where the trees yielding them naturally grow, yield nothing but individuals identical with the types found in nature. *To modify the plants proceeding from these types, we must*, he says, *sow their seeds in countries to which they are not indigenous, and where the circumstances are not the same as in their native land*. The seeds should be sown generation after generation, and by the second sowing the *variation* or organic disposition for change will be established, and that so strongly, that according to M. Van Mons, it can undergo no further alteration: a few successive sowings suffice to give the desired result, which is to be finally completed in the country to which the type is indigenous. But the modifications which seeds belonging to the *beurré sub-species* or *type* undergo will only give varieties of *beurré*, as the seeds belonging to the *sub-species* or *type bon chrétien* will only yield varieties of bon chrétien.

It is not necessary for our present purpose to inquire whether the respective types of Belgian fruit-trees are or are not to be found wild in the Ardennes; we need not consider that as an error which may be but a particular case; but we ought to make a few remarks on the proposition, that *as a principle*, all cultivated varieties which possess sufficient fixity to constitute a *race*, as above defined, spring from types, having the degree of fixity attributed by us to *sub-species*, and which are found between the cultivated varieties and the species themselves from which the types are derived. We do not grant this to be true, simply because in a great number of cases there are evidently no such intermediate types existing between the cultivated races and the individual types of the species; we shall content ourselves with citing the case of the carrot; there is nothing intermediate between the wild type of the species and the races artificially obtained.

We have two other remarks to make on what we think is too positively stated by Van Mons.

First Remark.—Although we are perfectly ready to admit the great influence that causes acting in different places have in the modification of plants, we cannot agree with M. Van Mons when he says that a plant can only be modified when in a different place from that to which it is indigenous, since we have seen—1. the influence of the organisation peculiar to each seed, and which can be itself modified by the particular circumstances, natural or artificial, in which the seed bearer may be placed (§ III.

First period of Vegetable Life); 2. the influence of causes capable of acting differently according to the weather, or some other peculiar circumstance, in one and the same place. And let us also call to mind the influence of the time of sowing, which may vary as well from accident as the will of man. (§ III. *Second period of Vegetable Life.*)

Second Remark.—Van Mons, after stating that, as a condition indispensable for the modification of a plant, it should be removed from its native country, and that the variation is established by the second sowing in the place to which the plant has been removed, adds, *that it cannot be afterwards changed from the species* (of the modified plant) *which it continually propagates from generation to generation.* This we think to be incorrect. If there be some species which are not, and some which are disposed to be modified, there are among the latter some individuals which tend to assume their primitive form when exposed to circumstances similar to those which existed before any modification took place; whilst other individuals appear to preserve their modifications out of the circumstances which caused them. Neither do we admit that as a principle the modifications are invariably produced at the second sowing; we are of opinion that they are produced gradually, by successive generations, under certain circumstances, and that they cease when a sort of equilibrium is established between the external agents and the organic forces peculiar to the species.

Surely if the modifications of seedlings were so easy and profound in individuals of the second sowing, we could never understand how Duhamel, the three MM. Alfroy, de Lieusaint, never obtained any good result from the fruit-trees they raised from seed; we could not understand how M. Vilmorin, when he sowed pips of the best pears, only obtained a small number of individuals bearing good fruit, the greater part of them having an evident tendency to revert to their wild state. It was in consequence of such results that we were led to observe the necessity which existed of noting by numbers the proportion of individuals which differed from the rest, whether from the sowing of cultivated or of wild plants; in short, whenever the modifications of plants were made an object of study.

The consequences which we have just drawn from the facts before stated are limited to those stated: we now have to examine the question of the effect of time on our varieties of fruit-trees, in the places where they have been modified, under the double view,

(a) of the persistence of actual modifications;

(b) of the duration of the varieties presenting them considered as living bodies.

(a) *Persistence of the modifications of actual varieties in the places where they have been produced.*

If MM. Sageret and Van Mons both admit that the disposition of plants to depart from their natural types is great in proportion as they are already distant from those types, nevertheless we think there ought to be a limit to this variation, and that this limit ought to be reached sooner than the last named gentlemen are disposed to allow. Be this how it may, we must not forget the insufficiency of our present knowledge to fix this limit, and, *à fortiori*, to determine whether the seeds of the individuals which have attained it would themselves produce, if sown in their native country, individuals identical with their parents, which is M. Puvis' opinion; or in the contrary case, to ascertain the proportion of seeds which would, and those which would not, produce their parents, and how many of those which would not do so would give rise to new varieties which would themselves revert to the original specific type.

(b) *Duration of varieties modified by culture.*

If our present knowledge is not sufficient to allow us to admit the extinction of non-modified vegetable species under present circumstances, we are not compelled to say that the varieties of plants brought into existence by cultivation have an indefinitely long existence, whether we regard the life of each individual or the existence of the variety itself. We imagine that it is perfectly possible the life of a fruit-tree may be shortened by the modifications it may have undergone; we conceive that such modifications in the individuals composing the variety may shorten its existence. For example, varieties with fruit so modified that it produces no seed can only be propagated by division, and if this ceases, the variety will become extinct with the death of those individuals which were in existence at the time that this propagation by seed stopped.

After the preceding observations it will not be necessary to criticise what M. Van Mons has said of the subject of the duration of our cultivated varieties and of those which he *improved* by successive sowing: it will be sufficient to remark that the period of two or three centuries fixed by him for the duration of the first, and the period of one-half or two-thirds of a century for that of the last, are merely fanciful. M. Puvis too, whilst he admits the principle of extinction, has vastly enlarged the term of existence. In short, we admit the possibility of the extinction of varieties, created by cultivation, under actual circumstances, but we do not admit it for all varieties without exception and when locality is not considered. This will be seen in the following section (§ 5), where we shall consider the duration, not of plants raised from seed, but of those propagated by division.

Our views on the influence of circumstances in modifying plants raised from seed may be thus summed up:—

We sow seeds gathered from a plant not a native of the place where the seed is sown, or if it be, it must have encountered circumstances sufficient to have modified its seeds either in their organization or their development.

We choose from the plants yielded by the sowing those most modified in the way desired; we sow their seeds, of course taking care to prepare the soil and use those methods which we have learned to be most proper for the end we have in view.

The changes are not indefinite in the same place and under circumstances actually existing: after a time a certain form is obtained which is stable for a given state of things.

A variety produced in any country can be improved for our purposes in another place, by virtue of circumstances analogous to, but more intense than those of the first place. There is then a possibility of success if a variety indigenous to one country be removed to another where it is exotic.

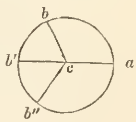
But this variety may be modified in a way different from that in which it was modified in the former place.

1. It may revert to the type of the species and remain such.

2. It may assume a modification of a type different from that it represented.

3. It may revert to its type, and then after successive generations it may undergo changes different from those it originally underwent. An example of this would be afforded if it were proved that the European fruits, sown in Virginia, first of all, reproduced their wild type, and then, by successive sowings, presented modifications different from those obtained in Europe.

Thus suppose the centre *c* to represent the type of a species, *a* the modification obtained in Europe; now, in Virginia, the modified plant would correspond with *c*, and then by successive generations with *b*, *b'*, *b''*.



§ V.—OF THE MULTIPLICATION OF PLANTS BY DIVISION, AND OF THE DEGENERATION AND EXTINCTION OF THE PLANTS SO OBTAINED.

It is first of all requisite to explain what we mean by the *perfectioning* and *degeneration* of plants and animals. In common parlance, the first means that a living body has been rendered more fit to satisfy the wants of man than it was before; and the last means just the reverse. Neither expression indicates that a plant or animal has gained or suffered in point of vigour, longevity, generative power, &c.; for a plant that is said to be cultivated to perfection, so far as the wants of man are concerned, may have had its life shortened and its productive power so reduced that it cannot be propagated by seed.

Such being the popular meaning of these terms, we must take care not to confound it with their scientific meaning; for in a scientific point of view, *perfection* signifies the state of greatest vigour, longevity, and generative power capable of being produced by art, compared with the same qualities as found in an individual in its wild condition; and *degeneration* signifies the reverse, and not the return of a modified living body to its natural state.

Article 1.

On the Multiplication of Plants by the Division of Individuals.

The influence that grafting has upon plants ought to engage our attention, because it is the most common method of propagating plants by division.

Although grafting does not succeed unless the graft and the stock are, to a certain extent, allied to each other, it is not true that the closer the alliance the greater is the success: certain varieties of pear, for example, succeed, according to Duhamel, better if grafted on a wild quince than if not grafted at all.

The almost universal opinion that a graft is productive of more fruit than it would have been had it not been detached from its parent tree, has within the last few years been combated by M. Van Mons: and in consequence of experiments made by him, he had before his death ceased to graft plants raised from seed in order to ascertain the quality of their fruit as soon as possible. However this may be, we think M. Sageret made a very just remark on this subject when he sought to explain the influence a graft might, often at least, have in diminishing or increasing the number of bifurcations of the stem, and when he stated that operations equivalent to grafting, to which the stock was submitted, improved its fructification.

We will now speak of grafting as a means of modifying the plants operated upon.

The influence of the stock on the graft is too well known to be stated at any length; we subjoin one case lately made known by M. Pépin.

Buds of *Bignonia grandiflora*, some of which were taken from a natural plant, others from a specimen of *Bignonia radicans*, were grafted on a plant of the latter species.

The *first graft* was a trailer, its wood *brown*.

The *second graft* became a *shrub*, its wood *green*.

M. Van Mons observed, in his experiments with fruit-trees, the law of *homœozygy*, for he grafted the variety he wished to preserve on a stock belonging to the same type. But if new qualities are desired, we should proceed in a different way, and recollect an observation made by Cabanis and fully appreciated by Sageret: we mean that *the seeds of a pear grafted on a wild quince have a greater tendency to produce varieties than the seeds of the same pear not grafted.* It ought also to be remembered that the influence of a graft is more especially visible in its seeds and plants derived from them.

The influence of the graft on the stock whilst admitted by some is denied by others, and De Candolle has given a clever criticism on observations cited in favour of it; our own opinion is, that some such influence is possible, but that it has not yet been shown to exist.

It has been stated that propagation by layers and cuttings tends to diminish, and even to destroy, the power which the plant operated upon has of multiplying itself by seed, because it is said that such propagation often favours the development of certain parts, especially of the succulent parts of many fruits, as the Pine-apple, Banana, &c., at the expense of the seed; this opinion has been combated by M. Duchesne; and M. Sageret, far from admitting it in principle, acknowledges that many plants raised from layers or cuttings fructify earlier than those which are not so raised, or than those which proceed from the seeds of the parent of the cuttings.

Article 2.

Of the Degeneration and Extinction of Plants obtained by the Division of Individuals.

Towards the end of the last century Knight published an opinion, which had been already formed by several other people, and more especially by Marshall, to the effect that plants obtained from grafts, cuttings, and tubers could not be long-lived; so that if these grafts, cuttings, and tubers represent varieties, these varieties would tend to disappear. Knight even went so far as to say that the life of the individuals thus obtained could not be longer than that of the parent of the graft, cutting, or tuber respectively. M. Puvis, admitting that all the varieties of known plants will die out, and that, consequently, recourse must be had to seeds to obtain new ones, nevertheless denies Knight's exaggerated statement, and remarks that the variety of the Chaumontel besi, although its type, has been apparently extinct for many years; and that the St. Germain is still in vigour, although the tree which produced it has long ceased to exist in the forest from which it derives its name.

According to M. Puvis, the death of a variety of fruit tree is caused, not by its returning to its wild type or *degenerating* in the common sense of the term, but by its loss of vigour: its fruit becomes scarce, stunted, woody; its bark, instead of being clean and smooth, is rough, cracked, covered with moss, or destroyed by canker; in short, the plant is a living body the functions of which become enfeebled never to be revived; it advances to a state of decrepitude which is only ended by death.

M. Puvis, as a reasonable man, could not but extend his opinion to species also, and this he accordingly has done. He says, "In this way numerous facts justify the opinion, long ago admitted by many people, that the propagation of trees by cuttings, layers, and suckers, gives a succession of individuals which become weaker and weaker, and steadily degenerate; the natural consequence is, that the variety is extinguished in successive generations. . . ."

He adds, "But is not the same the destiny of species also?" This is what he seeks to prove; he goes the length of stating, "We might perhaps succeed in showing that it is highly probable that the human species has the same tendency; that it has already perhaps passed the age of exuberance, strength, and vigour, producing great effects and great things, and the age of great passions, by which nations are moved like single men: we might perhaps be able to show that the intellectual power of the human mind, submitted to all the chances of the physical organization of the species, is less extensive, less vigorous, less creative; that we have arrived at the age of maturity when physical strength decreases, . . . at the age when organization is enfeebled and capable of less exertion."

Although M. Puvis admits the influence of soil, exposure, and climate on the quality of plants, he nevertheless attributes to organization, the degeneration and extinction of plants as well as animals.

Surely if there were not numerous and weighty objections to this view of things (as we have seen raised by the facts already collected by us to establish our definitions of species, simple varieties, races, and sub-species, and to show the truth of the principle of immutability of species under existing circumstances), we should be unable to explain how it has happened that observing men who have devoted their whole lives to the modifications of plants from all manner of causes, have been of opinion that in the present state of things vegetable species are fixed: that Van Mons denied the possibility of artificially creating races or sub-species from the individuals of a species, and only admitted that of creating simple varieties from individuals representing races or sub-species. If M. Puvis's view were correct, why should Sageret have maintained the principle of fixity of species, denied the justness of Knight's opinion, and affirmed the necessity of preserving our old stocks, when he at the same time admitted that budding and layers tended to enfeeble the plants produced by those processes, and that grafted plants do not live so long as those which are left in their natural state? How are we to comprehend M. Vilmorin's ideas on the fixity of species, if we are in ignorance that, when cultivating culinary plants to perpetuate modifications, he was incessantly endeavouring to find some means by which to prevent the return of his plants to their wild condition?

If we look at many plants raised by budding and from layers, and placed in conditions favourable to their development, we are sure to find some specimens stronger and more vigorous than the plants from which they were taken; we have come to this conclusion from a long series of experiments made on shrubs and arbustes, for the purpose of showing that a weak plant may, by means of a cutting, layer, or sucker, taken at the right time and placed in favourable circumstances, be made to give a strong, vigorous plant. We think this opinion is the more worthy of credit, as it is perfectly conformable to the following observations extracted from the *Pomologie Physiologique.*

"I have seen," says M. Sageret, "some *old* Turk's-cap Gourd *seeds, scarcely ripe, and badly formed*, come up, languish at first, *exhibit blotches on their leaves*, and after all become as vigorous as most plants of the species: poor, small, and unripe melon seeds have produced much finer melons than the plant from which they came: the little black Cantaloup des carmes, premature, ripened in April in a pit, and resown in the month of May in the same year in the open ground, yielded at the end of the season nothing but insipid fruit, the seeds of which, resown in a bed the next year, gave very fine and excellent fruit. This same melon, which, whilst under cover, never became very large, produced seeds when sown in the open air, but in a fine season the following year yielded very large and good fruit."

Moreover, M. Loiseleur-Deslongchamps has known small grains of wheat, properly sown and cultivated, to yield grains of excellent quality.

We think these facts remarkable, because they show that strong healthy plants may be obtained from old seed of inferior quality: they show that the seed of bad fruit may produce fruit of a good quality: they certainly do not strengthen the opinion which admits a degeneration and extinction, first striking plants obtained by division, then the varieties represented by them, and lastly the species themselves to which they belong.

M. Poiteau, who, as already stated, believes in the fixity of species, does not admit degeneration of varieties obtained by grafting, provided the graft was taken from a healthy plant. M. Reynier of Avignon, no mean authority in such matters, is of the same opinion.

Although the facts brought together by M. Puvis, in the first part of his work, favour the view from which we dissent, we find opinions by no means so favourable stated in the latter part of the same work, which is devoted to the consideration of the production of new varieties by sowing and crossing : take for example the following :—

"In all the families of plants cultivated by man, he may then almost always *obtain something better than what he has got.* Nature abounds in resources and combinations, and she always recompenses every one who studies her with care, perseverance, and judgment. The quality which distinguishes man from other organized beings is, that he is *capable of improving both himself and everything he touches.* The Almighty has given him a sort of dominion over a nature itself capable of improvement."

Now how can man obtain *something better than what he has*, if, as M. Puvis before stated, not only plants obtained by division, but varieties and species, die worn out? How is it possible for plants to get more feeble as they grow older, and yet to yield seed with a tendency to produce more perfect varieties? How can we reconcile the statement that *man is an improving creature*, with that before quoted from the same author, and according to which *the human species has passed the age of exuberance, strength, and vigour . . . the intellectual power of the human mind, submitted to all the chances of the organisation of the species, is less extensive, less vigorous, less creative; we have arrived at the age when physical strength decreases—at the age when organisation is enfeebled and capable of less exertion?*

In short,

1. The facts which are most to be relied upon do not prove the degeneration or extinction of plants propagated by division.

2. If it be true that several varieties of cultivated plants no longer exist, we do not know that their disappearance is due, as Knight and Puvis think, to their organisation; we are of opinion that the disappearance of at least a certain number of them has been caused by accidental circumstances.

§ VI.—CONSEQUENCES OF THE PRECEDING FACTS WITH RESPECT TO VINE STOCKS.

If, remembering the preceding facts, we endeavour to arrange what we know of the natural history of stocks, we shall have no difficulty in ascertaining those points on which we have little information, and which require to be cleared up by experiment :

an examination of the means adapted to the investigation of these points will show the relation between theory and practice, by demonstrating the necessity of attending to both, if we desire to ascertain the truth. Whilst we again call attention to the services rendered by Count Odart to Ampelography, we wish to direct his attention, and that of his successors, to inquiries necessary to be made, in order that this new branch of horticulture may attain the precision of which it is capable.

Can we, in the present state of our knowledge, apply one of the distinctions before established by us to the *Vitis vinifera* of Linnæus?

We should answer yes, if all botanists admitted, with M. Loiseleur-Deslongchamps, the wild vine, still to be found in the hedgerows and woods of many places in France, to be the stock from which all the vines now cultivated in Europe, whether for eating or for wine making, are derived. The *Vitis vinifera* would belong to the division *Gamma*, if the type were admitted to bear black grapes, and that the wild vine is only a variety of it, or *vice versâ:* if this question be left in doubt, the species belongs to the division *Delta.*

Unfortunately botanists and gardeners do not agree with M. Loiseleur-Deslongchamps: according to M. Michaux, it is probable that our cultivated vines spring from ten or twelve distinct species, natives of Armenia, Caramania, Asiatic Georgia, and the southern provinces of Persia. M. Sageret's opinion is somewhat between these two; he is inclined to think that the small black fruited *Vitis vinifera*, which grows in the hedges and hill sides of the woods of the Gâtinais, *may be* the stock of our common vines; but that the better sorts were at some very distant period imported into France, and that of these there may be hybrids, or at least sub-hybrids.

In this state of uncertainty, and acknowledging our inability to decide in favour of one opinion more than the other, we shall merely denote the species, be there one or more, to which cultivated vines are referred by the letter *Omega*, in order to express the doubt still hanging over the subordination of the individuals which compose the different groups of vines.

Although the origin of our vines is still a matter in dispute, we shall subjoin a few facts relative to the propagation of many of their varieties by seed and division, in order to apply the consequences to be drawn from those facts to the general considerations already laid before the reader (§§ 3, 4, 5).

Article 1.

Varieties of Vines reproduced from Seed.

Although there are vines which can be reproduced from seed, we shall give examples to show that there are others which cannot.

M. Sageret obtained from a seed of a Chasselas a plant which at the end of seven years bore fruit exactly like that of its parent.

There is a vine considered by Linnæus as a distinct species, and named by him *Vitis laciniosa;* but which, according to M. Loiseleur-Deslongchamps, is nothing more than a simple variety of *Vitis vinifera.* This vine, called *Cioutat*, *Parsley-leaved*, or *Austrian grape*, is reproduced from seed; for MM. Turpin and Poiteau state, in their great treatise on fruit-trees, that seeds of Cioutat sown in the Royal Garden at Versailles in 1807 gave plants which, at the end of four years, yielded fruit identical with that of the parent plant.

It is then clear that there are *varieties of vines sufficiently fixed to allow of propagation by seed*, and to be considered as well characterised varieties and even as races, at least in those localities in which they may be thus constantly propagated. If the existence of races which could be maintained wherever the vine could live had been ascertained, they might be considered as so many *sub-species*, taking for granted of course that they were not hybrids or distinct species.

To show that every variety is not constantly reproduced without change in all circumstances and in all countries, we refer to a variety of black Hungarian grape, which, sown at La Dorée, bore white fruit. M. Jacques too obtained white fruit from the seeds of the Raisin noir de la Madeleine.

Agreeing as we do with M. Odart, that the most economical, quick, and sure method of establishing a vineyard is by cuttings of the varieties most suited to the place, we would not on that account discourage gardeners who sow vines; but on the contrary, we recommend them so to do whenever it is possible. This is the best way for a man who cannot travel about to become acquainted with new and improved varieties, possessing perhaps valuable qualities not to be found in the old ones; and besides in a scientific point of view this is the only means of fixing our knowledge of the types of the varieties, races, and sub-species of our cultivated vines.

Count Odart acknowledges the use of seed (*Ampelographie*, p. 149) when he attributes to this method of propagation the origin of *many varieties of the small Gamay which*, he says, *are superior to it.* Some varieties, remarkable for their early fruit, raised by M. Vibert from seed at Angers, afford another example of the utility of these experiments, which we hope will be more encouraged, and become more numerous. On the other hand, as they alone can remove the numerous doubts still existing with respect to the vine, we see how practice, which is nothing but theory in action, constantly occupied in arranging and consolidating our knowledge, tends to the very same end; for as soon as we admit the possibility of determining whether there be one or more species of vine from which our cultivated varieties are derived, we must have recourse to sowing, in order finally to settle the question; by the same means alone will it be possible to distribute cultivated vines, with any thing like accuracy, into *simple varieties*, *races*, and *sub-species;* and when that is done we shall ascertain in what way the natural types have been modified by external agents and cultivation. Those who may hereafter devote their attention to this subject will find many difficulties removed by Count Odart, who by his own experiments, careful observations, and sound judgment, has arrived in his *Ampelographie* at what appear to us to be opinions most in accordance with the truth.

Article 2.

On the Propagation of the Vine by Division.

If, before we examine the stability and specific characters of different stocks in those countries in which they are propagated by layers and cuttings, we consult those who have already paid attention to this subject, we shall find some who, with Dussieux, Parmentier, Chaptal, Lenoir, and Bosc, believe in their mutability; for, say they, transplant stocks of different varieties from a place where they succeed well to another to which they are not accustomed, and their characters will soon disappear, and will be replaced by those of the stocks which grow in the place to which the first have been transplanted. This opinion is, however, far from being universal; for those authors to whom we are most indebted for observations on the vine think, and with reason, that if certain stocks do lose their peculiar qualities when thus transplanted, there are many others which do not, or at all events not in so short a time. This is quite in accordance with theory, and is moreover the opinion of Count Odart, whose authority adds not a little to the probability of its truth.

According to Count Odart, there are many varieties in Touraine, which, though introduced there, maintain their peculiar qualities more or less perfectly: such are the Carbenet of Medoc; the Mataro; the Claverie; the White Quillard of the

Pyrenees; the Liverdun of the Moselle; the Sarféjar of Hungary; the Chasselas of Fontainebleau, which preserves its qualities at La Dorée, in an arid soil.

We have already stated, in our first article, that the Côt, or Auxerrois, yields nearly the same produce on the hill-sides of the Cher and the banks of the Lot.

The Grey Pinot (Malvoisie, Fromenteau, Auxerrois, Rothklercher, Baratzin-szollo) has the same character in very different countries. Count Odart obtained specimens not only from distant departments, but from Italy, Germany, and even England, and they were all alike.

The Teinturier, or great Black, is another example in point.

The Sirrah (small), which forms the larger portion of the Hermitage vineyards in the department of the Drôme, maintains its character in Touraine and the department of Vaucluse, where, according to M. Reynier, it yields a better wine than the plants of that country.

These facts are then conformable to those of which we spoke when treating of the propagation of certain varieties of vine by seed.

There are varieties which are not constant, not only in distant countries, but in the same country in different soils. Count Odart gives as an example of this the Carbenet, cultivated in the arrondissement of Chinon: planted in a chalky soil, it yields an excellent grape, from which very superior wine is obtained; in gravelly and rather stiff soil its wine is rich in colour and keeps well; in a hungry, sandy soil by a river side its wine is light, cold, and does not keep; lastly, in a soil that is shallow and whitened by the tufa beneath, its wine is cold, flat, and colourless.

The conclusions to be drawn from the above facts, illustrating the propagation of the vine by seed and by division, are then the same as those already drawn by us from the propagation of plants in general by these two methods. This agreement, quite conformable to our definitions of species, sub-species, race, and simple variety, considered in living bodies, enables us to recapitulate the facts above explained as follows.

Recapitulation.

The general propositions and definitions laid down in the present essay are subordinate to what we conceive to be the true experimental method. Facts are collected by observation; they are submitted to a mental analysis in order that they may be as much as possible simplified and referred to their immediate causes; then recourse is had to experiment to test the truth or probability of our deductions. It is by experiment then that we ascertain whether the phenomena and effects we observe are really attributable to what we have conceived to be their proximate causes. We think our object attained when we are certain that the effect is proportional to the intensity of its cause or of the force to which it is referred, because it is possible to express this proportion numerically. It is for these reasons that we do not admit the existence of sciences of pure observation and reasoning, but sciences of observation, reasoning, and experiment combined, because where there is no experiment there is nothing but conjecture, or at most induction.*

Our definition of species is subordinate to two general facts; the greatest possible resemblance in the organization of the individuals composing it, and the transmission of this form from generation to generation.

We have not considered this transmission as absolute, but as depending on the circumstances in which the individuals live; as we cannot ascertain more than the effects of causes in operation at the present time, we have admitted the persistence of the essential nature of species at least since the last revolutions in

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* If we wished to justify our preference of the experimental method in the study of natural history, we should only have to refer to the history of the genus Medusa, for which science is indebted, first to MM. Sars and Siebold, and then to Van Beneden and M. J. Dujardin.

The female medusa lays *eggs*, which are fecundated by a male medusa under circumstances still unknown.

These eggs yield larvæ with vibrating ciliæ, and which would certainly be taken for infusoria if they were examined in an isolated way.

These larvæ change into *water polyps* (polypes hydraires), which either

(*a*) Divide into segments, which segments become medusæ; or
(*b*) Produce—

1. By *gemmation* other water polyps, which remain aggregated together.
2. *Bulbils*, which separate from the polyp and produce aggregated polyps, as in the last case.

The aggregated polyps forming medusæ in both cases.

Before the researches of the gentlemen above named, the larvæ of medusæ, their polyps, and medusæ in a perfect state, belonged to the last three classes of zoophytes, according to Cuvier's classification, thus:—

The *larvæ* to the 5th class, viz. *infusoria*.
The *polyps* to the 4th class, viz. *polypi*.
The *medusæ*, in their perfect state, to the 3rd class, viz. *acalepha*.

As we have already stated, it is only by experiment that we can hope to ascertain with certainty the transmission of form from ascendants to descendants, and thus, too, the precise definition of any given species. We should never have found out, except by experiment or observation, that an animal, like a plant, could be propagated by the *division* of a still imperfect individual, and again by *generation* when the same individual is fully organized.

the earth; it is from this time that, conformably to our actual knowledge, we have expressed our belief in the *immutability of species* without speculating on their existence or non-existence in the ages preceding that epoch, and without deciding what they may hereafter become.

We attach great importance to the subordination of the different groups of individuals distinguished into simple varieties, races, and sub-species. If we have not given any new mode of limiting these groups, we hope that, at all events, the manner in which we have examined and defined them will add somewhat to their precision, and that the naturalist who may endeavour to apply to the individuals of a given species the distinctions above pointed out, will be led to examine many points connected with the species which would not perhaps otherwise have suggested themselves to his mind; and we further hope that by appending the signs of these distinctions to the species of plants and animals as they are examined, their descriptions will be found to be considerably more precise than they at present are.

Whilst considering useful plants with respect to the stability of their essential characters, and also with respect to their tendency to become modified by a change of circumstances in which they live, we have found it sufficient to recall to the reader's remembrance the considerations and definitions previously laid before him, because the study of the changes in the individuals of a species itself furnished arguments in favour of our definition of species viewed generally with respect to the organization of its individual members, and of the circumstances in which they were placed.

This then is the conclusion to which we arrive after examining the changes of which plants are susceptible when propagated, 1, *by seed;* 2, *by hybridizing;* 3, *by division.*

1. *By seed.*—The modifications which can be produced in plants propagated by seed take place whilst the seed itself is forming, and during the development of the plant sprung from that seed. The modifications arise from organization and from external causes: these causes are essential, and differ from those occasional ones which arise from artificial methods of cultivation, and which may sometimes work concurrently with them.

2. *By hybridizing.*—An examination of the results thus obtained, far from being favourable to the principle of immutability, has revealed facts which are conformable to the opposite principle, as we have found hybrids which die out or separate into two individuals, which existed rather side by side than merged the one in the other.

3. *By division.*—Although it is true that plants propagated

by the division of an individual always resemble that individual, and although we never resort to this method of propagation if we wish to obtain varieties, yet it must not be forgotten that the plant separated from its parent may become modified by external causes. If this were not so, we could never explain the changes which take place in vines propagated by cuttings, or the changes a graft undergoes when removed to a country differing from that in which its parent grew, and which graft, taken back to its native country, will also reassume its primitive characters. We do not wish, however, to insist upon this as an absolute principle, and independently of the time in which the modifying external causes are capable of acting, because we cannot but admit that changes which have taken place in an organized body may remain, at least for a certain time, under circumstances other than those which caused them.

If Knight's opinion on the duration of plants propagated by division be not, in reality, incompatible with the principle of the immutability of species, even when it is admitted that plants live longer than the individual from which they came, yet M. Puvis has developed this view to such a degree that he has compromised the principle of the immutability of species under actually existing circumstances.

It was partly to discuss this question, and to develope our own notions on the influence of external agents on living bodies, that we availed ourselves of the opportunity offered us of examining Count Odart's Ampelography, and appended, in the above way, the researches of M. Sageret and the work of M. Puvis.

By far the greater number of the facts relating to plants on which we have relied have been ascertained by horticulture. This branch of agricultural science ought to engage our best attention, if we may judge of what it can do by what it already has done for us.

The extent of horticulture is indefinite ; it includes fruit-trees, vegetables, and every edible plant that can live in our gardens or hothouses. Compared with agriculture, which in a given country is applicable to but very few sorts of plants, horticulture is concerned with a vastly greater number of species and varieties.

The object of horticulture being not only to prolong the life and multiply specimens of all the plants with which it is concerned, but also to obtain as many modifications of them as possible, recourse is had to more numerous and varied methods and schemes than are necessary for the purposes of agriculture. The temperature of the air must be made to vary, and its moisture be confined to the neighbourhood of a few plants: an endless variety of manure and soil is requisite for the different purposes of the gardener. Horticulture is constantly making known some new fact which, but for it, would not have been observed; it suggests experiment after experiment for the purpose of thoroughly investigating the natural history of the plant in question. Horticulture is, in short, of the utmost importance to the physiologist as well as to the farmer, and forms the connecting link between the science of the naturalist and that of the agriculturist.

VIII.—*Description and Plan of a Fruit-room belonging to Josiah Moorman, Esq., Clapham-road; with some Remarks.* By Robert Thompson.

The supply of fruit in autumn is almost superabundant in favourable seasons, and in varieties there is then an ample choice. Many of these, however, are naturally of so short duration, that they cannot be long kept well under any circumstances. Means may be adopted for preventing their decomposition, but their flavour is frequently deteriorated or completely lost. In general, those kinds that ripen early soon decay; and a large proportion of the fruit cultivated by extensive growers is of this description, because it pays them better to take such at once to market than run the risk consequent on the keeping of later varieties. Hence we find that towards Christmas the quantity of fruit, of Pears more especially, is greatly diminished, and that the choice is reduced to comparatively few sorts. Such favourites as the Marie Louise and Beurré Bosc are not to be had under ordinary circumstances. In January the scarcity becomes greater, and Jersey Chaumontels make their appearance, imported at the high price of, not unfrequently, five pounds per hundred; whilst well matured specimens of the Easter Beurré and Beurré Rance are in request, leaving the greener and less perfect of these, and a few of some other sorts, to make occasionally the appearance of supply during the spring months—quite inadequate, however, to meet anything like a regular demand, such as would certainly be made if pears could be well kept in abundance till that period.

The high state of perfection in which fine specimens of pears have been frequently exhibited to the Society by Mr. Moorman at periods of the season much later than the varieties usually keep, rendered it very desirable to obtain an account of the method by which these were preserved in such admirable condition. On applying to Mr. Moorman he kindly afforded every information with regard to the mode by which his pears are kept; and he also permitted Mr. Sibthorp, the Superintendent of Works at the Society's Garden, to make the accompanying drawings, which will give a correct idea of the place.

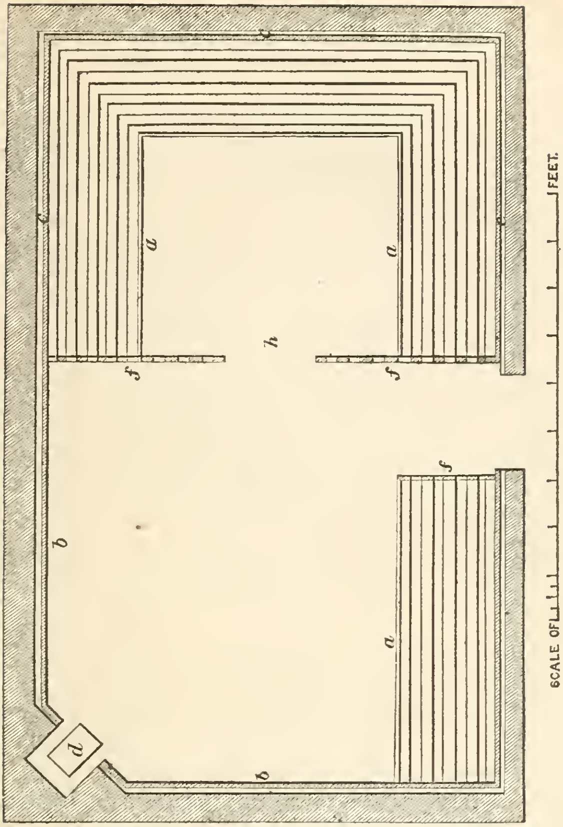

Fig. 1.—Plan of Mr. Moorman's Fruit-Room.

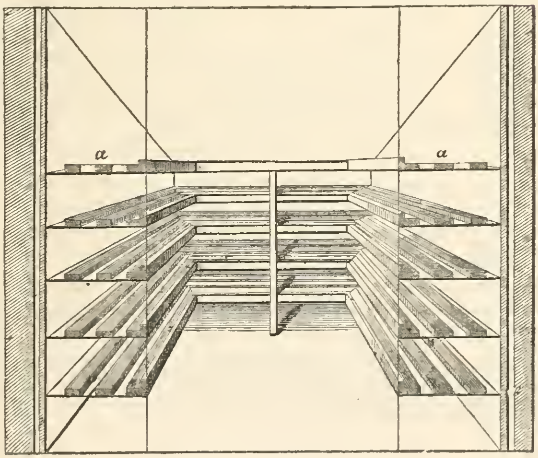

Fig. 2.—Interior View.

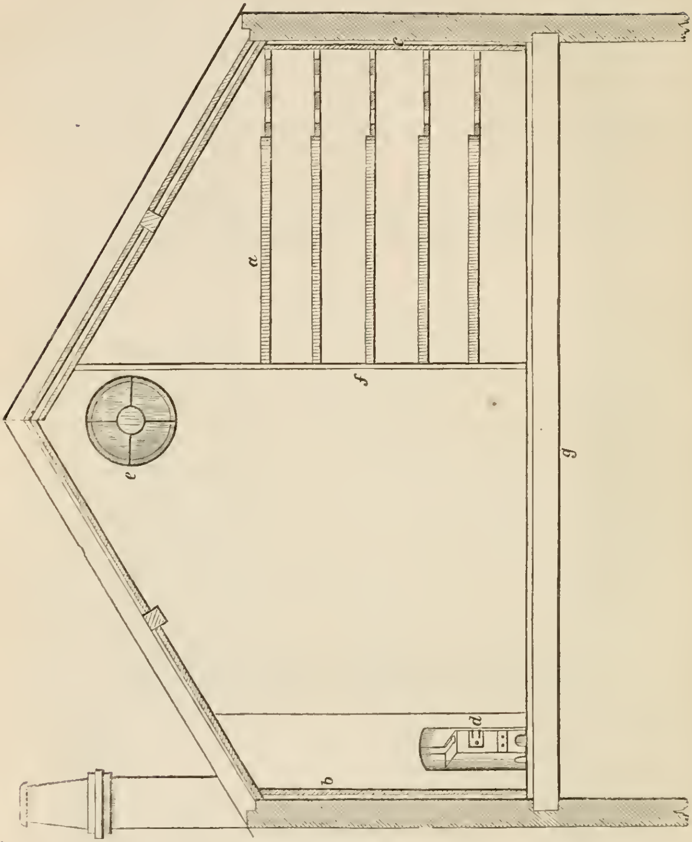

Fig. 3.—Longitudinal Section.

Explanation of the Letters.

a. Shelves made with battens, one inch and a half wide, and one inch and a quarter apart.
b. Close boarding around the sides of the room.
c. Air space between the boards and the wall. The roof also has an air space on the north side between the two plaster ceilings, as shown on the section.
d. Stove.
e. Circular window hung on pivots, and fitted with a roller-blind.
f. Partitions of open work similar to the shelves.
g. Coachhouse under fruit-room.

The room was not originally constructed for a fruit-room; but, by a little adaptation, Mr. Moorman has succeeded in rendering it a most excellent one, as is proved by the prizes awarded for the productions exhibited from it—not in any one year, but repeatedly, year after year. It is a partitioned-off portion of a loft, which extends over a coach-house and stables, and is that part which is above the coach-house. It was originally fitted up for a harness-room, the walls, as is usual in such places, being lined with wood. The roof is slated. The range of building is detached, and faces the south-west.

It will be observed that there is a cavity, *c*, between the boarding and walls. This, I believe, is an important circumstance, and so is the wooden lining, because air and wood are known to be slow conductors of heat. The ceiling on the north side is double, and the floor is wood above a ceiling. We may therefore conclude that a *uniformity of temperature* in the interior of the room is insured to a considerable extent.

There is the small stove, *d*, but it is seldom used, and never with the view of warming the air of the room unless the temperature is actually below freezing. The fruit is therefore *kept cool.*

The swing-window, *e*, is occasionally a little opened; but it is at all times covered with a roller-blind, so that the fruit is kept *in the dark.* A little fire in the stove, air being freely admitted by the window at the same time in a dry day, is useful for speedily removing any damp which may arise from the fruit.

The shelves, *a a*, have a layer of clean-drawn straw laid across them, and on this the fruit is placed singly.

From a consideration of all the above details it may be inferred that if a fruit-room be built over a place where there is a free circulation of air, its roof double ceiled, the walls lined with wood, a cavity being left between these two, it will possess the essential properties of the one under consideration.

The more important principles necessary to attend to with regard to the long keeping of fruit are *uniformity of temperature*, *coolness*, and *darkness*.

If the temperature is uniform, there can be little or no deposition of moisture on the surface of the fruit; but if the air of the room should be, say ten degrees warmer than the fruit, then the relative coldness of the latter will cause a condensation of the moisture contained in the air in contact with the fruit, just as a cold glass becomes dewed over when brought into a warm atmosphere. If the air is indeed very dry, then a proportionably greater difference of temperature is necessary to produce the above effect; but in winter the hygrometer seldom requires to be cooled more than a few degrees before it indicates a deposition of moisture. Fruits with smooth, glossy skins, in close contact with the cold substance beneath them, are those most profusely covered with moisture from the above cause. In russeted varieties their dry, rough coats serve as non-conductors of heat, and hence less moisture is deposited on them. When the air becomes colder than the fruit, a contrary action—that of evaporation—takes place, and the surface of the fruit becomes dry. But this wetting and drying must prove very injurious; whilst its cause, alternations of temperature, must likewise affect the specific gravity of the juices of the fruit. Mr. Moorman's fruit is not exposed to such vicissitudes; for when the weather becomes frosty, it is several days before the thermometer in his fruit-room is affected as much as one degree.

It may be remarked that in giving air a period of the day should be chosen when the thermometer outside indicates the same temperature as that in the room. No deposition of moisture can then take place in consequence.

With regard to *coolness*, it is well known that this condition is favourable to the long-keeping of fruit; for we act on the contrary when we wish to render any variety fit for use before its usual time. The fruit-room in question must be cooler on an average than if it had been on the ground; for the latter, under a building particularly, is much warmer than the air in winter.

Light accelerates the maturity and ultimate decay of fruit exposed to its influence. If the soundest specimens are picked and placed opposite a window, they soon become much inferior in appearance compared with those from which the light is excluded, all other circumstances being the same. In Mr. Moorman's fruit-room the light is excluded by a blind even when air is given.

By such arrangements as those above detailed, Mr. Moorman keeps the Marie Louise in fine condition till after Christmas. He possesses a selection of the best varieties of pears, which he grows chiefly on espaliers, which are well managed by his gardener, Mr. Tucker, in the Clapham-road. He had some remarkably handsome specimens of the Winter Nelis in his fruit-room in January, much larger than that excellent variety usually grows. We have also seen very large specimens of the Marie Louise, grown at his seat at Box Hill, in Sussex. The tree which produced them is trained against the gable end of a barn, about a quarter of a mile from the sea, and this tree is exposed to the strong sea-breezes from the south-west. It was planted in good soil, and a spring below it was discovered when digging the hole for the compost previous to the tree being planted.

IX.—*On the Scenic "Effect" of certain "common" Plants possessing remarkable Foliage.* By Thomas Moore, Curator of the Apothecaries' Garden, Chelsea.

(Communicated March 3, 1851.)

In a former volume of the Society's *Journal*, I ventured to recommend, as objects suitable for ornamental pleasure-ground scenery, some of the noble Umbellifers at present confined to botanical collections; and I then took occasion to remark, that the effect to be realised by the proper use of plants remarkable for the grandeur of their habits and foliation was too much sacrificed in garden decoration to that kind of effect obtained by the use of gaily-coloured flowers. It is the rule, that showy plants, in larger or smaller masses, are adopted in garden scenery, to the general exclusion of the rich variety of vegetation which may be realised by grouping plants of stately growth possessing remarkable and characteristic foliage. Of course it is not meant to be implied that masses or individuals of showy plants ought to be banished from pleasure-ground scenery to make room for those whose beauty resides in their foliage; by no means; but only that a mixed arrangement of striking and characteristic foliage is highly desirable in certain parts of an ornamental garden; and that a judicious admixture of this kind will be found to yield as much beauty, though under a different phase, as the most gaudy parterre can boast of. Foliage, too, it must be remembered, does not alone yield form towards the production of variety; it may, at least, yield also much difference of colour.

The taste for planting arboretums, which has of late years become widely diffused, is to some extent an acknowledgment of the truthfulness of this general view of the subject. The sober grandeur of a well-selected assortment of trees, planted with reference to their scenic effect, is found to be a relief from the kaleidoscopic blaze of modern flower-gardens; and there can be no doubt that, among the arboreous vegetation now available to planters, there exist materials adapted to realise, in this respect, the most perfect results. It is not, however, arboreous plants that I at present wish to recommend. The object of this paper is to commend to notice certain herbs of large growth, commonly known, and easily procurable, but which are rarely met with, unless by accident, in artificial scenery, and are seldom or never planted with a view to effect.

It should here be premised, that the realization of the full effect which plants such as these are calculated to produce in pleasure-ground scenery is dependent very much on their vigour and the perfectness of their growth. This must be especially obvious in the case of such plants as are selected on account of their stately habit or magnificent foliage, for deformed growth and diminution of size would be in either case subversive of the object in view. Whatever agents, therefore, can be induced to aid the perfect development of the plants, should by all means be made use of in such cases.

Foremost in the ranks of rich-foliaged plants are several kinds of Rhubarb, but more especially Rheum palmatum and R. Emodi, the former remarkable for its broad, deeply jagged-edged leaves, the latter for its rough-looking, red-tinted foliage of a pointed, heart-shaped figure. The leaves of both acquire considerable size, and whether alone or in company with the spiry flower-stems, are strikingly picturesque. One can scarcely conceive any vegetable form more beautiful than a perfect-foliaged plant of the palmate Rhubarb, spangled over, as it is sometimes seen, with the sparkling crystals of an April snow-storm. The blood-red flowers and fruit of R. Emodi, hanging round its tall, upright stem, are also very striking.

Another very beautiful object—reader, be not startled at the name!—is the Variegated Kale, with its tall stem, crisped-edged leaves, and elegant variegations. When in full leaf, in form no less than in colouring, it would stand out most strikingly in a mixed border of dwarfer and brighter-coloured flowers.

The Orach, too! In rich soil, how noble in its towering stem and ample green or coloured leaves! The red-leaved or the yellow-leaved sorts would be sure to "tell," if grouped with almost any other ornamental plants.

Then there is Maize, with its exotic aspect, which, though not remarkable either for the colour of its foliage or the showiness of its flowers, yet, in its habit and mode of leafing, equals, in its way, the effective "Laurel-oranges" of Trentham.

The Hemp is another plant of much elegance and grace; its single, upright stems of 6 or 8 feet high, branched on all sides, bear a profusion of slender, palmated leaves, which give it so graceful an aspect, that it might claim a prominent situation in flower-gardens, and would serve to break up, without harshness, their now too often monotonous surface.

In situations where shade and moisture were sufficiently abundant, some of the larger hardy Ferns would serve a similar purpose. The lovely Lady Fern, the more stately Male Fern, the spreading Shield Fern, and the drooping angular Shield Fern, are especially applicable. Even the common Bracken, if a very vigorous growth could be secured, such as occurs in the sheltered, shady lanes of the South of England, would be found to rival in elegance the most graceful vegetation of the tropics.

These are but a few of the available materials with which pleasure-ground and flower-garden scenery might be greatly enriched. I have purposely confined my remarks to the most common plants, for the sake of pointing out, in passing, that intrinsic worth mantled in a plebeian garb is too often passed by unheeded; and this is true in respect to other matters besides that under consideration.

X.—*Additional Observations on the White Rust of Cabbages.* By the Rev. M. J. Berkeley, M.A., F.L.S.

(Communicated March 4, 1851.)

An account was given in the third volume of this Journal of the white rust with which cabbages and other plants belonging to the same natural order are so frequently infested. It was stated that the species of fungus there described and figured is not the only one to the presence of which the white leprons patches are due, which disfigure the leaves and other organs, and often seriously injure the plant. At the present time, in the district at least in which these observations are written, a large portion of the cabbages, which are in a very unhealthy state from the extreme mildness of the winter, are to a great extent frosted with *Botrytis parasitica*, which is fast destroying the leaves which it has attacked. There is, however, a third production, of much more rare occurrence, to which the white rust is sometimes due, on which I am here about to offer some remarks. It is now nearly thirty years since Dr. Greville figured, under the name of *Cylindrosporium concentricum*, a little white fungus sprinkled in patches over the upper and under surface of cabbage-leaves with somewhat of a concentric arrangement. It was evidently abundant at the time in the neighbourhood of Edinburgh, as it was observed by several botanists, but till its recent occurrence in Northamptonshire no one seems to have gathered it since its first discovery in Scotland. Specimens communicated to Sir W. J. Hooker were examined at the time of the publication of the volume of Fungi of the English Flora, in 1836; but either they were in a very bad condition, or so mixed with *Cystopus candidus* that no correct conclusion could be formed as to the true affinities of the plant. Unger meanwhile had supposed that the white spots so common on the leaves of the common celandine, ground ivy, and other plants, consisting of short moniliform erect threads, were the production figured by Greville, though without the slightest authority for such a supposition, and totally at variance with the whole account and figure given by the great Scottish cryptogamist. Matters were in this condition when the original specimen was kindly lent by Dr. Greville to the author of the present memoir; and though almost entirely destroyed, a morsel of the plant was in a sufficiently good condition to show that it had no near affinity with *Uredo*, that it had still less with the parasitic moulds, that at any rate it was produced beneath the surface of the leaf, and that the spores oozed out by reason of the contraction of the substance of the leaf upon the pulpy mass stored up beneath the cuticle. There was indeed some difficulty about the genus, but little as to its true affinities. In the spring of 1850 a single plant of cauliflower attracted my attention from its leprous aspect, which seemed somewhat different from that exhibited by other plants attacked by the common white rust (*Cystopus candidus*). On examination it was, to my great delight, clear that I had at last discovered the doubtful plant of Greville. The summer proved most unpropitious to the growth of cauliflowers, few coming to perfection till late in the year, whatever the variety might be. Mine consisted of those distributed by the Horticultural Society, with the addition of the Walcheren, and neither my own garden nor those of my neighbours, who had merely the old variety commonly grown, exhibited a really good specimen; and the complaint probably might have been made very generally, as an inspection of the specimens exposed for sale in Covent Garden during the summer, on more than one occasion, showed that at least for part of the season they were neither plentiful nor well formed. At any rate the crop was most miserable here, and at the end of June and the beginning of July, in a large garden where multitudes are grown for the supply of the neighbouring markets, almost every plant, amongst which there was scarcely one which had not run, was white with the same interesting fungus which I had observed earlier in the year at home.

How far the condition of the crop might be due to any peculiarity of the season, or to the presence of the fungus, whose growth was favoured by the state of the atmosphere, it is impossible to say, though both in the case of the *Cystopus* and the fungus under consideration, I have observed a tendency in the plants infested to produce a multitude of green bracts amongst the flowers, greatly impairing the beauty, and consequently the market value, of the produce, even where tolerable heads are formed.

The parasite forms, both upon the upper and under surface of the leaf, roundish often confluent patches, varying greatly in size, consisting of little white specks disposed more or less concentrically, those of the centre frequently becoming yellow, and at length fading away, in consequence of the partial decomposition of the leaf which they have affected, while the outer pustules spread from the circumference to the part yet remaining healthy. Occasionally they extend to the midrib, which is then rapidly destroyed. On close examination it is found that the fungus, each speck forming a distinct individual, is produced between the true cuticle and the cuticular cells. To ascertain this point requires rather delicate manipulation, but the fact is very clear in an extremely thin slice, provided the flaccid membrane has not unfortunately been turned aside by the edge of the lancet with which the section is made. The cuticular cells, however, are much confused and deranged by the growth of the parasite, which is developed principally at their expense, those of the succeeding layer being very little if at all affected. The mycelium is closely incorporated with the cuticular cells, and appears simply grumous, without distinct structure: this, however, may be owing to its being so delicate as to be broken up under the knife; at any rate it does not appear to be filamentous. From the top of this mass, on the level of the tips of the cells, on which it grows, arise very short delicate sporophores, each of which is surmounted by an oblong, cylindric, often curved spore, three to five times as long as broad, and containing at maturity from two to three globose nuclei. It is highly probable that each sporophore produces in succession several spores, which are thus pushed forward, and in time fill the space between the true cuticle and the cuticular cells, thrusting the former out until it bursts. Partly owing to the successive development of the spores, which are mixed with a viscid fluid, and partly to the contraction of the leaf itself upon the pulpy mass, in dry weather or when exposed to the direct rays of the sun, the spores ooze out, kept in connection with each other by means of their attendant mucilage, and drying as they are exposed to the air, form rude irregular short tendrils. These tendrils are in their turn softened again by moisture, and after a time fall down, forming a little pellicle upon the leaf, the edges of which are often curved up like a little boat or canoe, as observed originally by Dr. Greville. There is not the slightest trace of a perithecium, so that we have here one of the lowest possible forms of the group to which it belongs. The spores, it should be observed, are not truly truncate, as they appeared to Greville when examined by the old imperfect compound microscope, but rounded and obtuse. They do not arise from the division of a thread in the direction of the septa, in which case they might indeed be truly truncate, but from the development and expansion of a distinct cell produced at the tips of the sporophores.

The question now arises to what genus is the production to be assigned? Dr. Greville was undoubtedly correct in forming a new genus for its reception, for it could not be referred to any established at the time in which he wrote. As said above, the genus was misunderstood by succeeding observers, and the name applied to very different objects. A species on ivy, clearly congeneric, was published by De Notaris, in his 'Micromycetes,' under the name of *Myxosporium paradoxum*, the specific term being intended to denote the complete absence of perithecium. De Notaris appears, however, to have forgotten that Link had already proposed a genus *Myxosporium*, which is in fact synonymous with *Næmaspora*, *N. crocea* being taken as its type to the exclusion of the similar *Libertella*. A third species was published by myself in the Fourth Fasciculus of British Fungi, under the name of *Asteroma labes*, *Asteroma* being used with the same latitude in which it had been taken by Fries in his 'Elenchus.' There is no question, however, that it cannot be congeneric with true species of *Asteroma*, which undoubtedly possess a real perithecium. Subsequently one or two more species were received by Dr. Montagne from various quarters, who saw at once that they were congeneric with De Notaris' species on ivy; but in the absence of specimens, and with the obscurity thrown on Dr. Greville's genus by Unger, he could not be aware of their generic identity with the plant of Greville. For these productions he has proposed the name of *Glœosporium*, and it is but proper courtesy to one who has done so much for these minute and obscure species to adopt his name, unless he should think fit to restore that of Greville, as to the identity of which there is now no doubt in the presence of abundant opportunities of examining the true structure of his plant. The total absence of perithecium is undoubtedly a most important circumstance, though we must not insist too nicely on the greater or less fusion of the perithecium in some of the lower species of Phoma, Sphæropsis, &c., with the surrounding tissues, as multiplied examinations of the same species under different circumstances show a great difference in this respect, and throw perhaps some doubt upon the stability of Desmazières' genus *Phlyctæne*. Indeed, in the genus *Discella*, where the lower portion of the perithecium is often quite confused with the cellular tissue and the stratum from which the sporophores are derived, the upper portion of the perithecium, even in the same species, varies greatly in its degree of development, being sometimes distinctly present, sometimes confused with the cuticle. Another nearly allied genus, if we are not mistaken, is entirely destitute of a perithecium, but unfortunately the fungus which exhibits this character, from the admixture of *Sphæria maculæformis* in the plate of Greville (*Septoria Ulmi*), has been assumed as the type of a genus which clearly possesses a perithecium, and the species now assigned to it are so numerous as to make any retrograde step extremely inconvenient. The better plan will be to raise *Septoria Ulmi* to generic importance: the name *Septorella* is sufficiently distinct, and the genus will be characterised by possessing the characters of *Glœosporium* with the addition of the existence of true septa in the spores.

A fresh examination of specimens in my own herbarium and in the published specimens of Kunze, Schmidt, Mougeot, Desmazières, Libert, and Rabenhorst, has quite convinced me that there is no perithecium. In Madame Libert's specimens, Sphæria maculæformis, though in an immature condition, as might be expected from its being on leaves which are still green, is intimately mixed up with the Septorella. Even in this case, however, the solid contents of the black immature sphærules sufficiently indicate that they have nothing to do with the other fungus, and where both occur isolated from each other there is no difficulty about the matter. Sometimes the spores of the *Septorella* ooze out at once from the ruptured cuticle without any thing that might deceive; but occasionally the cellular tissue becomes a little tawny where it is raised up by the subjacent spores, which induced Madame Libert to assign a tawny perithecium to the fungus, a very different thing indeed from the black perithecia figured by Greville. When, however, this discoloured tissue is removed, there is nothing like the regular cellular structure, which always exists in true perithecia. This fact was pointed out under *Cytispora fugax*, in the 'English Flora,' in 1836, as completely established by Desmazières under No. 534 of his 'Plantes Cryptogames du Nord,' though it seems to have escaped the notice of later writers, and indeed he has himself published since a host of species possessing beyond all doubt a true perithecium.

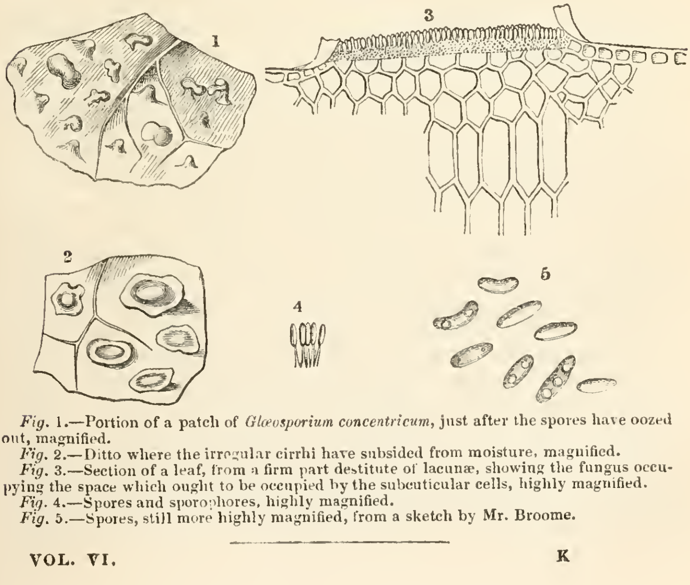

Fig. 1.—Portion of a patch of *Glœosporium concentricum*, just after the spores have oozed out, magnified.
Fig. 2.—Ditto where the irregular cirrhi have subsided from moisture, magnified.
Fig. 3.—Section of a leaf, from a firm part destitute of lacunæ, showing the fungus occupying the space which ought to be occupied by the subcuticular cells, highly magnified.
Fig. 4.—Spores and sporophores, highly magnified.
Fig. 5.—Spores, still more highly magnified, from a sketch by Mr. Broome.

XI.—*Glass Houses.* By A. Forsyth, C.M.H.S., St. Mary's Church, Torquay.

(Communicated March 6, 1851.)

The present seems an appropriate time to discuss the principles of glass house building, the subject having been brought so prominently before the public by the great glass house in Hyde Park, and by the pamphlet lately published by Mr. Rivers, entitled the 'Orchard House,' or, more properly, the orchard under glass. Mr. Rivers proposes to rival the climate of the most favoured locality in France, and produce good fruit, in great variety and abundance, in any part of Great Britain, without artificial heat, merely by means of sheet-glass, fixed in sash-bars, cut into proper shape at the saw-mills. These two examples, out of hundreds that might be adduced, are sufficient to show that the subject of glass house building is taking forcible possession of people's minds at this time; and as these are to be looked upon as only the first fruits of cheap glass, a rich harvest may yet be expected if the spirit can only be kept alive and rightly directed.

In very many instances the main-spring of action seems to be economy, whereby a great extent of glass house is to be realized at a small outlay. This is particularly the case with the "Orchard House" above mentioned. All walls, flues, pipes, stages, pavement, and indeed most of the other articles hitherto used in glass house building, are omitted. Advantage is taken of any existing fence, such as a hedge, and over this hedge-bank a glass shade is thrown, simply propping up the roof with posts and rails after the fashion of a mason's shed. Glass houses, therefore, which formerly were expensive luxuries, can be set up after this fashion, and put in good working order, for a less sum than would be required to erect a good thatched cow-shed of the same area in the corner of a paddock. The exterior appearance of these orchard houses is not very inviting, but still it must be owned that they are palaces compared with the melon-frames of the olden time; and the orchard house has this advantage over the melon-frame, that one can walk in it, and it is, moreover, free from those masses of filth above ground that all amateurs, and especially ladies, so much dislike. Mr. Rivers writes from practice, and proposes no mean advantages to horticulture. He takes the climate of Angers as a standard, and, by means of a cold frame, has realized in Hertfordshire the fruits of Angers, and that at the same time of the year; and, if others can succeed as well, the grapes and figs of the north-west of France will thus be cheaply brought to the doors of our farm-houses, and the north countryman will see the seasons actually rolled ten degrees backward in his favour, for Angers is just about ten degrees lower in latitude than Aberdeen.

Mr. Rivers is a nurseryman by trade and for profit, and a fruit-grower in his orchard houses only for pleasure; he is, moreover, located in one of the finest situations in England, as regards climate, being on the flinty gravel of Hertfordshire, just above the Essex swamps, sheltered from the breezes that sweep over higher ground, and sufficiently inland to be defended from those off the water. The latitude of Hertfordshire is about midway between Angers and Aberdeen; the reader will, therefore, see what can be done in lat. 52° at Sawbridgeworth, and thus arrive at the principles which guided Mr. Rivers in contending against certain difficulties of climate. I may add, from my own experience of Hertfordshire, that I have never found any locality in England so well suited for the higher order of horticulture, being generally sunny above—that is, free from fogs—and on the gravelly knolls the soil, though poor, is unquestionably healthy and dry.

But although Mr. Rivers has only had to glaze the earth in sunny Hertford to equal Angers 5° further south, I must state from my own experience of Aberdeen that another element must be added to the orchard-house to adapt it to the Straths of Don, 5° northward of Hertford, and 10° on the frosty side of Angers, where the open hedge would be a very ineffectual barrier to a snow-drift.

It is, therefore, evident that sound principles of construction in glass house building are safer guides in general practice than trusting implicitly to these experiments in favoured localities, however honourably and faithfully detailed. In the valley of the Thames, at Syon, the amount of hours of sunshine during winter was thirty per cent. less than those registered at East Barnet, in Herts, only 15 miles distant, but out of the London fogs and far above the level of the Thames.

The principles that guided Mr. Paxton in glass house building may be gathered from his own published accounts, and it will enable strangers to form a correct judgment when I state the nature of the climate that he had to contend with. The climate of that part of the valley of the Derwent where Chatsworth stands is one of the worst in England. The kitchen-garden, where the finer plants are kept, is very little above the bed of the river; and the climate is so uncertain that I have known the dahlias at Chatsworth to be killed by frost in August. Although the latitude is only one parallel northward of Herts, the climate is of such ungenial quality that only a few miles (if more than one) from Baslow the land is not worth cultivation. And as

Mr. Rivers makes the Frenchman exclaim, on entering the orchard-house, "This is my climate!" the Scottish highlander might say of a wintry day in the Peak of Derbyshire that it differed little from the stormy days on his native mountains.

Such being the case, Mr. Paxton must have recourse to certain artificial means to improve the climate. He had heat under control by means of pipes, &c. in his glass houses; but light was scarce, and much wanted where the climate of "sunny skies" had to be imitated. Consequently, he had recourse to the bow window, which necessarily admits more light to an apartment than a hole in the wall, and, with this light, more sun-heat. Here then we have a principle developed. Economy is here out of the question—glass by the acre, hot-water pipes by the mile. To imitate Angers in Hertfordshire is one thing, but to imitate Hindostan in the Peak of Derbyshire is quite a different affair; and it is not to be wondered at that parties under such dissimilar circumstances, and with such dissimilar ends in view, should arrive at different conclusions and pursue unlike paths. The closely-glazed bow-window, or, in other words, the ridge and furrow roof, and expensive columns of heated iron, are necessary to conquer the sullen temper of the climate of the valley of the Derwent: whereas the chinks and rents of the weather-boarding of the orchard-house in Hertfordshire are found salutary to the inmates.

From the foregoing remarks I would fain argue the necessity of studying the locality where a glass house is to be built and the ends in view, lest the bow-window, from not being necessary in all cases, may be really injurious, and, what is of equal importance, it may add 30 per cent. to the cost of erection.

Some years ago I had glazed quarries of cast iron made to answer the purpose of hand-glasses. I found that, with four inexpensive boards and one light, I made a good hand-glass, which roofed four square feet of land with about four square feet of glass; and when I took a common hand-glass of sufficient size to roof the same four square feet of land, I found that it contained rather more than twelve square feet of glass; and whilst these quarries could be used to grow pines, vines, &c., and fall into any right-angled figure, the hand-glass was only available for the single purpose for which it was made. The late Mr. Loudon, speaking of these quarries (in *Gard. Mag.*), said that he considered them one of the greatest improvements in horticulture that had been introduced in his time. But persons who have been in the habit of having glass fronts and backs to their plant-houses are ready to condemn all erections otherwise constructed; and this is just the time to discuss the matter with such parties, and see if their ideas can be supported by facts.

The late Mr. Wilmot had an immense extent of frames, and was very successful in cultivating melons. I took notes upon the spot of the angle of his glass and the light his plants received, and I found that a sash 6 feet by 4 roofed a space of the same size, minus only an inappreciable quantity for the frames, and had just slope enough to carry off rain; and as there were only opaque sides, he grew fruit well in dark walled cells with flat roofs. The orchard-houses which I saw at Sawbridgeworth had no light except from above, and the roofs were at a very low pitch; but there is a flower-garden under glass at the Exeter Nursery that surpasses anything in the way of flower-growing which I have ever seen, and it has light only from the top; the stone walls of this magnificent temple of Flora being illuminated with a blaze of camellia blooms. I have seen more flowers in this gigantic camellia-house than could have been got together if ten of our largest gardens had been stripped of every blossom they possessed. Surely, then, these well-attested examples may suffice to show that for very many fruits, as well as for very many flowers, less glass will serve than has hitherto been deemed necessary.

In growing French beans and strawberries in old-fashioned lean-to houses, the top-shelf was sure to be the best place for setting the fruit, and indeed for the general purposes of cultivation. Now, Mr. Wilmot's melon-frames were all top-shelves, so is Mr. Rivers's orchard-house. In short, there is a zone or belt of air in a glass house (similar to that atmosphere wherein animal life exists on the earth's surface) that is not to be departed from with impunity; for too far from the glass, or too near it, are errors so common and so well known to all practical men that I need not say a word on the subject in a work of the nature of this Journal. But an important step in the improvement of glass house building is now being taken, and one which is fraught with advantage to horticulture—I mean the getting rid of the open lap, of the many closed laps—in short, of all laps, for the lights now before me have none. We have been long fettered with these laps, which require a slope to be given to the roof in order to keep the house dry, in the same way that all tile and slate roofs require to be steep to prevent the rain from beating in between the pieces; but when sheets of lead are used, we find that, being composed of very few pieces, the pitch of the roof, instead of rising several feet, rises only a few inches, and the apartments under such a roof run up to within a few inches of the lead, whereas, in the case of the tile and slate roofs, there is an apex in the shape of a useless garret, a great part of which is not sufficiently high for a person to stand upright in; consequently, the triangular-roofed garret would readily be dispensed with, were it not for the lap in the roofing materials.

Having thus far premised, I must break the subject at once; and, although I foresee all sorts of opposition to the plan, I have no hesitation in stating that, for all purposes for which glass houses are used, provided their roofs remain stationary all the year (and this includes nine-tenths of the glass houses in Britain), the flat roof, such as is employed for sheets of lead, is decidedly the best, and by at least 30 per cent. the cheapest. The cucumber-grower pitches his roof almost perpendicular, to catch the winter sun, and does wonders with it, saying triumphantly, " Look here; is not this far before the old-fashioned flat-roofed plan?" Now, as this will be a general cry, I will meet it, and state that I condemn the roof of little slope, many laps, and many drips. These old roofs sloped to the south, mine *does not;* they had laps, mine *has none.* And in order to see clearly about the affair of slopes, let us suppose a white horse on the face of a hill—which really does exist in a certain locality—and when the sun shines on it you can see it for miles, if you are at a certain elevation. Now just go round to the 90th degree from where you stood before, and the horse is gone: you have got an end now, you were then abreast. But if the white chalk horse were placed on Salisbury Plain, and you were to take the view from the spire of the cathedral, you would see him quite plain at ten miles off; and if you were to go the whole 180 degrees, or at any degree, you would still see all the horse from a like elevation. I am sorry to be compelled to embody this subject thus in order to make it plain; but I maintain that all slopes in glass house roofs injure the character of the zone of climate inside, and the plants literally long (for they elongate their structure) to get to the full sun near the glass, and the globular form of the head of most plants points out that they are tied to the earth equally on all sides, and obey the vertical and horizontal lines. The steep pitched roof facing the south will aid the early forcing of cucumbers, since the sun's rays are confined to that part of the compass lying between south-east and south-west in the depth of winter; and the ridge and furrow roof is admirably adapted for peach-forcing, as it admits rays of light direct from the sun at 6 in the morning, and again at 6 in the evening.

But as it is only by figures that the true state of affairs can be tested, and as many a bankrupt thought himself doing well until he balanced his books, so I am forced to appeal to facts and figures to meet the host that would assail any luckless wight that might dare to doubt the propriety of ridge and furrow, even in an economical point of view. The ordinary lean-to roof takes, in its cross-section, about 13½ feet to roof a horizontal space of 10 feet,—and mark, this is only the *cross* section, at an angle of about 40°. But upon the ridge and furrow, in the longitudinal section, at an angle of about 45°, we have a space of 15 feet, requiring 22½ feet to roof it: or, in plainer language, the space of 10 feet cross section is to be roofed flat with 10 feet, say for 10*l.* With a slope of 40°, 13½ feet is wanted, or 13*l.* 10*s.*; and with ridge and furrow at 45°, the proportions are as 15 to 22½, or as 13½ feet to 20¼ feet, requiring just 20*l.* 5*s.* to do the work that 10*l.* does, and that comfortably. It is easy to see now that the ridge and furrow, having just two houses in one, may well do its work a little better than its neighbours; but I imagine that the skill of a Wilmot, a Prince, and a Rivers would be found heavy odds against fine glass houses. And now, when we have no more laps to fear, and find that some of our most experienced horticulturists have done wonders without side-lights or high roofs, whilst we praise the ingenuity that gets all the light that can be got where all is wanted, cost what it may, we should not give 200*l.* to do the work of 100*l.* by putting a ridge and furrow roof upon a camellia-house in the southern counties. Neither should we erect for noblemen or gentlemen rough sheds for forcing-houses, with posts, and rails, and weather-boarding, and Arnott's stoves; not that the system is bad—far from it, but it is not suited to the circumstances of the case; for, if gardeners are to do anything odd, they should do it at home, as Mr. Rivers has done, and at their own expense. But for the general purposes of horticulture fruit trees must be full-grown, and, consequently, houses of large size must be built. These, being conspicuous, must be as handsome as they can be made compatible with the work they are to do; and, as economy is the order of the day, it is a real saving to get an article as strong, as handsome, and as efficient as your neighbour's at half the cost of his; and if this can be effected by studying the facts and figures I have given, my labour will not be thrown away.

It is not the outside of the glass house that I find fault with: it is the uneven character of the climate inside, and the burning tops and damp ill-ventilated bottoms that I complain of. If 18 inches from the glass is found to be the best place for Mr. Rivers's fruit-bushes in pots, why not have every plant in that better place? and surely no argument is needed to show that all sorts of variations occur in a house of various heights: the temperature, the moisture, the ventilation, and even the light varying as we approach the apex of the roof from the earth.

The glass for the houses that I advocate is inserted in heavy cast-iron quarries, and one pane 3 feet long runs from top to bottom; the quarries being struck off at a heat are cheaper than any other sort of light can be on account of the saving of labour in their mode of construction, and as for durability, they admit of no comparison with the ordinary lights used in glass house-building. I had a quantity cast from a model made at Alton for some pits there, and they answered admirably for the purpose intended; but the glazier, having only half emerged from the dear glass-glazing, could not be prevailed upon to put the pane in of one piece; consequently, there was one lap still, and that tied us to the steep-roof system. The same model is now supplied here by the same person (Mr. Mellard, ironmonger, Uttoxeter, Staffordshire), and the quarries are beautifully glazed in one length panes without a lap; consequently the roof has only just as much rise as will comfortably clear it of wet, as may be seen by the following statement. A house, 12 feet wide inside, is roofed beautifully with 12 feet of glass in its cross-section: a feat which, I believe, has not been attempted before; and in regard to light, the space where the plants are is as well lighted as it possibly can be. The climate is more regular and more under control than it could be in any up-and-down house; and the cost, as has been shown above, as compared with glass houses upon other plans, is just one half.

XII.—*Some Suggestions for the Better Management of Wall Trees.* By George Lovell, Bagshot, Surrey.

(Communicated Feb. 1, 1851.)

A well covered wall of fruit trees is an exception rather than the rule. Visit twenty gardens, and the chances are that two-thirds will exhibit lamentable deficiencies in this respect. In accounting for the occurrence various causes are supposed to operate. The soil is "cold," the subsoil "hard," the climate "not genial," the trees "old and worn out," or some other untoward influences are concerned in producing the debility and decay of the trees. It cannot be age, for an old peach, nectarine, or apricot would be a horticultural novelty worth travelling a few miles to see. As to what the real cause is, I should be loth to offer a decided opinion; but, after giving the subject some degree of attention, there appears to be sufficient reason for calling in question certain time-honoured practices which writers on this subject do not seem to have recognised, or if recognised, have dismissed briefly, and without due comment.

I confidently believe that to the disagreement between the scion and the stock, and to the early and ruthless application of the knife, may be attributed in the majority of cases the diseases and early death of the Peach and its allies. In this opinion I am supported by no less an authority than the greatest of all gardeners, Thomas Andrew Knight. In that text book for all horticulturists, practical, theoretical, or purely scientific, the 'Physiological Papers' of the above named author, occurs the following passage, which, as eminently illustrative of what I have to adduce, I shall transcribe at length :—

"Many gardeners entertain an opinion that the stock communicates a portion of its power to bear cold, without injury, to the species or variety of fruit which is grafted upon it; but I have ample reason to believe that this opinion is wholly erroneous; and this kind of hardiness in the root alone can never be a quality of any value in a stock, for the branches of every species of tree are much more easily destroyed by frost than its roots. Many also believe that a peach tree, when grafted upon its native stock, very soon perishes; but my experience does not further support this conclusion than that it proves seedling peach trees, when growing in a very rich soil, to be greatly injured by the excessive use of the pruning-knife upon their branches, when these are confined to too narrow limits. The stock in this instance can, I conceive, only act injuriously by supplying more nutriment than can be expended; for the root which nature gives to each seedling plant must be well, if not best, calculated to support it; and the chief general conclusions which my experience has enabled me safely to draw, are, that a stock of a species or genus different from that of the fruit to be grafted upon it can rarely be used with advantage, unless where the object of the planter is to restrain and to debilitate; and that where stocks of the same species with the bud or graft are used, it will generally be found advantageous to select such as approximate in their habits and state of change, or improvement from cultivation, those of the variety of fruit which they are intended to support." *

Now the very circumstances here pointed out as conducive to debility and shortness of life, are exactly such as the peach and analogous fruits receive at the hands of cultivators generally, beginning in the nursery. To render the argument clearly I shall briefly trace the routine of treatment which the kinds of trees under notice are subjected to, and then offer some suggestions for a reformed mode of procedure, and one, it is hoped, more consonant with the nature of vegetable life and the results sought to be obtained by the cultivator.

The peach bud is inserted on a plum stock, and we will presume it to have taken kindly to its foster parent. The next step is to "head back" the stock, that when the peach bud starts into vigour the wound may be healed over, and an apparent natural union take place between head and stock. If the

* Physiological Papers, p. 223.

latter, which is often the case, be half an inch in diameter, the wound, allowing for the angle of the cut, will be of a formidable character. To proceed: the spring advances, the peach-bud pushes with vigour, and by the close of summer a miniature tree two or three feet in height, with a host of lateral branches, crowns the plum stock. The winter passes: in anticipation of the growing season, the knife is again brought into operation, and a decapitation of the peach takes place, two or three inches above the yet bare wound of the plum stock. Why permit such an amount of growth merely for the sake of cutting it away? But I am anticipating. The buds in the remaining portion of the peach of course start into as many shoots, when the season of growth arrives. Supposing the tree not to be sold from the nursery at this stage of its progress, the following pruning season sees it once more denuded of its branches by the knife, leaving as many bare and bleeding wounds open to all the varying influences of spring frosts, drying winds, and scorching suns, to say nothing of the disturbance of the general *economy** of vegetation in the individual plant. We will, however, follow the plant to the wall of the kitchen garden. Here again the shoots succumb to the knife, leaving of course more wounds with all their ill effects. The new situation and the stimulants applied for a time give the plant an impetus, and it flourishes. But look at the point of junction of the head and stock, now become an ugly protuberance; gum stands in pellucid drops, telling of wounds inflicted and never healed, of debility induced, and constitutional vigour destroyed never to be regained. Years pass on, the bases of the principal branches exhibit ruptures in the bark, and gum exudes. What it foretells need scarcely be recorded. Branch after branch lingers, becomes stagnated in energy—the fruit drops off in stoning. At pruning time a lamentable deficit in the branches appears; unsightly gaps and bare walls tell sad tales. The sequel is soon told. A year or two more of unsatisfactory crops, and you root out the remnant of your peach, or satire on what should have been a healthy, vigorous, and fruitful tree, and put another in its place only to follow its predecessor to the faggot heap.

Now why not bud, or in some way produce a union of the cultivated peach upon stocks of its own species? And let that union be effected at the earliest possible stage of growth in the stock, with the view of rendering as slight as possible the wound caused by heading back. For, after examining many trees in various stages of growth and age, I feel confident that the knife is the *primary* cause of gumming. To discuss the collateral effects of

* The reader will understand the term here used to signify the various phenomena, visible or inferred, of the vital principle of plants.

inducing gum need not now be insisted on. That gumming almost invariably follows large wounds by the knife in stone fruits, is a fact respecting which any one may satisfy himself, and that speedily. I have examined the half-healed over wounds on trees of but two and three years' growth, and found large secretions of gum; and I need scarcely say that when a tree once is disposed to this disease (for it is a disease), the rule is, that it follows it to the death, which consummation it accelerates, being at once the cause and effect of debility. To return to our tree: we will presume the bud to have been inserted in a peach stock of barely sufficient diameter to accommodate it, and that a union has taken place, and the heading down performed. As soon as the bud has become a shoot a few inches in length, I would destroy the young top while it is in a state of cellular tissue, in order that no ultimate wound might remain. The lateral branches would then break into shoots, and by judicious management a beautifully formed tree fit for removal to the fruiting wall would be produced at the end of the growing season, in place of what, under ordinary management, is a gross shoot requiring to be headed back at the pruning season, thereby consuming a year without any perceptible good being attained, to say nothing of the injury inflicted by the knife. Suppose a tree, such as I have described, to be a reality, why could not its future progress be wholly guided without the application of the knife, at least to its branches? Should an undue vigour evince itself, the remedy lies in the gardener's hands. Root pruning will be a compensating power. Its benefits need not be here insisted on. I am convinced that a free use of the knife on wall trees cannot be too strenuously combated. All our best gardeners are aware of it, or why do they so warmly advocate summer pruning to obviate that of winter? I would render the office of the knife a sinecure. That it could be effected is apparent. But the first step must be taken in the nursery garden. Constantly wounding the branches of a tree cannot, even in a simple mechanical view of the matter, be deemed expedient; and to allow a season's growth to run wild, and then destroy it, in the case of young trees, seems to me an anomaly unaccountable. Within a few days I have seen very many peaches, nectarines, and apricots, of one year's growth each, possessing more than wood enough, if properly distributed, to form a large and handsome tree, waiting for the knife, from the effects of which a whole season will be consumed. Surely this cannot be sound practice! The peach and other wall fruit are so universally grown, and disappointments from seasons and otherwise so prevalent, that any mode of treatment likely to obviate them is surely worthy of attention. There can be no question but that the strength of blossoms to resist spring frosts depends in a great measure upon the state of the wood bearing and producing those blossoms; and that the state of the wood depends upon the general health of the tree. This being assumed, and further, that the health of the tree depends in a great measure on the treatment it receives—climate we cannot control—it follows that success is in a great measure in the hands of the cultivator. To be constantly cutting a tree to pieces, to say the least of it, cannot, by the widest stretch of imagination, be supposed to benefit it.

In this paper I have purposely avoided many points which would seem to grow out of the argument, and demand attention, in order that I might the more clearly set forth the main features of the plan I would recommend, which I trust will be found worthy of general adoption.

XIII.—*An Abstract of Meteorological Observations made in the Garden of the Society.* By Robert Thompson.

[The following returns are in continuation of the tables of daily observations published in the 'Transactions' of the Society, of which the last part, for 1844, appeared in the third volume, p. 264, of the New Series. The originals from which this abstract has been prepared are preserved in the Society's Library.]

1845.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In. pts.	Max.	Min.	Mean.	
Jan.	65°	16°	38·75°	2·97	30·239	28·932	29·777	996
Feb.	65	9	33·07	0·93	30·409	29·377	29·917	933
March	74	6	38·49	1·25	30·495	29·500	29·963	865
April	94	15	48·41	0·95	30·328	28·972	29·812	826
May	84	22	50·04	2·89	30·302	29·407	29·842	955
June	107	35	62·14	1·36	30·365	29·230	29·908	894
July	99	39	61·43	2·31	30·196	29 532	29·886	914
Aug.	92	34	59·30	2·79	30·303	29·111	29·847	912
Sept.	94	26	52·60	1·77	30·278	29·271	29·887	947
Oct.	83	21	49·96	1·39	30·510	29·295	29·976	925
Nov.	74	15	44·26	2·11	30·317	29·077	29·684	997
Dec.	60	14	40·49	2·61	30·447	28·785	29·776	986
Means	82·58	19·50	48·24	22·33	30·349	29·207	29·856	929

General Observations.

January.—The mean temperature of the month was about 2° above the average, S.W. winds being prevalent. The quantity of rain was, however, nearly double the usual amount; much fell on the 11th, 18th, and 19th. The mean height of the barometer was considerably below the average. It fluctuated nearly an inch between the morning of the 20th and that of the 21st. The 20th, 26th, and 27th were very boisterous.

February.—The mean temperature was $6\frac{1}{2}$° below the average. On the night of the 11th, which was exceedingly clear, the common thermometer was 3°, and the radiating thermometer as much as 9° below zero. Rain and melted snow amounted to little more than half the usual quantity for the month. The barometer stood above the average.

March.—The mean temperature of the month was about $4\frac{1}{2}$° below the average. Many gardening operations were retarded in consequence of the frost. On the 18th, the soil was found to be frozen to the depth of 5 inches in recently dug ground in the kitchen garden, but where not recently stirred previously to the frost setting in, the frozen crust was between 7 and 8 inches thick; hence it must be inferred that plants in severe weather are more liable to suffer in compact than in loose soil. On the 15th clouds were observed moving in different strata, the lower, briskly, from N.E. to S.W.; the upper, slowly, from S.W. to N.E. Snow commenced to fall on the 16th in small granular particles.

April.—Owing to the very fine weather in the end of the month, the mean temperature was 1° above the average; but sharp frosts occurred in the first week, the thermometer on the 8th being as low as 23°. The amount of rain was more than half an inch below the average. There were no continuous heavy rains. A rainbow was observed on the morning of the 14th, very low, the central part of the arch being estimated at not more than 5° of elevation. The day and following night proved boisterous.

May.—The general character of this month was wet and cold. The temperature was 4° below the average; and the amount of rain was an inch above the usual quantity. North winds were unusually prevalent. A sharp frost for the period of the season occurred on the 5th, the thermometer indicating 5° below freezing, whilst the radiating one was 10° below that point. On the 6th, a heavy shower of rain and hail fell between 5 and 6 P.M., and there was also a heavy shower of hail on the 7th. On the 10th there was thunder, $\frac{1}{4}$ to 1 P.M., 2 P.M., and between 5 and 6 P.M.

June.—This month was genial for vegetation. The temperature was above the average, the prevalent winds being from S.W.; but the hottest days occurred between the 12th and 15th, with easterly winds, the temperature then ranging from 82° to 85° in the shade; and on the 14th as high as 107° in the sun. On the afternoon of the 13th, few but very large drops of rain fell; lightning occurred at night. Thunder was heard on the 17th at 5 P.M.; and at 7 P.M. there were heavy thunder clouds, with a rainbow, of which about three-quarters of the south half was entire, the rest of the arch was indicated by fragments.

July.—The mean temperature was about 2° below the average. The rain amounted to the usual quantity for the month. S.W. winds were prevalent. Thunder was heard on the 3rd; and there was much sheet lightning on the evening of the 6th. Thunder and very heavy rain occurred on the 11th, commencing about 20 minutes before 1 P.M., and half an inch of rain fell in 25 minutes.

August.—The mean temperature was nearly 3° below the average. The amount of rain was about a quarter of an inch in excess. The 9th was boisterous, with slight rain. Thunder occurred on the 7th and 11th. The morning of the 19th was foggy, and rain fell heavily during the forenoon.

September.—The mean temperature was nearly 5° below the average. The nights were frequently cold; and on the 23rd the thermometer indicated 2° below freezing. The amount of rain was below the average for the month, yet the barometer was somewhat lower than usual, contrary to its general condition when little rain falls. The wind was from the N.E. for nearly half the month.

October.—The mean temperature was almost equal to the average. After the 11th the days were generally very fine, but the nights were occasionally frosty. The barometer stood high. No rain fell after the 15th; and altogether the quantity was little more than half the usual amount, although S.W. winds were most prevalent. There were heavy showers on the afternoon of the 3rd; and between 5 and 6 P.M. of the same day the sky was covered with fiery-red and copper-coloured clouds, below which floated a low dusky-violet haze. At 4 P.M. on the 10th, thunder was followed by a heavy shower of large irregularly turbinate or pyriform hail.

November.—The temperature and amount of rain differed little from the average. The barometer was generally low. Sharp frost occurred on the night of the 3rd, and this was followed by exceedingly dense fog on the 4th. The morning of the 19th was boisterous, with rain.

December.—The mean temperature was $1\frac{1}{2}$° above the average, the amount of rain was almost double the usual quantity. Barometer generally low, but remarkably so on the 20th. The tide rose higher in the Thames early in the morning of the 12th than it had done since November, 1841. The barometer stood high at the time. The 20th was dark and cloudy, with rainbow. The 21st, 23rd, and morning of the 28th were boisterous. The evening of the 31st was also boisterous, with heavy rain.

1846.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In. pts.	Max.	Min.	Mean.	
	°	°	°					
Jan.	61	18	43·38	2·85	30·621	28·943	29·773	979
Feb.	77	17	43·32	1·47	30·341	29·405	29·995	938
March	79	16	43·43	1·09	30·600	29·169	29·769	900
April	81	22	47·38	3·93	30·298	28·984	29·704	875
May	92	28	56·16	1·35	30·320	29·023	29·893	770
June	106	41	66·46	0·80	30·320	29·401	29·985	724
July	110	42	65·95	1·78	30·218	29·294	29·872	797
Aug.	108	42	64·16	4·50	30·210	29·539	29·901	888
Sept.	97	33	60·79	1·76	30·382	29·350	29·926	909
Oct.	79	26	50·37	5·54	30·260	28·934	29·623	973
Nov.	67	12	44·66	1·43	30·449	29·232	29·913	971
Dec.	51	5	31·25	1·21	30·573	28·620	29·808	984
Means	72·33	25·16	51·35	27·71	30·382	29·158	29·852	884

General Observations.

January.—With the exception of a few frosty nights in the first week, this month was remarkably mild for the period of the season. Much rain fell between the 16th and 29th. In that period there was not one dry day; and the total amount of rain was fully an inch above the average. On the 19th rain fell constantly throughout; the night was very boisterous. The 22nd was also boisterous, but little rain fell; in both instances the barometer was very low. More than half an inch of rain fell on the 25th.

February.—This month, like the preceding, was several degrees warmer than usual. There were no severe frosts; the lowest indication of the thermometer was 22°, on the 10th. From the 16th to the end of the month, there was no frost even at nights. The amount of rain was below the average. On the whole the weather was very favourable for the operations of the garden.

March.—The mean temperature of the month was about half a degree above the average, but the weather throughout was not favourable to vegetation, which the mildness of the preceding month had brought forward so far, that by the 10th many of the plums were in flower, as were also peaches and nectarines on walls. The 16th was stormy, with hail in the afternoon; and on the morning of the 20th a fall of snow commenced, which attained a depth of nearly 2 inches, lodging heavily on trees and shrubs. The plum-trees exhibited a strange crowding of snow and blossoms, and the Ribes sanguineum had a most singular appearance. The snow disappeared in the course of the day; but the frost at night was more severe than it was in the two preceding nights, the thermometer being 12° below freezing. The blossoms of fruit-trees of course suffered much.

April.—This month was very wet, the depth of rain amounting to nearly 4 inches. On the 25th alone the quantity which fell was little short of an inch and a half. The mean temperature was almost equal to the average; but the nights of the 8th, 9th, 20th, 21st, and 28th were frosty, and consequently proved injurious to the crops of fruit.

May.—The temperature was 2° above the average. From the 20th to the end of the month the weather was very hot for the period of the season. On the 31st the thermometer stood as high as 80° in the shade. The quantity of rain was nearly half an inch below the average; none fell after the 20th. Thunder occurred on the 6th, and some thunder showers on the 19th.

June.—This month was hot and dry; and still the potato disease progressed. The mean temperature was fully $5\frac{1}{2}$° above the average. On eighteen days the maximum temperature in the shade was above 80°, and on the 22nd it was 93°. No rain fell after the 22nd. The total amount was only $\frac{8}{10}$ths of an inch, of which $\frac{6}{10}$ths fell on the day just mentioned, when the long-continued hot dry weather broke up with a thunder-storm.

July.—This month was not so hot as the preceding, still it maintained above an average temperature. The days averaged a lower temperature than those of June; but the nights, compared with those of the latter, were warmer. The 4th was excessively hot and dry: the hygrometer then indicated 34° of dryness, a condition rarely equalled in this climate. The evening was clear; the morning of the 5th was very hot; the temperature increased to 95° in the shade; thunder was heard at 2½ P.M.; rain began to fall in torrents for a short time. Early A.M. on the 6th there was a halo round the sun; and a rainbow appeared in the north-west. The amount of rain was below the average.

August.—The mean temperature of the month was 2° above the average. The 1st was excessively hot and dry; in the morning the sky was uniformly overcast; soon after 2 P.M. thunder was heard almost constantly, but without lightning or rain, till 3 P.M., when a few large drops began to fall; the lightning soon became vivid, and rain, mixed with hail, fell in torrents till 4½ P.M.; at 5 the wind veered from E. by N. to W., and thunder and rain again became heavy. Comparatively little damage was done by the hail in the Garden, but on the south side of the Thames, in the neighbourhood of the metropolis, the destruction of glass and garden productions was greater than any one had previously seen or heard of. The hailstones were so large that, near Vauxhall, sheet glass, 16 oz. to the foot, could not withstand them.

September.—The weather was hot, with very little rain, till the 22nd. The mean temperature was 3° above the average. The amount of rain was nearly an inch below the usual quantity, and most part of it fell on the 23rd. Thunder, with showers, occurred on the 6th, at 2 P.M. In the forenoon previous, the clouds, in strata, were moved by the under current of air from E. to W., and by the upper in the opposite direction.

October.—This was a very wet month, the quantity of rain, upwards of 5½ inches, being more than double the usual quantity. That which fell on the 14th, 15th, and 16th averaged fully half an inch for each of these days. The mean temperature was very nearly equal to the average. The 10th, 13th, and 14th were boisterous. The barometer on the two last-mentioned days was very low.

November.—This month was damp and foggy; but the amount of rain was nearly an inch below the average. The usual temperature was fully maintained. Frost was not indicated by the common thermometer till the 26th. There was a rainbow on the 3rd, about 7 A.M. The 20th was boisterous, with rain in forenoon; the evening was clear, and lightning was seen at night.

December.—The mean temperature of the month was 8½° below the average. With very few exceptions every night was frosty, the most severe being that of the 13th. N., N.W., and N.E. winds were prevalent. The barometer was exceedingly low on the 23rd.

1847.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun. °	Min. by Radiator. °	Mean of Shaded Therm. °	In. pts.	Max.	Min.	Mean.	
Jan.	56	16	34·24	1·31	30·333	29·245	29·828	981
Feb.	58	1	34·80	1·34	30·279	29·326	29 891	972
March	66	3	40·11	0·41	30·508	29·446	29·968	941
April	74	16	44·28	0·92	30·064	29·247	29·769	807
May	103	27	56·88	1·59	30·471	29·334	29·883	837
June	92	33	58·46	1·31	30·475	29·509	29·935	841
July	101	40	65·84	0·79	30·284	29·737	30·039	834
Aug.	100	32	62·47	1·50	30·316	29·504	29·990	862
Sept.	85	22	53·40	1·66	30·323	29·389	29·940	876
Oct.	83	24	52·12	1·75	30·306	29·382	29·910	957
Nov.	74	16	44·61	2·26	30·372	29·908	29·968	975
Dec.	60	21	41·09	1·81	30·353	29·287	29·843	978
Means	79·33	20·91	49·02	16·65	30·341	29·351	29·913	905

General Observations.

January.—The mean temperature was below the average. Snow fell on the 2nd, and in considerable quantity on the 20th and 21st, but it soon melted. Fogs were prevalent from the 12th to the 16th, and on the 22nd the fog was very dense. The 26th and 28th were boisterous, without much rain.

February.—This month was only about half a degree warmer than the preceding. The temperature was exceedingly variable. On the 9th it was within 4 degrees of zero, and on the 17th the maximum in the shade was 57 degrees: hence the range was 53 degrees in the shade. Previously to the 9th snow had fallen to the depth of 4½ inches; the frost was again intense on the nights of the 11th and 12th. A thaw commenced on the 14th, and on the four succeeding days the weather was unusually mild for the period of the season. The night of the 18th was boisterous, with a warm south-west wind.

March.—The mean temperature was between two and three degrees below the average, and vegetation made very little progress from the 1st to the 17th of the month; and although the days were afterwards warm, still the nights were generally more or less frosty, so that the blossoming of fruit-trees was much retarded. There was a slight snow-storm on the afternoon of the 9th, and some fell on the 10th, the night of which was excessively cold, the thermometer indicating only 7 degrees above zero. The amount of rain was unusually small.

April.—The mean temperature of this month, like that of the four preceding, was below the average. Nearly half the number of nights were frosty: on the 16th the thermometer was as low as 20 degrees. The 14th was bleak and cold, with some hail in the afternoon; and there were snow and hail showers on the forenoon of the 15th. The 27th was boisterous. Thunder was heard between 1 and 2 P.M. on the 29th.

May.—Frosty nights commenced on the 26th of last November, and their frequent occurrence only terminated on the 5th of the present month, to the injury of many kinds of vegetation at this period in a forward state. After the 5th, the weather, on the whole, was exceedingly fine throughout, and the mean temperature was 2 degrees above the average. On the morning of the 29th, thunder, lightning, and heavy rain commenced soon after 1, and continued almost incessantly till ½ past 4 A.M.

June.—The mean temperature was 2 degrees below the average; the amount of rain half an inch less than the usual quantity for the month. Thunder-showers occurred on the 8th; the 15th was boisterous, and there was some thunder, with heavy showers, on the afternoon of that day. On the 18th the wind changed suddenly to N., and constant rain commenced ½ past 11 A.M.; at 1 P.M. the under-current was from N.E. and the upper from N.

The potato disease was again evidently progressing, although the weather was neither so cold nor so wet as in many corresponding months of former years, when no potato disease existed.

July.—The general character of this month was hot and dry. The mean temperature was 2½ degrees above the average. The 14th was excessively hot, the thermometer indicating 93½ degrees in the shade; and it stood as high as 90 degrees on the two preceding days. The amount of rain was little more than three-quarters of an inch, the greater portion of which fell on one day—the 17th. There was no rain after the 20th.

August.—The average temperature was fully maintained. The 1st and 2nd were very hot and sultry. There were some thunder-showers on the afternoon of the 8th. The evening of the 15th was clear, and there was much vivid lightning; rain fell during the night. The total amount of rain was an inch below the usual quantity. N.E. winds were prevalent.

September.—In this month the mean temperature fell nearly

4 degrees below the average. On the 27th the common thermometer indicated 4 degrees below freezing, and the radiating one 10 degrees below that point. There was a slight frost so early in the month as the 6th. The amount of rain was nearly an inch below the average. The 16th was boisterous, and much rain fell on the 19th. The Dahlias were much injured by the frost of the 27th.

October.—This month was warm and rather moist, according to the hygrometer. Heavy rain fell on the 23rd; but the total amount was nearly an inch below the average for the month. There was a slight frost on the 21st; and the thermometer indicated 4 degrees below freezing on the night of the 25th.

November.—There were some very fine days in this month; but, with this exception, it maintained its usual character, foggy and damp. The mean temperature was a degree above the average; the amount of rain somewhat less than usual. The barometer stood high, as is usually the case in foggy weather.

December.—The mean temperature was very little above the average. There were only slight frosts. Up to the 18th the weather was frequently boisterous, especially on the 4th, 6th, 7th, and 17th. On the 6th there was lightning at night, and the barometer was then remarkably low, the atmospheric pressure balancing little more than 28½ inches of mercury.

1848.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In. pts.	Max.	Min.	Mean.	
Jan.	56°	15°	33·72°	1·16	30·461	29·306	29·899	962
Feb.	64	20	42·96	3·12	30·436	28·840	29·657	956
March	82	18	42·43	3·05	30·262	28·637	29·586	953
April	90	22	47·35	3·06	30·171	29·292	29·711	903
May	96	27	58·12	0·28	30·320	29·296	30·044	724
June	92	34	59·58	3·20	30·142	29·270	29·769	886
July	103	37	57·09	2·21	30·448	29·299	29·952	855
Aug.	86	37	58·74	4·70	30·058	29·369	29·841	937
Sept.	93	26	55·96	2·20	30·433	29·326	29·929	884
Oct.	84	26	49·59	2·93	30·151	29·163	29·751	960
Nov.	60	14	41·18	0·90	30·435	29·151	29·879	971
Dec.	65	14	41·75	2·03	30·343	29·116	29·897	971
Means	71·50	24·16	49·04	28·84	30·303	29·172	29·826	913

Geothermometrical Observations.

(The next page is a continuation of Tables in vol. iii., exhibiting the temperature of the earth at 1 foot deep, and at 2 feet deep, in contrast with that of the air in the shade. In explanation of the meaning of the tables we may take, for example, the month of January, when it will be found that

The temperature of the earth was—

Highest on the 5th	=	42° at 1 foot deep. 43° at 2 feet deep.
Lowest on the 30th	=	35° at 1 foot deep. 37° at 2 feet deep.
Mean temperature of the earth, deduced from 31 daily observations	=	37·92° at 1 foot deep. 40·13° at 2 feet deep.

The temperature of the air in the day was—

Highest on the 3rd	= 51°.
Lowest on the 26th	= 27°.

The temperature of the air in the night was—

Highest on the 3rd	= 41°.
Lowest on the 28th	= 17°.

Mean maximum temperature of all the days . .	= 39·12°.
Mean minimum temperature of all the nights . .	= 28·32°.
Mean temperature of the month, deduced from these	= 33·72°.

From the above example the whole of the Table on the following page will be readily understood.)

General Observations.

January.—E. and N.E. winds were prevalent for nearly half the days in the month, and the temperature was in consequence generally low; yet there were no intense frosts. The amount of rain was below the average. The 4th, 15th, and 16th were exceedingly fine. Some snow fell towards the end of the month.

February.—The mean temperature was nearly 3½ degrees above the average for the month. The lowest indication of the common thermometer was only 7 degrees below freezing. The wind was mostly from S.W. The amount of rain was nearly double the usual quantity. Much fell on the 10th and 26th; the latter was boisterous; and there was a heavy storm of rain and hail on the afternoon of the 27th.

March.—Nearly an average temperature was maintained, and the amount of rain was more than double the usual quantity for

1848.		Day of the Month.	Temperature of the Earth.		Day of the Month.	Temperature of the Air.		Day of the Month.	Monthly Mean Temperature of the Air.
			1 Foot.	2 Feet.		Day.	Night.		
Jan.	Max.	5th	42·	43·	3rd	51·	41·	3rd	
	Min.	30th	35·	37·	26th	27·	17·	28th	33 72
	Mean	—	37·92	40·13	—	39·12	28·32	—	
Feb.	Max.	27th	44·	44·	28th	56·	48·	14th	
	Min.	2nd	36·	38·	1st	37·	25·	18th	42·96
	Mean	—	41·54	41·95	—	49·58	36·35	—	
Mar.	Max.	31st	47·	46·50	31st	71·	44·	23rd	
	Min.	8th	40·	42·50	17th	42·	22·	7th	42·43
	Mean	—	43·00	43·72	—	51·13	33·74	—	
April.	Max.	5th	51·50	50·	3rd	78·	46·	16th	
	Min.	11th	45·	47·	8th	43·	26·	26th	47·35
	Mean	—	48·05	48·30	—	58·26	36·45	—	
May.	Max.	30th	61·	59·	15th	85·	53·	29th	
	Min.	1st	48·	48·50	1st	60·	31·	2nd	58·12
	Mean	—	56·40	55·38	—	75·25	41·00	—	
June.	Max.	23rd	63·	61·	16th	82·	57·	27th	
	Min.	4th	58·	58·	1st	60·	37·	30th	59·58
	Mean	—	60·15	59·98	—	69·80	49·36	—	
July.	Max.	19th	65·	64·	6th	88·	65·	22nd	
	Min.	2nd	59·	60·	1st	65·	40·	1st	57·09
	Mean	—			—	73·93	50·25	—	
Aug.	Max.	1st	63·	63·	18th	75·	63·	27th	
	Min.	25th	58·	59·50	14th	60·	40·	9th	58·74
	Mean	—	60·70	61·03	—	69·32	48·16	—	
Sept.	Max.	6th	63·	61·50	5th	83·	57·	5th	
	Min.	20th	54·	56·50	12th	58·	31·	12th	55·96
	Mean	—	57·46	58·61	—	66·80	45·13	—	
Oct.	Max.	7th	58·	58·	6th	74·	58·	4th	
	Min.	31st	48·	51·	18th	42·	29·	21st	49·59
	Mean	—	52·61	54·27	—	58·16	41·03	—	
Nov.	Max.	1st	48·	50·	22nd	55·	43·	26th	
	Min.	17th	42·	44·50	4th	39·	18·	15th	41·18
	Mean	—	44·53	46·06	—	49·00	33·36	—	
Dec.	Max.	8th	47·50	47·	11th	60·	50·	7th	
	Min.	25th	38·	41·50	23rd	33·	21·	23rd	41·75
	Mean	—	43·59	45·29	—	48·67	34·83	—	

the month. The barometer was generally very low. There was a hail-storm on the forenoon of the 10th. The 11th was boisterous, with heavy showers.

April.—The mean temperature was very little below the average, but the amount of rain was nearly double the usual quantity. The last six nights were frosty, those of the 26th and 29th being the most severe. In the former of these the common thermometer indicated 6 degrees, and the radiating thermometer 10 degrees below freezing. Fruit trees were then generally in blossom; many of the flowers appeared to withstand the first, and even the second night's frost, probably from the heat then existing in the trees; but six successive frosty nights produced a ruinous effect on most of them, and the crop of fruit was, in consequence, but very partial.

May.—This month was remarkably hot and dry. The mean temperature was about 4 degrees above the average. No rain fell till the 19th, and none between the 22nd and 30th inclusive. The air was exceedingly dry on the 8th, 11th, and 12th. On the morning of the 18th the clouds were observed moving in different directions; and in the afternoon there was thunder, accompanied with hail showers.

June.—The mean temperature was rather more than a degree below the average. The amount of rain was nearly double the usual quantity; much of it fell on the 10th, 12th, and 23rd. Thunder and lightning occurred on the afternoon of the 12th, with heavy rain.

July.—This month was 6 degrees colder than usual. The amount of rain was nearly an average. On the 14th there were thunder, lightning, and heavy rain at night; and a peal of thunder was heard on the 20th. The 26th was boisterous, with slight rain. The unusually low average of temperature was not so much owing to the want of heat during the days as to the coldness of the nights.

August.—The mean temperature was $3\frac{1}{2}$ degrees below the average, whilst the amount of rain was almost $2\frac{1}{2}$ inches above the usual quantity. There were only five days on which no rain fell. There was a thunderstorm, with large hail, on the 9th, and from $5\frac{1}{2}$ till 7 P.M. on the 10th. A heavy thunderstorm was experienced on the 31st; a distant peal was heard on that day at 15 minutes past 4 P.M.; clouds then formed rapidly; at 5 P.M. it was so dark that one could scarcely see to read indoors, and at that time lightning and thunder commenced, with rain in torrents. The lightning had a bluish tinge. Sometimes it seemed to dart perpendicularly from the clouds to the earth, appearing for the instant like an entire stream. The storm continued from 5 P.M. till $7\frac{1}{2}$ P.M.

September.—This month, like the preceding as regards temperature, was below the average. The total quantity of rain was moderate, but there was a heavy fall on the 28th. Frost made its appearance as early in the month as the 12th. Lightning was seen on the 22nd and 30th.

October.—The mean temperature was about a degree below the average. Amount of rain about a quarter of an inch above the usual quantity. From the 12th to the end of the month rain more or less fell every day. The 10th and 25th were boisterous. On the 28th there were heavy showers and bright sunshine at the same time.

November.—There were more clear days than is usual in this month. The mean temperature was below the average nearly 2¼ degrees. The amount of rain was less than half the usual quantity. The barometer stood above the average. The 20th and 29th were boisterous; on the evenings of the 17th and 21st there was a peculiar reddish luminosity in the sky.

December. — The mean temperature was nearly 2 degrees above the average, the wind being either from S. or S.W. for more than half the days in the month. The amount of rain was nearly half an inch above the average. The nights of the 1st and 3rd were very boisterous; and the 4th was also boisterous throughout the day.

1849.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In. pts.	Max.	Min.	Mean.	
Jan.	56°	15°	39·56°	1·73	30·414	29 002	29·869	980
Feb.	65	18	41·35	2·52	30·880	29·326	30·208	970
March	69	19	41·56	0·85	30 618	29·250	30·040	915
April	78	20	44·04	2·21	30·284	29·218	29 657	895
May	90	25	55·19	3·53	30·205	29·286	29·888	824
June	94	29	59·30	0·31	30·237	29 668	29·977	742
July	99	39	62·29	2·82	30·373	29·434	29·910	776
Aug.	96	36	62 91	1·60	30·337	29·570	29·962	809
Sept.	95	33	57·76	2·49	30·460	29·011	29·890	869
Oct.	78	26	49·58	2·18	30·636	29·128	29·849	932
Nov.	78	14	41·99	1·32	30·330	29·055	29·840	972
Dec.	58	14	37·17	1·28	30·572	29·275	29·903	967
Means	79·66	24·00	49·39	22·84	30·445	29·268	29·916	887

Geothermometrical Observations.

1849.		Day of the Month.	Temperature of the Earth. 1 Foot.	Temperature of the Earth. 2 Feet.	Day of the Month.	Temperature of the Air. Day.	Temperature of the Air. Night.	Day of the Month.	Monthly Mean Temperature of the Air.
Jan.	Max.	22nd	45°·	45°·	14th	56°·	47°·	24th	
	Min.	7th	35·	39·	2nd	29·	19·	6th	39°·56
	Mean	—	40·50	42·11	—	45·35	33·77	—	
Feb.	Max.	6th	44·	44·	15th	57·	44·	3rd	
	Min.	1st	39·	42·	13th	42·	21·	12th	41·35
	Mean	—	43·50	43·03	—	49·50	33·21	—	
Mar.	Max.	19th	45·	45·	31st	59·	45·	15th	
	Min.	11th	40·	42½·	25th	40·	24·	10th	41·56
	Mean	—	42·79	43·70	—	50·09	33·03	—	
April.	Max.	30th	51·	49·	29th	68·	45·	29th	
	Min.	21st	41·	43·50	19th	39·	25·	13th	44·04
	Mean	—			—	54·26	33·83	—	
May.	Max.	28th	60·	58·	31st	79·	53·	30th	
	Min.	11th	49·	50·	10th	51·	30·	11th	55·19
	Mean	—	54·09	53·00	—	66·13	44·25	—	
June.	Max.	25th	64·	64·	24th	89·	57·	5th	
	Min.	14th	57·	57·50	12th	57·	34·	13th	59·30
	Mean	—	60·20	59·60	—	72·47	46·13	—	
July.	Max.	8th	68·	61·	8th	88·	58·	3rd	
	Min.	26th	60·	60·50	4th	67·	43·	4th	62·29
	Mean	—	62·24	62·30	—	75·16	49·42	—	
Aug.	Max.	12th	66·	64·	8th	85·	65·	29th	
	Min.	5th	60·	61·	16th	64·	39·	3rd	62·91
	Mean	—	62·00	62·30	—	74·03	51·80	—	
Sept.	Max.	4th	64·	63·	3rd	80·	58·	3rd	
	Min.	19th	56·	57·	18th	57·	36·	17th	57·76
	Mean	—	59·16	59·76	—	67·56	47·96	—	
Oct.	Max.	1st	58·	58·50	19th	69·	52·	17th	
	Min.	16th	48·	51·	13th	48·	28·	9th	49·58
	Mean	—	52·34	53·70	—	58·32	40·84	—	
Nov.	Max.	10th	51·	50	9th	60·	52·	8th	
	Min.	29th	40·	43·	28th	33·	18·	26th	41 99
	Mean	—	46·96	49·05	—	50·33	33·60	—	
Dec.	Max.	17th	46·	46·	16th	58·	48·	14th	
	Min.	31st	37·	39·50	28th	27·	16·	28th	37·17
	Mean	—	41·32	43·01	—	43·42	30·93	—	

General Observations.

January.—The mean temperature was nearly 3 degrees above the average. S., and more especially S.W. winds, were experienced for more than half the days in the month, yet the amount of rain was very little above the average. The 10th was boisterous. The nights of the 14th and 21st were boisterous, with rain. The 27th was exceedingly fine through the day, with wind direct from S., but heavy rain fell in the evening and at night.

February.—The mean and extreme heights of the barometer in this month were very extraordinary, especially with the wind from S.W. during sixteen days. The average height of the barometer was fully $30\frac{2}{10}$ inches; the extreme height occurred on the evening of the 11th, when it stood at 30·880, or nearly $30\frac{9}{10}$ inches—a height unprecedented since the register was kept at the Garden. The day was clear and very fine, and the night calm, clear, and frosty. The weather was calm and generally fine till the 20th. On the evening of the 22nd there was a peculiar redness in the sky, and also a whitish luminosity. Lightning occurred on the evening of the 24th. The 25th was stormy, and much rain fell at night.

March.—The barometer still averaged high. Very little rain fell till the 27th, and altogether the quantity was limited. The mean temperature was a little below the average. Half the number of nights were more or less frosty. Vegetation was consequently rather backward. The 1st was clear and windy. A hail-shower fell on the 8th, and some snow on the 9th and 25th.

April.—This month was cold, wet, and unfavourable to vegetation. The mean temperature was $3\frac{1}{2}$ degrees below the average; and fourteen nights were more or less frosty, frequently 6 or 7 degrees below freezing. The blossoms of fruit-trees in the open ground were, in consequence, mostly destroyed. There was a sharp frost on the 17th, and a fall of snow on the afternoon of the 18th. The mean height of the barometer in this month was nearly as much below as it was above the average in the two preceding.

May.—The mean temperature was fully equal to the average. The amount of rain was nearly double the usual quantity. The 5th was very fine in the morning, but at 2 P.M. a storm of thunder, lightning, rain, and hail commenced. Heavy rain fell on the 28th.

June.—The mean temperature was $1\frac{1}{2}$ degrees below the average. Rain fell only on four days, and altogether the quantity was very small. N.E. winds were prevalent. Thunder was heard early A.M. on the 5th, and between 2 and 3 P.M. there was a storm of thunder and lightning during which large pieces of ice fell, of an irregular, flattened shape ; some of them measured $1\frac{3}{10}$ inch in length. The central part of some of them was composed of compactly frozen snow, and this was surrounded with pure ice. The night of the 13th was cold, the radiating thermometer indicating 3 degrees below freezing.

July.—Although the mean maxima heat of the days was above the average, yet the mean minima of the nights was so much colder than usual, that the mean of the month was about 1 degree below the average. The amount of rain was about half an inch more than usually falls in this month ; it fell generally in heavy showers: on the 24th the quantity was unusually large.

August.—The weather was generally fine throughout this month. The mean temperature was fully maintained, and less than the usual quantity of rain fell. There was much lightning, with some thunder, early on the morning of the 8th. Heavy showers fell at $\frac{1}{2}$ past 3 P.M. on the 9th.

September.—The weather, on the whole, was favourable, an average temperature being fully maintained, with scarcely the usual quantity of rain. The air at intervals possessed a considerable degree of dryness. There was lightning, with rain, on the night of the 1st ; thunder, lightning, and rain on the evening of the 2nd, and also on the night of the 3rd. Lightning was seen on the evenings of the 5th and 12th ; and distant thunder was heard between 12 and 1 P.M. on the 10th.

October.—The mean temperature was nearly a degree below the average. The amount of rain about half an inch less than usually falls in this month ; and of the total quantity nearly one-half fell on the 3rd. The nights of the 8th, 9th, and 10th were frosty.

November.—The maxima temperatures of the days were fully equal to the average of these for this month ; but the minima were low, especially in the last week. On the night of the 26th the thermometer was 14 degrees below freezing.

December.—The mean temperature was $2\frac{1}{2}$ degrees below the average. The amount of rain was less than usual. In the last week frost set in severely, and, at the close of the year, ground operations were, in consequence, generally obstructed.

1850.

	Thermometer.			Rain.	Barometer.			Mean Moisture.
	Max. in Sun.	Min. by Radiator.	Mean of Shaded Therm.	In. pts.	Max.	Min.	Mean.	
	°	°	°					
Jan.	55	9	33·11	1·43	30·485	29·107	29·953	985
Feb.	60	16	42·60	0·95	30·374	28·795	29 940	965
March	68	9	37·71	0·13	30·630	29·492	30·151	841
April	75	26	48·41	1·79	30·336	29·193	29·713	877
May	86	19	51·14	1·84	30·274	29·369	29·832	842
June	99	27	59·26	1·40	30·417	29·442	30·011	738
July	103	38	61·91	2·68	30·197	29·628	29·903	887
Aug.	95	30	59·38	0·97	30·300	29·612	29·934	850
Sept.	84	27	54·23	2·36	30·446	29·266	30·045	870
Oct.	72	21	44·32	1·55	30·357	29·165	29·801	925
Nov.	65	17	45·29	2·03	30·315	28·696	29·841	977
Dec.	62	16	38·47	1·15	30·586	29·015	30·025	992
Means	77·00	21·25	47·98	18·28	30·393	29·231	29·929	895

[For Geothermometrical Observations, see next page.

General Observations.

January.—The temperature was 3½ degrees below the average for this month. With four exceptions, the nights throughout were more or less frosty. Snow fell occasionally, in slight showers, during the first half of the month, but in considerable quantity on the 18th, after which the frost was less severe. The depth of rain and melted snow was below the average.

February.—The mean temperature was 3 degrees above the average, the wind being from S.W. for more than half the days in the month. Notwithstanding this, it is remarkable that the amount of rain was less than usual. The barometer stood higher than it generally averages at this period of the season. It was, however, very low on the night of the 5th and morning of the 6th, which were boisterous. Lightning was seen on the night of the 16th which was also boisterous, as were likewise the 9th and 11th.

March.—This month was unusually cold and dry. The mean

Geothermometrical Observations.

1850.		Day of the Month.	Temperature of the Earth. 1 Foot.	Temperature of the Earth. 2 Feet.	Day of the Month.	Temperature of the Air. Day.	Temperature of the Air. Night.	Day of the Month.	Monthly Mean Temperature of the Air.
Jan.	Max.	30th	40°·	39°·	25th	51°·	45°·	25th	
	Min.	17th	34·50	37·	20th	30·	14·	7th	33°·11
	Mean	—	45·91	37·70	—	38·58	27·64	—	
Feb.	Max.	20th	44·	44·	3rd	57·	47·	1st	
	Min.	1st	39·	39½·	24th	42·	21·	13th	42·60
	Mean	—	42·00	42·40	—	50·21	35·39	—	
Mar.	Max.	3rd	45·	44·	13th	57·	43·	2nd	
	Min.	29th	38·	40·	25th	42·	14·	25th	37·71
	Mean	—	41·06	42·33	—	48·74	26·68	—	
April.	Max.	19th	50·	49·	7th	66·	45·	6th	
	Min.	1st	42·	41·50	14th	54·	29·	23rd	48·41
	Mean	—	47·51	47·10	—	58·60	38·23	—	
May.	Max.	31st	57·	55·	31st	76·	50·	24th	
	Min.	3rd	46·50	48·	6th	45·	23·	2nd	51·14
	Mean	—	51·22	50·86	—	61·97	40·32	—	
June.	Max.	26th	65·	62·	23rd	86·	55·	5th	
	Min.	1st	57·	56·	15th	57·	30·	15th	59·26
	Mean	—	59·98	58·58	—	73·43	45·10	—	
July.	Max.	25th	65·	63·50	16th	89·	62·	31st	
	Min.	10th	59·	59·	7th	63·	39·	8th	61·91
	Mean	—	61·87	61·12	—	72·67	51·16	—	
Aug.	Max.	8th	65·	63·50	5th	82·	58·	10th	
	Min.	31st	56·50	58·	21st	62·	32·	21st	59·38
	Mean	—	61·53	58·19	—	71·51	47·26	—	
Sept.	Max.	2nd	58·	57·50	1st	72·	53·	19th	
	Min.	15th	54·	55·50	30th	59·	30·	6th	54·23
	Mean	—	55·65	56·51	—	66·20	42·26	—	
Oct.	Max.	1st	54·	55·50	18th	63·	44·	18th	
	Min.	30th	43·	47·	24th	41·	23·	26th	44·32
	Mean.	—	48·58	51·08	—	54·22	34·42	—	
Nov.	Max.	5th	48·50	49·	1st	60·	50·	1st	
	Min.	30th	40·	44·	29th	37·	19·	14th	45·29
	Mean	—	46·28	47·75	—	54·76	35·83	—	
Dec.	Max.	16th	44·50	44·	15th	55·	50·	31st	
	Min.	25th	37·	39·	8th	37·	19·	20th	38·47
	Mean	—	40·54	42·30	—	45·68	31·26	—	

temperature was 5 degrees below the average. The nights were generally more or less frosty. In that of the 25th the thermometer was 18 degrees below freezing. Scarcely any rain fell till the 31st; and altogether the amount was less than has been registered in any month for at least twenty-five years.

April.—The mean temperature was fully maintained, and there were no frosts to occasion any material check to vegetation. The amount of rain was a little above the average. S.W. winds were prevalent. The mornings of the 4th and 5th were boisterous. Several loud peals of thunder were heard between 12 and 1 P.M. on the 12th. The wind came from N.E. and E. during the last five days of the month.

May.—With fully an average temperature during the last month, vegetation was considerably advanced at the commencement of this. Fruit-trees were generally in blossom, and of this much was killed on the 1st, the common thermometer being then 4 degrees, and the radiating one 9 degrees below freezing. But on the night of the 2nd the common thermometer was 9 degrees below freezing, whilst the radiating one was 13 degrees below that point. There were, in consequence, scarcely any crops of apples and pears, excepting on walls, and there they were considerably injured.

June.—The mean temperature was $1\frac{1}{2}$ degrees below the average; and on the 15th there were 2 degrees of frost, according to the indication of the common thermometer, the radiating one at the same time indicating as many as 5 degrees below freezing. The amount of rain was below the average. On the 3rd and 4th the air was excessively dry. The weather was very fine between the 15th and 26th. On the 18th there was a large and distinctly luminous solar halo at noon. On the 26th lightning was seen at night; and there were thunder and lightning on the night of the 28th.

July.—The mean temperature was fully a degree below the average, and the amount of rain was $\frac{3}{10}$ths of an inch above the usual quantity. The 3rd was boisterous, with lightning in the evening; and thunder and lightning occurred on the evening of the 17th. On the 18th distant thunder was heard, and heavy rain commenced at $\frac{1}{2}$ past 6 A.M.

This was the only month in the year in which there was no frost.

August.—The mean temperature was nearly 3 degrees below the average. The amount of rain little more than $\frac{1}{8}$ of the usual quantity, and nearly half of it fell on the 21st. The weather, on the whole, was exceedingly favourable for the harvest; but fruit-trees and others suffered from dryness at the root, so that if the frost had spared a full crop, it could not have been well supported, and the trees would have suffered, so as to be unable to bear well in the following season.

September.—Mean temperature exactly 3 degrees below the average. There were several frosty nights in the early part of the month. With the exception of a slight drizzle on the 1st, no rain fell till the 19th. The 21st was boisterous. Lightning was seen on the evening of the 23rd. On the 27th there was one peal of thunder with a very heavy shower about ½ past 3 P.M.

October.—The temperature of each of the two preceding months was about 3 degrees below the average, but in this it was 6 degrees below. On the 15th the thermometer was 8 degrees below freezing, and it was a degree still lower on the 26th. The amount of rain was fully an inch less than usual. Lightning was seen on the evening of the 9th. On the 20th there was an exceedingly large halo round the moon.

November.—S.W. winds were prevalent; and the mean temperature was between 1 and 2 degrees above the average. The first half of the month was generally very fine, with the exception of the 4th, which was boisterous, with slight rain. The 24th was also boisterous, and much rain fell on that day, and likewise on the 18th.

December.—The mean temperature was about 1½ degrees below the average. Little more than an inch of rain fell. Fogs were prevalent during the first half of the month. The 15th was warmer at night than at any time throughout that day. The 16th was boisterous, with rapid showers.

XIV.—*Some Notes on Fruits and Vegetables grown in the Society's Garden in* 1850.

CUCUMBERS.

Australind.—Seeds, under this name, were sent to the Society by M. Waller Clifton, Esq., Australind, Western Australia. In the account by this gentleman of the fine climate of Australind (Hort. Soc. Journal, Vol. IV. p. 203), he says, "Cucumbers, melons, water-melons, and vegetable marrow, I have actually in cart-loads from December to April." The seeds came along with some "Australind melon-seeds, taken from a fruit weighing 25¼ lbs." When this tribe of plants grows in such profusion in the open air, infinite mixtures will take place, unless extraordinary care is taken to keep them distinct; such care, in fact, as the founder of a new colony could scarcely have it in his power in the first instance to bestow. The seeds of the cucumber in question had been so hybridized as to prove worthless. It was very short, light green, and bitter.

Berkshire Champion.— From Messrs. Sutton and Sons. Fruit long, dark-green, surface somewhat uneven, spines white. A good, early, and free bearer.

Conqueror of the West.—Messrs. Sutton and Sons. Resembles the preceding, but larger, and therefore preferable as a show variety, although not so free a bearer.

Warwickshire Hero.—From Mr. Cattell. Fruit long, with large spines, surface grooved, a free bearer.

Bristol Champion.—From Messrs. Garaway, Mayes, and Co. Fruit of a good size, surface somewhat uneven, deep-green, spines black. A very free and early bearer. It may, therefore, be considered a very useful sort for general cultivation.

Roman Emperor.—Messrs. Garaway, Mayes, and Co. Fruit long, nearly smooth, dark-green, spines black, with round bases, a free bearer.

Walker's Long Rambler.— Messrs. Noble, Cooper, and Bolton. Fruit large, with black spines; a free and early bearer, requiring plenty of room, otherwise the fruit is apt to be rather light green, owing to the shading of its very broad foliage when crowded.

Lord Kenyon's Favourite.—Mr. E. Tiley. Fruit short, with an even surface, light green; spines black. A good bearer, well adapted for winter cultivation.

Acme of Perfection.—Fruit middle-sized, dark-green ; spines obtuse, greenish. A late shy bearer.

Melons.

No one can be absolutely certain that seeds of cultivated varieties of plants will produce others exactly like the respective parents; nor that a difference, scarcely perceptible at first, will not increase in successive generations. The change may be an improvement, or it may be the contrary; and most probably the latter when a high degree of perfection has been attained. Were it not so, the Bromham Hall Melon might be almost exclusively cultivated. At present it is allowed to be the best green-fleshed melon. There are, however, others of considerable merit, and improved varieties of these may some day take its place, should it degenerate in consequence of the tendency above alluded to. The Bromham Hall is described in Vol. V. p. 280.

Emperor Green-fleshed.—From Mr. Tiley. Sown April 12th, ripe August 12th. About 3 lbs. weight; roundish, a little depressed at the stalk and crown; ribbed, but not prominently so, and somewhat warted; greyish-green, tinged with pale yellow. Flesh green, tolerably rich, but not equal to that of the Bromham Hall, seeds of which, also received from Mr. Tiley, were sown on the same day, and the plants proved not only better bearers, but ripened their fruit a month earlier than the Emperor green-fleshed.

True Syon House.—From Mr. Kernan. Small, roundish, or somewhat obovate, very slightly ribbed; skin greyish green. Flesh green, faintly tinged with orange; flavour very good.

Prince Albert Melon.—From Mr. Josling. A small, handsome, oblate fruit, of a pale grey colour; rind thin; flesh green; flavour rich. A prolific bearer; a good little melon, but it is inferior to the Bromham Hall.

Real Cassabar Melon.—From Messrs. Weeks and Co. Sown April 4th, ripe August 4th; middle-sized, oblong-oval, scarcely ribbed; skin downy, greenish-yellow; flesh green, melting, tolerably rich.

Castlebai Melon, from Smyrna.—Large, oblong, striped with green and yellow, like a gourd. Doubtless it had been crossed with some of the gourd tribe, for the quality was very bad.

Feri Melon.—Cylindrical, pale yellow, like a gourd, and, like the preceding, bad in quality.

Parsley.

The Society has for many years distributed to the Fellows a very fine dwarf curled Parsley, the *Persil nain très frisé*, from Paris, and to this may be attributed much of the improvement which has taken place in this article. Parsley with plain leaves, for which the poisonous Æthusa cynapium has been sometimes mistaken, is now scarcely to be met with.

Englefield Curled Parsley.—Sutton and Sons.

Sutton's Dwarf Curled.—Ditto.

Usher's Curled.—Messrs. Noble, Cooper, and Bolton.

These are very similar to each other, and to the Persil nain très frisé.

Rendle's Treble Garnishing.—From Mr. Rendle. This is stronger-growing than the preceding, and beautifully curled. An excellent variety.

Myatt's Treble Curled.—From Mr. Rendle. Grows about as tall as the preceding; some of the plants were likewise as finely curled, but others were different.

Turnips.

Early White Mouse-tail.—From Messrs. Sutton and Sons. An early round turnip, tender and sweet; skin thin, and very white.

Red American Stone.—From Messrs. Noble, Cooper, and

Bolton. Small, handsome, oblate, chiefly above ground, and where so exposed the skin is violet; flesh white and tender, but not so sweet as that of the preceding and some other white sorts.

Navet jaune de Finlande.—Resembles the Malta, and appears to be a small but very handsome variety of it; round above, concave below, with a very small tap-root proceeding from the centre of the evenly-rounded hollow; skin smooth, yellow; flesh yellow, tender, and sweet. Seeds of a turnip from St. Petersburgh were received this spring from the Rev. M. J. Berkeley, accompanied with the following note, from which there is a strong probability that it is the same as the Navet jaune de Finlande: "I send for the Horticultural Society some seed of a turnip which I received from St. Petersburgh. It is used there, I understand, as we use radishes. I find it an excellent kind for early spring and autumn sowing, but it does not stand the winter well. Its roots are very neat in shape, and the head of leaves scarcely larger than that of a radish. It is not, I think, the same as the yellow Malta." The Navet jaune de Finlande agrees with the above description, but its hardiness has not been ascertained, having only been grown in the Garden last season, and the mild winter afforded little means of judging of the hardiness of vegetables.

XV.—*Observations on Inverted Growth.* By Peter Mackenzie, West Plean, Stirling.

(Communicated January 24, 1851.)

Trees and shrubs growing under the shade of other trees often assume forms that they would not acquire if they grew in an open exposure; this may be owing, in a great measure, to the agency of light, for if a little attention be given to such circumstances, it will be found to be true what the late Mr. Knight stated long ago, that the stems and branches of trees and other plants incline in whatever direction they receive the greatest quantity of that fluid, and consequently avoid, and appear to shun, the shade of every contiguous plant. By such means many plants may be made to take what is called a weeping form, the line of grace and beauty may be seen in the branches of others, and the stems and branches of some evergreens, where the shade is close and thick upon them, may be made to grow almost horizontally; and in many cases the lower branches are so much bent as to come in contact with the ground, and natural layering in many instances is the consequence. This season I obtained several scores of young plants of the Portugal and common laurels that had struck root by such means, and also finely formed plants of spruce and silver firs may be seen growing near larger trees of the same species: the lower branches of the old trees had at some period touched the ground, and the two being friendly to each other a closer union was formed, the branches struck root into the earth, seeking nourishment for themselves, and growing with erect heads by the side of their parents. The connection was not altogether dissolved, for there was still a rod between the old and the young tree. The connection in most cases has the appearance of a withered limb; it is not altogether dead, but its increase in thickness, if any, is extremely small; however there are exceptions, and as I do not recollect having read much about such things in works treating on vegetable physiology, a few remarks on the subject may not be uninteresting.

In a wood, some time ago, I met with a pretty large plant of the Wayfaring tree (*Viburnum Lantana*): many of its young branches were bent considerably all over the plant; some of the lower branches in their bending touched the ground, and getting entangled among the grass, were kept firm until many of them had struck root, and young plants grew around the old one. Some may be ready to say there is nothing remarkable in all this—such things may be seen daily. Well, it may be so; but I thought I saw in one of the young plants something different from the others, whereby I might get a lesson that would have been interesting even to men who had advanced far in the study of vegetable physiology. Many experiments and observations have been made to ascertain the motion of the sap in trees by such men as Knight, Duhamel, De Candolle, and others: they did not think it trifling, in order to gain knowledge, to make cuttings of various kinds of plants and put them in, in an inverted position; by such simple means they gained useful information. Now I thought I could see in one of these natural layers something like what these men, among other things, sought for, namely, that "the forms generally assumed by trees in their growth, evinced the compound and contending actions of gravitation and of an intrinsic power in the vessels of the bark to give motion to the fluid passing through them."

The part of the branch of the Wayfaring tree, when it reached the ground, was a few feet from the root of the plant; a kind of arch was formed between the two extremities; and a few shoots grew from the point of the branch after it had taken root.

But what appears to be the most remarkable thing of the whole is, what was formerly the smallest part of the branch, to increase in thickness nearest the ground and taper gradually backwards until it reaches a certain point, when the branch again gradually increases in thickness as it approaches its original roots.

The branch that has struck is at present about an inch in diameter nearest the ground, then it diminishes in thickness gradually till it becomes about one-fourth of an inch in diameter, when it again increases like other branches the nearer it gets to the main stem of the plant. In this case, if not in reality, we have the appearance at least of part of an inverted branch growing with as much vigour as others that are not inverted, and also connected together. Will the sap in the bark take opposite directions where the stem is smallest? If such is the case we must conclude "that the organization of the internal bark becomes again inverted and adapted to the position of the branch."

I may also notice, that in connection with the same plant there are other branches that have struck root, and yet scarcely any increase has taken place in their thickness near the ground, although several young shoots have sprung up where the branches first struck root in the soil. This may also be accounted for: in the first case the branch that has struck root and increased in diameter near the ground is well feathered, upon small shoots, with living buds, which will in due time produce leaves, and the leaves new wood; the other branches that have struck root are without buds where the other has them, and where these are wanting there will be no leaves to produce new wood.

Perhaps the same reasoning that Knight applied to his inverted cuttings may be used in the case of the inverted branch. "The force of gravitation will, however, still be felt, and by its agency sufficient matter to form new roots may be conveyed to those parts of the inverted cutting or tree which are beneath the soil. Besides, if we suppose a variation to exist in the powers or organization of the vessels which carry the sap towards the root, we may also attribute in a great measure to this cause the different forms which different species or varieties of trees assume; for if the fluid in these vessels be impelled with much force towards the roots, little matter will probably be deposited in the branches, which in consequence will be slender and feeble, and there is not any tree that has been the subject of my experiments in which new wood accumulated so rapidly at the upper end of inverted plants."

The growing of inverted plants may be useful in some departments of gardening, especially where plants are wanted to occupy a small space; for although some plants will grow freely in that position, others will form dwarfish habits, and some species that will not strike from inverted cuttings may succeed when layering is employed.

NEW PLANTS, ETC., FROM THE SOCIETY'S GARDEN.

8. Quercus agrifolia. *Née, in Ann. Sciences Naturelles, III.*, 271. *Hooker, Ic. Plant., t.* 377. *Botany of Beechey's Voyage, p.* 371.

A few miserable living plants of this species were sent home by Hartweg from California, and are now beginning to grow in the Society's Garden. It will probably be a hardy evergreen tree, concerning which Nuttall, who knew it in its native country, has the following remarks:—

"This species, almost the only one which attains the magnitude of a tree in Upper California, is abundantly dispersed over the plain on which St. Barbara is situated, and, being evergreen, forms a conspicuous and predominant feature in the vegetation of this remote and singular part of the Western world. It appears more sparingly around Monterey, and scarcely extends on the north as far as the line of the Oregon territory. It attains the height of about 40 or 50 feet, with a diameter rarely exceeding 18 inches; the bark is nearly as rough as in the Red Oak. The wood, hard and brittle and reddish, is used only for purposes of fuel, or the coarse construction of log-cabins.

"As an ornamental tree for the south of Europe or the warmer States of the Union, we may recommend this species. It forms a roundish summit, and spreads but little till it attains a considerable age. As a hedge it would form a very close shelter, and the leaves, evergreen and nearly as prickly as a holly, would render it almost impervious to most animals. The leaves vary from roundish ovate to elliptic, and are of a thick rigid consistence; the serratures are quite sharp; the young shoots are covered more or less with stellate hairs, and for some time tufts of this kind of down remain on the under side of the midrib of the leaves, which are, however, at length perfectly smooth, and of a dark-green above, often tinged with brownish yellow beneath. The staminiferous flowers are very abundant, and rather conspicuous; the racemes the length of 3 or 4 inches; the flowers with a conspicuous calyx and 8 or 10 stamens; the female or fruit-bearing flowers are usually in pairs in the axils,

Quercus agrifolia.

or juncture of the leaf with the stem, and sessile, or without stalks. The cup of the acorn is hemispherical, and furnished with loose brownish scales; the acorn, much longer than the cup, is ovate and pointed.

"We do not recollect to have seen this tree properly associated with any other, except occasionally the Platanus racemosa; their shade is hostile to almost every kind of undergrowth.

"By Persoon this species is said to have been found on the eastern coast of North America, while Pursh attributes it to the north-west coast, about Nootka Sound. It does not, however, extend even to the territory of Oregon, as far as my observation goes."

Née says, "I have only seen branches collected at Monterey and Nootka. The leaves of the young plants are perfectly smooth when first developed, of a thin consistence, with numerous slender sharp dentures beneath; they are of a brownish yellow colour, and appear smooth and shining."

The long narrow acorns, almost conical, are a remarkable feature in the species.

9. Thyrsacanthus lilacinus.*

A plant of this well-marked species exists in a stove in the Garden of the Society, but its origin is unknown. It approaches the Justicia bracteolata of Jacquin, which is no doubt the same as *Thyrsacanthus Lemaireanus*, but differs essentially in the barren stamens being subulate and not spathulate as if preparing to bear a piece of an anther.

The leaves are oblong-lanceolate, thin, downy, wrinkled, tapering into a long stalk. The flowers are in contracted thyrsoid panicles, with subulate abortive bracts. The calyx is downy. The corolla pale lilac, funnel-shaped, inflated, with a four-lobed limb, covered inside with glandular hairs. Its upper lip is erect and 2-lobed; the lower is deeply divided into 3 revolute segments.

It requires the same treatment as such Acanthads as tropical Justicias, Ruellias, Eranthemums, and the like.

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* T. *lilacinus;* pubescens, foliis oblongo-lanceolatis rugosis in petiolum angustatis, thyrso interrupto nudo contracto multifloro, sepalis pubescentibus, corollæ inflatæ infundibularis limbo intus glanduloso labio supremo emarginato erecto inferiore tripartito revoluto, staminibus sterilibus subulatis.—J. L.

XVI.—*Contributions to a History of the Relation between Climate and Vegetation in various parts of the Globe.*

No. 11.—*The Vegetation of Brazil, Bolivia, and Peru.* By H. A. Weddell, M.D.

(Translated from the French.)

The environs of the Brazilian capital have been so often described by the various travellers who have visited them, that it will not be necessary for me to dwell at any great length on them.

It is difficult to state with clearness the impressions which I experienced when I first entered the forests above Rio, and which cover the coast of Brazil. It was not the size so much as the disposition of the plants which surprised me. In this fine climate the atmosphere appears to contain within itself all that is required for the healthy being of plants: the most inaccessible rock, every tree, every branch is a support for a vegetation even more vigorous than that which is borne immediately by the earth. Bromeliads and Orchids without number, Cacti, Arads, *Peperomias*, *Begonias*, Gesnerads, and Ferns, are closely packed on the narrow surface on which they grow, and which they soon clothe with a beautiful verdure.

It would hardly be too much to say that the great Epiphytes of the damp tropical countries * take the place of mosses and lichens of more temperate climates. Climbers, which add so much to the character of tropical countries, are found near Rio in every variety: they are so numerous, that in places it is next to impossible to cross the woods. Their stems are generally naked, and can be compared with nothing better than ropes hung from the trees to which they are attached. They often intertwine, affording each other mutual support, and rising to the highest attainable point, there to develop their flowers: often they are seen to choke, in their tight embrace, the tree which supports them.

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* At Rio the air is almost always completely saturated with moisture; the hair hygrometer generally standing between 80° and 85°. The lowest temperature we ever observed in this part of Brazil was, in summer, + 17° C., and the highest, in the shade, + 24° C. The mean temperature ascertained by M. Boussingault's process is 23·5°, and the night temperature is not more than 1° lower than that of the day.

One might be led to suppose from these figures that the climate of Rio was tolerably agreeable; but in addition to the intense heat in the sun, which is far above anything denoted by instruments, the perfect stillness of the air renders the least exercise extremely fatiguing.

It was once thought that the forests of Rio would some day lose their primitive character, which a few of them, in spite of the inroads of civilized men, still retain. This fear is but too well grounded; large tracts are continually laid low by fire, and in a few years the Mandioc, Plantain, and Maize will no doubt replace the wild *Cecropia*, *Lecythis*, and arborescent Fern.

Every place I visited in the neighbourhood of Rio was a source of great interest; but none was surpassed by the inexhaustible Mount Corcovado, to which every botanist first directs his steps. Never, when I think of my wanderings on this mountain, shall I forget the great attention which I, in common with my predecessors, experienced at the hands of the kind and hospitable Ildefonso Gomez. Had it not been for him I should have had no information about the various places which I visited during my stay at Rio, such as, for example, the mountain-chain of Tijuca, which is the highest of any in the neighbourhood, Mount Babylone, the Restingas of Copa-Cabana, San Bento, Marica, and Taipû. The Restingas have a peculiar vegetation which deserves especial notice. They are plains very little above the level of the sea, and shut in between it and the mountains behind. The soil is sandy, and sometimes a little like peat: it seems to have been once the sea-shore, and to have been left dry by the receding of the waters. The streams which come down from the mountains often form little lakes and marshes. Not a tree is to be seen in these plains; but large Cacti are abundant, sometimes erect, sometimes lying over the rocks, or upon the burning sand amidst bushes of *Eugenia*, *Feliciana*, *Andromeda*, *Gaylussacia*, *Sophora*, *Icica*, *Cassia*, &c., which form small copses or thickets. I found there, for the first time in Brazil, several specimens of *Eriocaulon* growing in the sandy peat, in the midst of a carpet of Utricularias. Several dwarf Palms, of the genus *Diplothemium*, add to the special character of the vegetation of the Restingas.

In the middle of October we left Rio and proceeded to the bottom of the bay to a village called Porto d'Estrella, on the Rio Inhomirim, about three leagues from the Serra d'Estrella, or the Orgues Mountains (Serra dos Orgãos), which we had to pass to get into the province of Minas-Geraës. These mountains are richer in botanical curiosities than perhaps any other place in Brazil; and, although many naturalists have visited them, their riches are very far from being exhausted. The highest tops are 2500 yards above the level of the sea, that is more than double in height of any mountain near Rio: they are covered to their very summit with dense forests, and nature has been more bounteous than even on the sides of Corcovado.

Thousands of streams descend the mountains and keep the ravines perpetually damp. Some flow without noise over beds of Lycopods, Hymenophylls, and Dorstenias; others rush with violence on their bed of granite, and sweep with irresistible force before them any obstacle they may encounter. Near Sambambaia or Bello-monte, about 800 yards above the sea, we followed a small river, on the banks of which we found the gigantic *Guada* or *Bambusa Tagoara*, which, rising to the height of some 60 feet, falls over and forms a sort of natural cradle. The Tree Ferns grow much larger here than in the neighbourhood of Rio. These beautiful plants give a charm that is almost magical to tropical vegetation; their rugged stems are generally covered with other species of the same family, or afford support to different sorts of *Billbergia* or *Æchmea*, *Caladium*, and other epiphytes. Begonias are so numerous that they give quite a character to the vegetation; one of them climbs to the tops of the largest trees, runs over their trunks, and sends forth a beautiful scent from its large red flowers.

Whilst in the Organ Mountains I made a large collection of interesting plants, which were, however, afterwards for the most part destroyed.

A long stay in virgin forests near Rio had accustomed me to their marvellous beauties. When I left the Serra d'Estrella, with its fine Palms and trees covered with festoons of *Bugainvillea* and Bignonias; when, returning from the plains, I saw the horizon everywhere bounded by ramparts of trunks and dark foliage, I longed to get away to the Campos of the interior, which were represented to be a second promised land. At the end of November we passed the small town of Parahyba, and a few days afterwards we crossed the Rio Parahybuna, the southern limit of the province of the Mines. From this place the ground rises by several gradients as far as the great central table-land of Brazil. The Serra de Mantiqueira forms the first of these steps. The mean height of its plain is about 1000 yards above the sea. Here begin the Campos, literally the fields; but they are so only as compared with the forests. I should not have had an accurate idea of them had I not seen the description given of them by M. Aug. de Saint-Hilaire. The soil is seldom naked, and still more seldom clothed with a true herbaceous vegetation. Their surface is generally covered here and there with small bushes, Malpighiads, Melastomads, Myrtleblooms, *Kielmeyera*, *Mimoseæ*, *Bauhinia*, *Solanum*, *Diplusodon*, *Anona*, *Vellozia*, &c.; to which may be added, as we advance inland, a large number of taller species, which more or less resemble in appearance the trees of our own orchards; such are Bignoniads, Dilleniads, Sterculiads, several Papilionaceæ, a *Hymenæa*, *Sal-*

vertia convallari-odora, and many other Vochyads; *Anacardium occidentale*, *Caryocar brasiliensis*, *Simaruba versicolor*, *Strychnos pseudoquina*, *Magonia glabrata*, &c.

The greater part of these trees lose their leaves in the dry season. When they are more numerous and close together they form copses or even small woods, which have, in the language of the country, particular names, and to which I shall again call attention.

The herbaceous vegetation of the Campos is too varied to be easily described. Cæspitose grasses are the most numerous; amongst them grow in great profusion Composites, Stellates, Mallow Worts, some Papilionaceæ, *Hyptis*, *Cuphea*, *Polygala*, *Lippia*. Here and there specimens of many other orders, such as *Lysianthus*, *Callopisma*, *Evolvulus*, the magnificent *Gomphrena*, and, above all, the elegant *Eriocaulon*, which, with different species of *Xyris* and *Sauvagesia*, abound in all the damp and marshy spots of this region.

It must not, however, be supposed that on entering the Campos forest scenery is entirely wanting; for it is difficult to proceed for half a day without falling in with at least two or three large woods, thrown as it were like so many oases in the midst of the undulating and comparatively sterile vegetation of the Campos, to protect by their shade the source of some one of the many streams which water Brazil. The traveller seeks their shelter with eagerness, and the botanist when crossing them forgets for the moment the virgin Mattos which he has left behind. The magnificent Brazilian Pine (*Araucaria Brasiliensis*), so common in the great forests, is also one of the principal ornaments of these woods.

On the 14th of November we entered Barbacena, the first town we came to in the province of Minas-Geraës. The climate appeared almost temperate,* so much had we suffered from the heat at Rio. For my own part, finding myself in the midst of some swamps covered with *Drosera*, I fancied I had wandered to some of our peat bogs in Europe.

The road which leads from Barbacena to Ouro-Preto, the capital of the province, follows the line of the sources of the Rio San Francisco and the Rio de la Plata; a little beyond the village of Quéluz, it rises to the upper level of the great Brazilian table-land by the Serra d'Ouro-Branco, in which are the topaz mines of Capão. Few places are so interesting to the botanist and general traveller as this. The *Vellozia*, a truly

* The temperature is, however, on the whole but little lower than that of Rio, but it varies more, and the constantly moving air renders the place agreeable enough.

arborescent lily, there attains a height of some 9 feet, and now and then forms dense thickets; its beautiful blue flowers seated in the midst of elegant terminal rosettes, the snow-white umbels of *Eriocaulon*, the brilliant panicles of *Microlicia*, the festoons, golden and purple, of *Banisteria* and *Echites*, produce a most enchanting effect.

The town of Ouro-Preto, formerly known by the name of Villa-Rica, is as poor now as it was formerly rich. Its population, about 12,000, is not above two-thirds of what it was. In company with M. Claussen, generally known in Brazil as the Dane, we visited Cachoeira do Campo, a small village about 12 miles from the town; the famous Mount Itacolume, which gives its name to the rock which constitutes the greater portion of the geological formation of this province; the botanic garden, &c. In the latter place we were shown a small cypress, a horse-chesnut, and a mulberry-tree, which are here looked upon as great curiosities. Nearly all the tea consumed in the province is grown in the botanic garden.

Early in 1844 we visited the gold mines of Catabranca de Morro-Velho and of Gongo-Soco, worked by Englishmen, who paid us every attention. Mount Itabira, which rises near Catabranca to a height of about 1600 yards, and which is composed of iron that is nearly pure, was the object of a special visit. At the time of which we speak all the surrounding table-land was covered by an immense pink mass of the flowers of *Microlicia*. M. Aug. de St. Hilaire has made known a plant which is peculiar to these iron mountains of the high parts of Brazil; it bears the name of *Remija*. Its bark is called Quina da Serra, and is used as a substitute for Peruvian bark.

From Rio to Sabara, a little town of 5000 inhabitants, and about 30 miles from Ouro-Preto, our course had been nearly due north, but we now turned towards the centre of the continent. The thickets which had begun to appear in the neighbourhood of Sabara, grow denser and denser as the interior is approached; and the height of the table-land, which is at Ouro-Preto about 1200 yards above the sea, is soon reduced to one-half. Beyond Pitangui and the charming river Para, which is flanked by magnificent forests, the Campo appears for a short distance, and then gives way to the woods which border on the Rio San Francisco. To these succeed the fertile pastures of As Dores, bounded by the small Serra da Saudade, a branch of the Serra da Canastra; then come new forests, and so on.

When we entered the Campos Geraës, the palm-trees which had attracted our attention in the province of Rio de Janeiro seemed to have completely disappeared, and to be replaced by the *Araucaria Brasiliensis*. *Cocos oleracea* alone showed itself here and there in cultivated places. But at Sabara, where the *Araucaria* is not to be found, we again saw *Acrocomia sclerocarpa*, the terminal bud of which is eaten just like that of the common cabbage-palm. Farther on, near Pitangui, we also found the beautiful *Attalea compta*, or Indaiá; and in the neighbourhood of Patrocinho we saw, for the first time, the Buriti (*Mauritia vinifera*), with its fan-shaped leaves, the largest and most magnificent of all Brazilian palms.

The Campos themselves, too, began to be clothed with some species of this family; but not with specimens which suggest themselves to the mind when we hear of the "princes" of the vegetable kingdom; they are little dwarf plants that a person unaccustomed to observe would not have distinguished from the meadow-grass; a few were 2 or 3 yards high, and formed in places small copses, such for example as *Cocos flexuosa* and *C. campestris*.

Cocos capitata, or Cabeçudo, is common in the west of the province of the Mines, but it never grows in woods; its stem is at the outside a yard in height, and carries at its summit a cup formed by the persistent base of its leaves, which latter fall backwards very gracefully. The stemless species belong to the genera *Diplothemium*, *Astrocaryum*, *Attalea*, and *Cocos*.

On the 23rd of March we crossed the Rio Paranahyba, which divides the province of Minas-Geraës from that of Goyaz. Of all the forests I ever saw, none are so enchanting as those traversed by this river; their peculiar aspect is owing to the presence of *Attalea compta*, of which I have already spoken.

We stopped at Villa da Catalão, the first village in this province we came to, and then pushed on to Goyaz. As far as Bomfim, about half way, the country is very like some parts of Minas; there are undulating Campos, interspersed with little woods. From Bomfim to the capital the country is more woody, and after leaving the pretty town of Meiaponte, the road plunges into a dense forest known by the name of Matto-Grosso (great forest). The road was a perfect quagmire, in which men and horses sunk deep, and were often with difficulty set right. It was here that I lost many of my most valuable recent collections. The air too was so hot and damp that a beautiful specimen of a palm that I had brought from the banks of the Rio das Velhas was in a few days little better than so much rotten wood.

The day after our arrival at Goyaz, which is about 420 miles from Rio, we fell in for the first time with some Indians.

We made a pleasant excursion in the environs of this town, which is delightfully situate on a small torrent, the Rio Vermelho, in a basin surrounded by mountains, to the Serra Dourada, the farthest point reached by M. A. St. Hilaire. I there saw among rocks of Itacolumite, and accompanied by many species of Vellozia which I had not before seen, the curious Melastome named in Brazil *Pao-papel*, or paper-tree, and described by the last-mentioned gentleman under the name of *Lasiandra papyrifera*. The Quina do Campo (*Strychnos pseudo-china*) abounds in the Campos which extend beyond the small chain, as does also a species of Sarsaparilla which forms rounded bushes; the Mangabeira (*Hancornia speciosa*), the savoury fruit of which makes a delicious preserve; and the Pao Violet (wood violet), of which I was unable to procure any flowers, but which appeared to be a species of *Jacaranda*. The small virgin woods of this district are remarkable for the number and variety of their climbers. The long aërial roots of the Imbe (*Philodendron Imbe*, Schott), which are used instead of ropes, and which never rot, even under water, hang from every branch; and nearly every tree is the prey of some parasitic fig called generally Gamelleiras,* the roots of which intertwine and anastomose so as to form a complete sheath over the trunk on which they grow.

As far as Goyaz our route had been explored by several European travellers; Langsdorff, Natterer, Gardner, A. St. Hilaire, Spix and Martius, Pohl, Claussen, and several others having followed the same route. From this point we entered a new and almost unexplored country. We determined to proceed north, down the Araguay to the confines of Para, and then back up the Tocantins, which flows nearly parallel with the last river.

On the 3rd of May we quitted Goyaz for Salinas on the Rio Crixas, where we prepared for our expedition.

Towards the end of March the rainy season was over, and a scorching sun followed. The Campos were already changed in appearance; the rich verdure which had resulted from the long-continued wet had begun to lose its freshness; in many places, as is common in Brazil, fire had been set to the dried grass, and clouds of smoke and long lines of flame marked out the approach of the destroying element. This process of clearing the surface of the Campos is nearly universal, and has become in some degree necessary to their vegetation; it seems that many plants would not come up, or at all events flower, unless their activity were excited by some such means. The beautiful little Mimosa called in Brazil *Flor da queimada*, or fire-flower, makes its appearance as soon after the fire as the ground has begun to

* These plants are met with not only on living trees, but very frequently on the posts of the cattle-sheds in Brazil, where they are useful as a screen from the burning sun; in this case the Gamelleira is, to a certain extent at least, nourished by its roots directly from the soil, from which it no doubt first sprung.

cool, and in a very short space of time it dots with a beautiful carmine colour the still smoking soil. The country between Goyaz and Carretão, a Chavante Indian village, and Crixas, is of extraordinary magnificence; the large number of *Mauritia* which grows there gives it an appearance peculiar to itself. These elegant trees mark out all the marshy spots, and serve as rendezvous for troops of gay-coloured Aras. Of the herbaceous plants which inhabit these countries, the family of Pipeworts (*Eriocaulaceæ*) attracts especial attention; I found two species which grow higher than a man.

As we advanced towards the bed of the Araguay, the height of the great Brazilian plain lowered considerably: Crixas is not more than 1200 feet above the level of the sea. The temperature increased in proportion; before the day fairly broke the thermometer stood at 40° C.*

Beyond Crixas the aspect of the country changed. The Campos, with their pleasing undulations and copses dotted with the pink-flowered *Chorisia speciosa*, were replaced by a flat country, here and there a little wooded and intersected by nearly dry marshes, fringed with Buritis and variegated with Melastomads, Utricularias, and Eriocaulons; at other times covered with dense forests choked with Bamboos and crossed by almost impassable paths, interrupted here and there by prairies of tall grass, called Sapé, in which both man and horse soon disappear; or else again covered with the grass which, as M. A. St. Hilaire has shown, makes its appearance wherever a large forest has been cleared—I mean the Caapim gordura, or *Tristegis glutinosa* (*Melinis minutiflora*). This country was much more thickly peopled than it at present is; for many years past the Indians have reconquered it from the whites, and the traveller himself does not always pass on his way unscathed.

The preparations for our expedition on the Araguay were being made at the Aldea of Salinas, so called from the saltworks which are near it. This village, like Carretão, is inhabited by Chavantes Indians, and is situate between the Rio Crixas-Mirim and the Crixas-Assu, which falls into the Araguay: it offers a fine field for exploring to every naturalist, but especially to the botanist. The plants I found there were all new. In the bad season the principal food of the inhabitants consists of the fruit of *Attalea compta* and *Œnocarpus Bacaba*, which are very abundant in the neighbouring forests, as well as another *Attalea* (?) with a short thick trunk, and which is called Acuri.

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* The mean climate does not, however, differ much from that of Rio, which is more even; on the table-land of the Mines it varies from + 20° to + 22° C.

In the vicinity of the same town there are large marshy plains which are constantly inundated in the rainy season and nearly dry in the hot weather. These places are covered with a species of *Byrsonima* with greyish leaves, which form large round heads somewhat resembling in the arrangement of its branches the Persian lilac of our gardens.

The details of our expedition down the Araguay will shortly be laid before the public. So far as botany is concerned there is not much to say. The banks of the rivers offer nothing like the variety of vegetation that is found by pursuing the country roads, and I did not collect more than one hundred specimens the whole time I was on this river. The first day I fell in with nothing but a *Croton* and a *Psidium*, which had the banks almost entirely to themselves; a *Cissampelos*, which ran over the white sand of the bank; a *Cassia*, a Composite with a vanilla scent, and two or three grasses. The animal kingdom was much better represented. One family of plants has, however, had many genera and species added to it, and is much better known in consequence of this voyage, and that I afterwards made on the Tocantins; I refer to the Podostemads. These little plants, which at first sight look much more like Liverworts than flowering plants, only flourish on the face of rocks which are kept damp by the spray of some cataract; wherever a torrent descends with violence, these Podostemads abound and flourish. I had previously met with them in other parts of Brazil, but nowhere in such profusion as here. One species, *Mourera Weddelliana*, Tul., covered the rocks with its pretty spikes to such a degree that the river seemed to flow over a bed of roses.

The forest trees of the country traversed by the Araguay resemble, as a general rule, those of other parts of Brazil; Mimoseæ, Cæsalpineæ, great Myrtle-blooms, Sterculiads, Bignoniads, Fig trees, *Cedrela brasiliensis*, *Schinus arroeira*, *Apeiba Jangada*, on Pao Jangada, from the bark of which excellent cords are made; the Landi, of which we built our canoes; the Pao d'Arco, &c. Amongst the Palms I saw the Indaiá (*Attalea compta*) and another species new to me, remarkable for the 4-rowed arrangement of its leaves, and called Anaja. At San João das duas Barras, in the province of Para, the Rio Araguay is joined by the Rio Tocantins, and flows with it to the Atlantic, which is not more than 60 yards below the level of the last mentioned town. The grand *Bertholletia excelsa*, which furnishes Brazilian nuts, is one of the principal ornaments of the forests of this district.

What I have related concerning the navigation of the Araguay is in many respects applicable to the Tocantins, which we began to ascend on the 20th of July, after a few days' stay at San

João. The banks of the Tocantins are not nearly so wooded as those of the Araguay; a narrow strip of forest alone separates them from the Campos, and even that is not to be met with everywhere. Near its mouth the river is jammed in by immense tabular blocks, or rather mountains of red sandstone, which have a remarkable appearance.

On the 12th of August we reached San Pedro d'Alcantara, and on the 31st of the same month we disposed of our canoes at Porto Imperial, from whence we proceeded across the country to Goyaz, from which town we had started upon our expedition. The country between Porto Imperial and Goyaz, and which bears the name of Sertão (desert) de Amaroleite, was rich many years ago, when slaves abounded and worked its numberless mines, but is now poor, and the prey of the Canoeiros Indians, who are the daily dread of the few wretched inhabitants still remaining there. The character of the country we crossed was not unlike that of the province in general; two Myrtle-blooms with eatable fruit, the Cagateira (*Eugenia dysenterica*, St. Hilaire), the Puça (*Mouriria pusa*, Gard.), a *Qualea* with purple flowers, encroached upon by a large Loranthus, a *Curatella*, and many species of *Anacardium* were most remarkable. After a six months' absence, on the 17th of October we re-entered Goyaz.

On the 28th of the same month we again left the town and took the road leading to the province of Matto-Grosso. A four days' journey brought us to the Rio Claro, which rolls diamonds as well as flints along its bed. On the 8th of November we passed the Serra da Rapadura, owing its name to the colour of its rocks, which resembles crude sugar or *rapadura*. On the 16th we crossed the Serra de Taquara. Between these two low chains, which form, the one the western boundary of the table-land of Goyaz, the other the eastern boundary of that of Matto-Grosso, the valley of Rio Grande is situate, dividing the two provinces.

The table-land which originates in the Serra de Taquara differs considerably in a geological point of view from that of Goyaz and Minas-Geraës. We here saw, for the first time in this direction, the red sandstone rocks which we had before noticed on the banks of the Tocantins; the vast masses of these rocks resemble immense fortifications. A little *Vellozia* grows there in abundance, just as the wallflower does upon our own old walls.

At a place called As-Lages the road is for many miles naturally paved with slabs of this same rock, and in its cavities may be found little pools of water fringed with a fine turf of Eriocaulons. From this place the Eriocaulons become more and more scarce, and they are not to be found at all on the western frontier of Brazil.

The name of Matto-Grosso given to this province had led us to expect a wooded country, but hitherto we had been disappointed. As soon as we had got out of the forests on the Rio Grande and ascended the table-land of Taquara, we again met with the vegetation of the Campos; some trees which were so common in the provinces of Minas and Goyaz had, it is true, disappeared, but others had taken their places, and the character of the country was not very different. Amongst the smaller plants we found some Cacti creeping like serpents over the soil, and covering the white ant hills with spiny crests. Lastly, some new dwarf Palms had been met with since we left Goyaz.

The table-land of Taquara, inhabited by the Cayapos Indians, appears to be the most elevated district in the province of Matto-Grosso. Travelling towards Cuyaba, viz. towards the basin of the Paraguay and its tributaries, two vast steppes are successively descended: these are the Serra d'Agoa Branca and the Serra de Manoel Antonio. Between these points the Campo is nearly level, and for a considerable extent without a single tree, a very rare occurrence in Brazil, at least in those parts of it which we visited. The highest plants to be seen in this district do not rise more than a few inches above the ground; there are some shrubs of the family of Myrtle-blooms and Spurge-worts, and a small *Lecythis*.

From the foot of the Serra de Manoel Antonio to Cuyaba is about 30 miles. The traveller here enters into a new country, called the region of the Pantanals, the soil of which is not more than 150 yards above the level of the sea, and hardly at all above that of the Paraguay and its tributaries, by which it is periodically inundated. As we shall see hereafter, the Pantanals or marshes are most distinct in the Delta formed by the Paraguay, the San-Lourenço, and the Cuyaba.

At Cuyaba the rainy season overtook us, and rendered any attempt to reach the frontier of Bolivia at that time perfectly useless.

We determined to visit Paraguay itself, and also Diamantino, to the north of Cuyaba. The rain had ceased, and had for a time been succeeded by a scorching sun, when on the 20th of December we started on our new journey. We amused ourselves with ascending the Serra do Tombador, from which there is a succession of lovely panoramic views: we explored the picturesque table-land, where in a forest of Mauritias (Buritisal) are the seven sources of the Rio Paraguay. On our return I saw, near a place called Machada, a fig tree the trunk of which, 3 feet from the ground, measured 30 feet in circumference; this was by far the largest tree I ever saw in America, and yet it was not half the size of the Baobabs which are met with on the banks of the

Senegal. It is not uncommon for travellers to exaggerate the size of the American trees: they state that to be the rule which is the exception. It must be borne in mind too, that although the trees which are exposed to the hot damp air of the equator grow with astonishing vigour, they are exposed to many more causes of destruction than are those of more temperate climates; and I am sure that, were the age of the oldest of the tropical forest trees correctly ascertained, it would be found to be much less than that of many of our hedgerow oaks. From this statement we ought perhaps to except the Fig-trees, which are preserved from the attacks of insects by their acrid or milky sap.

On the 27th of January, 1845, we left the capital of Matto-Grosso, and made the best of our way down the Rio Cuyaba.

The banks of this river were very unlike those of the Araguay; here were none of those barren tracts of white sand left dry by the receding water; the forest came close down to the water's edge; from the branches of every tree hung long festoons of flowers and foliage which were rocked by the wind over a carpet of Heliconias and Pontederas, with their orange and blue flowers; or else there were large swamps covered with tall plants and dotted with bushes, here and there overtopped by the immense panicles of *Gynerium saccharoides*, or Uva, the peduncle of which being 2 or 3 yards long, and without a single knot, is used by all Indian tribes which dwell near the rivers of tropical America for making arrows.

The Rio San Lourenço, or dos Porrudos, which we reached on the 2nd of February, and the Rio Paraguay, which we left on the 4th of the same month, are on the whole like the Cuyaba; near the Paraguay the Pantanals or marshes are perhaps still more numerous than near the latter river; in the midst of the tall grasses which constitute its vegetation, two *Hibiscus* and a large pink flowered Bindweed attract especial attention, whilst on the edges of the marshes are banks of Pontederas, often intermixed with numerous yellow flowered species of *Jussiæa*. The roots which hold these plants down sometimes break, and then masses of flowers are floated along the stream and produce a very pleasing effect.

The village of Albuquerque, on the right bank of the Paraguay, is remarkable for the great number of different Indian tribes often congregated there. On the 11th of February we passed before the Brazilian fortress of Nova Coimbra, and the next day we entered the province of Paraguay, which, however, we soon had to quit, no foreigners being allowed to enter it. We nevertheless were permitted to stay a fortnight at Fort Bourbon.

Below Nova Coimbra the character of the vegetation had completely changed; instead of marshes or forests of Exogens, which abounded on both banks of the upper part of the river, we saw vast barren plains or immense forests of the Palm Caranda (*Copernicia cerifera*), the trunk of which either bristles with the persistent petioles of the bygone leaves, or is slender, naked, and terminating in a roundish head of dove-tailed leaves, something like our own *Chamærops*. From the bastions of the fortress of Paraguay may be seen vast tracts of country covered with the Caranda, the glaucous foliage of which produces a most remarkable and extremely fine effect. This plain is the Gran-Chaco, inhabited by the Guaycourous and Tobas Indians, and bounded by the Rio Paraguay on the one side, but extending towards the west to the foot of the Andes, south of Bolivia, where it is lost among the Pampas of the Argentine Republic.

During our stay at Fort Bourbon I made daily excursions in the neighbourhood, and gathered a large number of interesting plants either in the plains, or the woods on the river side, or on some of the conical hills covered with a large *Cereus*, and which are scattered all over the environs. A few days before our departure the grass of the prairie accidentally took fire, and it spread with such rapidity that by the next morning the beautiful verdure we had so much admired was converted into a dismal black. The Carandas alone escaped, and their blueish heads were brought still more into relief by the black ground with which they were contrasted. For forty-eight hours the eye could track the course of the destroying element, but after that it disappeared in the distance.

The temperature of Fort Bourbon is, as ascertained by M. Boussingault's method, 28° C.,* which would make it one of the hottest places in the world; but this number is evidently too high. In the interior of the fort the thermometer marked in the shade at 2 or 3 o'clock in the afternoon nearly 40° C., and in the sun as much as 50° C. The temperature of the water was constantly, during our stay, about 29° or 30° C.

On our return from Albuquerque we found nothing of any interest.

Our next expedition was to Miranda, a Brazilian settlement

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* The fort being upon a small hillock, it is easy to understand that the soil is heated to a greater depth than in the plains. The water found at the bottom of a cavern which we visited near Nova Coimbra was 24° C., which is probably the mean temperature of this district.

Although there are no doubt accidental circumstances which invalidate the results obtained by M. Boussingault's method, its general utility cannot be denied. My friend Mr. Pentland, to whom I entrusted the observations to be made with the thermometer in both Bolivia and Peru, is of opinion that the results obtained by examining the higher parts of those countries are less correct than those similarly obtained in other parts of the Equinoctial Zone. I am of the same opinion.

to the east of Albuquerque, on the right bank of the Rio Mondego. The current of this river is so rapid that it took us no less than sixteen days to go from the one place to the other; the vegetation of the river sides is very like that of the Rio Cuyaba and other third-rate rivers of this country. Many twining plants, especially some Bindweeds and a spiny-stemmed Araliad with scarlet corymbs (Cipo da Raïa), sometimes spread out like a carpet even on the water's edge of the Rio, at others rising up into domes or columns according to the nature of their support, formed the vegetation of the Pantanals. Near Miranda the river is fringed with large *Bambusæ* (Taquará-asou), the clusters of which had, at a distance, the appearance of a collection of monstrous ferns with finely divided fronds. A new palm, the Giruva, not unlike in its manner of growth the *Acrocomia sclerocarpa*, also made its appearance as our journey drew to a close.

The environs of Miranda are very marshy; I found there a large quantity of a small *Nymphæa*, not very different in size from our *Hydrocharis*, and the tubercles of which are eaten by the Indians. The *Victoria* is, I was told, common in all this part of the basin of the Paraguay; the Guaycourous call it Gakauré-Lodo, which signifies large Water-lily.

On the 18th of April we left Albuquerque for the last time, and made the best of our way up the Paraguay to Villa-Maria. We were preceded by many canoes full of Indians, who were going to collect ipecacuanha. On the 28th of August we arrived at the San Lourenço, which we left on our right. We there found some Guatos Indians, who alone inhabit this country, and who undertook to conduct us through the innumerable network formed by the branching of the Paraguay, and which was described by early travellers as a lake (Lac Xarayes). Immense Fig-trees (Gamelleiras) form one of the principal features of the half-inundated forests of this part of Matto-Grosso. These trees assume the most strange shapes, owing to the number and arrangement of the adventitious roots, which form so many accessory trunks, columns, or props around the central trunk. Several small *Bactris* (Tucum), with hard, sharp spines, also abound and render the woods difficult of access. I also saw a curious tree, allied to the *Genipa*, the wood of which was white when first cut, but soon became a most brilliant carmine. But no plant is more common than the *Inga edulis* (Inga da Berada), which secretes within its pods and around its seeds a large quantity of sugar. Too often may be also found here the *Triplaris*, which harbours in the empty cells of its pith an ant with a terrible burning bite. On the 13th of May we left this damp district and regained the Campos. The next day we passed the mouth of the Rio Jauru, and on the 18th arrived at Villa Maria, where we found our mules and baggage.

At Villa Maria my companions and myself parted company, as I was obliged to return for a few days to Cuyaba. I was again at Villa Maria on the 12th of June, and then proceeded onwards.

Instead of the ordinary road over the Campos, I took that of the Pantanals, which is never followed in the rainy season, and from which I had great difficulty in extricating myself, although many scorching days had already partially dried it. Nothing is more uninteresting than the journey across the great Pantanal, which takes its origin near the small town of Poconé, about 60 miles S.W. of Cuyaba. I first of all came upon a great desert of cracked mud, covered with tall herbaceous plants, and dotted here and there with a clump of Carandas (*Copernicia cerifera*); then I found myself in a large sort of quagmire, no less than 20 miles long, with here and there a tree, and inhabited by hundreds of herons and spoonbills. There was not a single interesting plant in the whole of this dismal and monotonous country, and it was not until I re-entered the forests in the neighbourhood of Villa Maria that I again increased my collections. During my stay in this village I visited the places in which the Ipecacuanha grows, but as I have already ('Annales des Sc. Nat.,' 3rd ser., vol. xi.) described these places, I shall omit all mention of them here.

It was not until the 26th of July that I finally quitted Villa Maria; and the very first day I journeyed towards Matto-Grosso I had the misfortune to lose half my things in consequence of the villainous state of the roads; the reader may form some idea of this when he is told that of the twelve mules with which I started only three arrived safe in camp. The route I took is impassable in the rainy season, and travellers always cross the bay, which is at this time of the year navigable, and which is formed by the spreading out of the Paraguay. I was told that in December the whole of this piece of water was covered with the large spiny leaves and white flowers of the *Victoria*, but I saw nothing of it. Between this place and the Rio de Jauru the road lies through a country of Campos and thick copses (Serradôes), broken here and there with a small forest interwoven with climbers and bamboos: the soil is in some places sandy and dry, in others covered with a layer of mud of varying thickness, which is deposited by the waters which periodically irrigate it. The most remarkable plant in this district is a small Cycad (*Zamia Brongniartii*, Nob.), which is also found in tolerable abundance in the hilly Campos near Villa-Maria; of all the Cycads this seems to be found farthest to the south of the Equator; its thick fleshy trunk is sometimes eaten.

About 20 leagues beyond Jauru we entered a large forest which extends to within a short distance of the town of Matto-Grosso, and to which the province and its capital no doubt owe their name. The large number of Palms and Arborescent Ferns which grow in this forest give it a very picturesque appearance; the *Iriartea* (Catisar), *Euterpe*, and *Attalea compta*, here called Uaua-assu, are particularly abundant; it is crossed by the Guaporé, one of the principal tributaries of the Rio Madeira. Between this river and the town, which is distant from it about 12 leagues, I did not find any water except one small pool called Buriti; this is the more extraordinary, seeing that in the rainy season the whole of this country is under water and one immense lake.

I entered Matto-Grosso, or Villa-Bella, on the 13th of August and left it on the 25th. The ancient capital of one of the largest provinces of Brazil is nothing better than a heap of ruins already encroached upon by the forest; the same may be said of all the other Brazilian towns which depended for their prosperity solely on their mines. The Guaporé, after making an immense bend, reappears immediately on the west of the town, where I crossed it for the second time on my road to Casalbarco: this village, which is not more than 8 leagues from Matto-Grosso, is situated on the little river Barbado, and is the last the traveller meets with on quitting Brazil for Bolivia. Here I saw the *Victoria regia* still in flower; I was then only 11 leagues from the frontier, where a well, hidden in the brushwood, shows the traveller that he is no longer in the empire of Brazil. I was again among the Campos, which I had never seen so gay. A fire had just exerted its vivifying influence on the soil, and a carpet of delicate green had replaced the grass which the scorching rays of the sun had burnt. Tiuvas, with their masses of flowers, the golden heads of the Caraïbas, and of another white-flowered, sweet-scented Bignoniad, formed on every side immense thickets which were crowned by the elegant plumes of *Attalea compta;* in one place was a *Jacaranda*, with its long violet-blue corolla; in another was the *Petræa*, with its snow-white inflorescence; on every side, in short, the eye fell upon masses of brilliant and harmonious colours: a rich frame enclosing the finest vegetation on the face of the globe, but with it many dull and monotonous sides and many scenes of abject misery.

It was on the 29th of August that I finally quitted Brazil and entered Bolivia. The province of Chiquitos, where I then was, forms part of the department of Santa Cruz, and extends from the frontier as far as the Rio Grande * My first halt was at a village founded by the Jesuits, and still enjoying a little prosperity. The province hereabouts resembles in its general features many parts of Matto-Grosso. Here, as in the environs of Poconé, we have vast plains periodically inundated and dotted with Copernicias or spiny Mimosas: there we find the Campos with its characteristic vegetation, or else an expanse of forest more or less considerable in extent. Santa-Ana, San-Rafaël, San-Ignacio, and San-Miguel, which is the last mission I visited, are connected with the capital of the department, Santa-Cruz de la Sierra, by two roads; of these, one runs along the frontier of the country of Moxos and passes through the villages of Concepçion and San-Xavier; the other, more to the south, crosses a country with scarcely a single inhabitant, and this was the one I too hastily chose.

In truth, the very first day I found myself on a soil which, half covered with water, sank under the foot, and from which my mules could with difficulty extricate themselves and get onwards. My health, too, was failing me, but I managed, by travelling 14 or 16 hours a day, to get over 120 leagues of interesting country. For the first few days I saw nothing but Pantanals, with their never-ending Copernicias; but here and there the sameness was broken by some other plant. At a short distance from San Miguel, I found in the woods which broke the Pantanal a considerable quantity of the large *Cereus*, which bore at a height of 10 or 15 yards, its angular branches covered all over with starry prickles; then there was the Gayac, the wood of which, known by the inhabitants of Chiquitos by the name of *Guaiacum*, is used for making drinking-cups, which are believed to cure a virus that the people think is constitutional. But the most characteristic tree of this country is the fine Mimosa called Vinal, the astringent leaves of which are much used in Bolivia for the cure of ophthalmia. The trunk of this tree divides a little above the ground, and the branches grow obliquely, which makes a very fine head that can by its delicate tint be distinguished as far as the eye can reach.

As the Copernicias disappear, another Palm, at first sight like a small specimen of the preceding species, but distinguished from it by the long prickles which clothe its stem, makes its appearance. This small tree, called Saro (*Thrinax brasiliensis*, Mart.), grows in dense closely-packed tufts, and with

* This Rio Grande is the same as the Guapai, which more to the north takes the name Mamoré, and flows into the Guaporé and the Beni, which together form the Rio Madeira, one of the principal tributaries of the Amazon.

the *Cereus* and large Sterculiads, with fusiform stems (*Chorisia ventricosa*), constitute nearly the whole of the vegetation. In the great forest (Monte Grande), which is reached immediately before the Rio Grande, the Saro forms, with the plants last named, large zones, which alternate with other zones formed for the most part of Myrtleblooms, *Eugenia cauliflora* especially, and two great *Myrtus*, which I found in full fruit.

Amongst the herbaceous plants which I noticed in this journey the Bromeliads above all demand mention ; nowhere did I ever see more of these plants than here. Several species of *Bromelia* cover the soil of the forest in many parts with their dangerous rosettes. Of the Epiphytes the most attractive is the beautiful *Vriesia*, called by the Spaniards Flor del Aire ; in places there is hardly a tree which this plant does not ornament, hanging by tendrils at the end of its leaves, and balancing its long spikes of purple flowers in the damp air below.*

On the 13th of October I reached the Rio Grande, which was then half dry ; and the next day, after rapidly crossing 10 miles of sandy country, I reached Santa Cruz de la Sierra. The environs of this place had been before explored by naturalists, and my state of health did not permit me to quit the town. On the 22nd of November, 1845, I resumed my journey and proceeded towards Tarija, in the south of Bolivia, distant about 200 leagues from where I then was ; this was one of the most difficult tasks I have ever taken in hand.

As soon as the traveller has crossed the Rio Grande de Chiquitos he may be considered to have entered the subandine region ; for not far from there he falls in with gigantic spurs proceeding from the great chain of which they form, as it were, the ribs. The vegetation is very different from that of Brazil. The absence of those tracts of land which have been described under the name of Campos was very marked. In their place are found large plains covered with a herbaceous vegetation, which, though common in Europe, are very rare in those parts of Brazil ever visited by me. When they are of considerable extent these prairies are called Pampas ; when they are smaller and bounded, by forests for example, they are known by the name of Potreros.

The first day's journey on my way to Tarija was across a Pampa. The next day, and part of the one following that, were passed in a large forest of Guaypurus (Huaypourous), with

* It is a question often mooted as to how far a plant can be nourished by the absorption of its leaves. The present plant and another of the same family, *Tillandsia usneoides*, are cases in point; for although both of them have roots when young, these are after a time destroyed, and the plants still continue to live, suspended between earth and sky.

knotted trunks and covered with round black fruit: this forest was followed by another of a very peculiar aspect, owing to the great number of short thick-stemmed Palms which grow in it.*

On the 25th I reached Piray, in the province of Cordillera, which is bounded on the south by the forest of *Eugenia*, already mentioned. The country between Piray and the Rio Pilcomayo is inhabited by the Chiriguanos, who speak Guarani. The Rio Piray, which flows to the south of the village or Pueblo of the same name, is perfectly impassable in the rainy season, although when I crossed it the water was not knee-deep. Such is the character of the streams of this country; shallow and quiet or even dry in the hot weather, they swell, in a moment after a heavy rain, into furious torrents which it would be madness to think of crossing. Two leagues from Piray are the village and river of Florida; and 6 leagues further, at the edge of a pretty wood, is the Pueblo of Cabeças, which is separated by a sandy plain 4 leagues in extent, from Abapo, beyond which I, for the second time, crossed the Rio Grande. This river, descending from the Andes of Cochabamba, encloses in an immense bend a large portion of the department of Santa-Cruz, which probably owes its sandy soil to successive deposits from it.

It was not far beyond the Rio Grande that I found the species of Quinquina which I afterwards named *Cinchona australis*, because it marks the southern limit of this interesting genus. The mountains on which it grows are composed of a quartzy and iron sandstone, covered in some points with violet schistoid clay. Further on I skirted the mysterious lake of Opamon, the water of which is salt, smells strongly of Sea-weed, and is coloured dark green by some microscopical Algæ, the only plants that can live in it.

Beyond this lake the road dives into a thick forest of Copernicias (Carandai) with a swampy soil, and then runs along narrow tracts of Pampas, bounded on each side by small wooded mountains, and dotted here and there with groups of Mimosas and Nightshades. On the 2nd of December I arrived at Gutierres, the capital (there are only some half dozen huts) of the province of Cordillera. The forests in this neighbourhood are not at all like the magnificent ones of Brazil; one might imagine oneself quite out of the torrid zone. Amongst the most interesting of the trees, and one which is found throughout the region of the Andes, is the Quina-quina (*Myroxylon Peruiferum*), with a dark red wood, smelling like balsam, from the bark of which

* This tree, called Motacu in Bolivia, bears the name of Acuri in Matto-Grosso and the province of Goyaz.

exudes a reddish brown resin used as incense in Bolivia, and known in commerce by the name of Balsam of Tolu. Another plant, not less worthy of attention, and more characteristic of the country, as it is found isolated in the midst of the Pampas, is the Algaroba; its large, round, evergreen head, supported by a stem only a few yards in height, serves as shelter as well from rain as the rays of the sun. The legumes of this tree, gathered a little before they are ripe, are used to fatten cattle; later, its seeds, ground to powder, constitute the principal food of many of the inhabitants of the country. Its wood is white, and is used for several economical purposes, and the black astringent matter which oozes from its bark is employed in the preparation of a dye, as is also the fruit of the Algarobilla, a smaller tree of the same class, and found in similar places. Of smaller plants I need only notice the Mangara, a curious Arad, common in the Pampas, known by its spathe, which is dark violet on its inner surface; the root of this plant is flattened like the tubercle of a Cyclamen, and is eaten by the Chiriguanos Indians, notwithstanding its extreme acridity, which they only succeed in slightly subduing.

As no guide would accompany me through the country of the Chiriguanos Indians, I was compelled, having arrived at Gutierres, to proceed to Tarija by a route which I had not intended to follow, viz. through the provinces of Azero, Tomina, and Cinti.

The road I took brought me through valleys, over high tablelands, and amongst a vegetation no longer like that which I had left. The Pampas of Gutierres are not more than 1000 or 1100 yards above the sea, and the climate is tropical; but at Sauces, which I reached on the 16th of December, the climate was more temperate, and I met for the first time with plants belonging to European genera, such for example as a yellow Ranunculus very like our own Buttercup, the common Elder (*Sambucus nigra*), and Willows, which are so abundant that they have given their name (Sauces) to the place. Amongst the objects worthy of notice here are the various plants used by the inhabitants for dyeing. Foremost stands the Chapi, which yields a red dye like Madder; there are two sorts of it; the one, called Chapi del Monte, or of the woods; the other, Chapi de la Pampa, or Pampa-Chapi; both belong to the genus *Galium*, and contain their colouring matter, the first in its slender woody stem, which resembles that of a creeper; the second, like most other Stellates, in its roots. Next in importance is a *Baccharis* closely allied to *B. genistelloides*, upon the stem of which there is a sort of gall which yields a tolerably good green dye. Another *Baccharis* (Tolilla) furnishes by a simple boiling a beautiful yellow. The Indigo plant yields a blue; and black is obtained from the fruit of the Algarobilla, together with some matter containing iron. Lastly, the inhabitants of this country and of Bolivia in general use the root of the Palillo or *Escobedia scabrifolia*, instead of saffron, with which the Spaniards so constantly colour their food. At Sauces I observed, for the first time, that it was the custom to chew the leaf of the Coca, which, as is well known, is to the Quichas and Aymaras inhabitants of Bolivia what the Betel is to the Malays, and Tobacco to sailors of all countries.

Quitting Sauces on the 24th of December I soon left the province of Azero for that of Tomina, when to my dismay I found that the rains had set in. In an attempt to pass the Rio Grande de Chapimayo, myself and company were within an ace of being all drowned. I was thus compelled to force my way through a forest of Myrtles (Sauni) and spiny trees crossed everywhere by ravines and bogs; and then to keep along the beds of the Rio Canical, San Lorenzo, Monomai, and Caravallo, which were all nearly full of water, and which I had to ford more than 120 times in three days.

The above statement may give the reader some little idea of the difficulties I had to contend with—difficulties which were, however, enlivened by the stupendous and magnificent rocks around. The ravines of which I have spoken are often walled in by rocks rising perpendicularly to a height of 300 feet, and their surface, kept moist by the ever rising vapour which no wind dispels, is covered with a host of curious plants appearing in relief on a delicate network of Lycopods; there are, for example, several Gesnerads, rich scarlet-flowered *Begonias*, numerous *Oxalis*, and an immense quantity of lovely Ferns. Almost every tree growing in this neighbourhood is covered with the curious *Tillandsia usneoides*, which, hanging down in long grey festoons like a light moss, gives an almost supernatural cloudy aspect to the forest.

On leaving the bed of the Rio Caravallo, one of the tributaries of the Parabiti, I reached the foot of the celebrated mountain (Cuesta) Curi, or Uli-Uli, the highest in the district, and composed, like all the others of this range, of red schist and sandstone. At the top of this high ground is the table-land of Tomina, on which is the town of Pomabamba. Unaccustomed as I was to mountain travelling, I trembled when I looked at the frightful paths my caravan had to pursue; the road is often little better than a furrow hollowed on the bare face of a perpendicular rock; at other times it is literally nothing more than a succession of holes sunk in the limestone, and which prevent the feet of the mules from slipping. However, the journey over this mountain was rewarded by a very rich collection of plants which I had never met with in any of my previous expeditions, as might have been expected, when it is remembered that I was several thousand feet higher than I had as yet been. The forests which clothe the lower part of the mountain contain nothing particular; several frutescent Nightshades and a *Podocarpus* were the most worthy of notice. Where the vegetation is lower I found many *Berberis* and an *Ephedra;* then several genera of Heathworts (*Vaccinium*, *Gaultheria*, *Andromeda*), purple-flowered *Oxalis*, and a beautiful species of *Escallonia;* lastly, quite on the top of the mountain, which I did not reach till sunset, I gathered a creeping *Alchemilla* (*A. aphanoides*), which makes a sort of turf mixed here and there with tufts of *Luzula;* this point was 4000 yards above the level of the sea. Soon after the ridge of the mountain is crossed, the forests reappear and extend to within a league and a half of Pomabamba, at the end of a plain and on a river of the same name, or rather on the Rio Parabiti, the upper portion of which is known by the name of the Rio Pomabamba. A beautiful plant adorns the nearly barren mountains to the S.W. of the town; it is an arborescent Bromeliad (*Pourretia pyramidata?*): its stunted and divided trunk terminates in one or more immense rosettes of leaves, stiff as those of the Yucca, and from the centre of which spring spikes half a yard long of azure blue flowers, elevated on foot stalks some 3 or 4 feet in length. In low damp places is found a *Gunnera*, the subacid fleshy petioles of which are eaten by the natives like Rhubarb, which it somewhat resembles. Pomabamba is 2600 yards above the sea, and its mean temperature is 14° C.; here I saw corn for the first time since I left Europe; for although it is to be found in several places in Brazil, especially on the table-land of Minas Geraës, I had not come through that country, and so I missed it.

To reach the Pilcomayo, which is not above 12 leagues from Pomabamba, I had to cross a country as high as that I had just traversed, and I again enriched my collections. The clayey schists, constituting the greater part of the soil, have a disordered aspect, which one is at first sight inclined to attribute to a process of boiling which this substance might have undergone at the moment of changing from the liquid to the solid state. The plants which I here met with had a still more Alpine look than those I had left behind me; I found Plantains, Rushes, Mallow-worts, and stemless Amaranths, Valerianworts, and in particular a beautiful Cranesbill (*Hypseocharis pimpinellæfolia*, Rem.), the greatest ornament of the pastures of Tomina. The muddy waters of the Pilcomayo roll in a bed 150 yards wide, and 2500 yards below these interesting localities. I soon descended into the torrid zone, and, thanks to the skill of my guides, passed the formidable barrier which separates the province of Tomina from that of Cinti much more easily than I expected.

I had now to ascend the opposite mountain and to rise almost into the snowy regions. The woods which skirt the river are almost wholly composed of Mimosas, and amongst others of a large bush of some species of *Ruprechtia*, covered with bunches of scarious flowers: a hundred yards higher the region of the Cacti begins, and here I found many of these plants that were quite new to me; higher still, these made way for others more suited to a less temperate climate—to Gentian, Ranunculi, Calceolarias, and *Luzula*; on the top of the scale were linear-leaved Violets, Umbellifers, stemless Composites (*Azorella*, *Werneria*, *Trichocline*, &c.), and Papilionaceous plants forming a carpet. I had now reached one of those cold pasture lands called Punas, the country of the Vigognes and Guanacos, where there is always a piercing wind, and the thermometer descends every night below the freezing point. Notwithstanding the bitterness of the climate the country is inhabited.

The sandstone, which is the principal substance in this part of Bolivia, is here found in immense naked blocks, each of which is a mountain by itself; the vertical sides of these masses, which are formed of perfectly horizontal layers, are divided from top to bottom by deep furrows.

After travelling for about two days in this cold district, I began once more to descend, and soon found a very remarkable vegetation, composed of spiny shrubs or bushes, rivalling the quantities of *Cereus* and Melon-cacti which grew upon the surrounding rocks and made them bristle with their formidable spines. There were Berberries, Nightshades, the Orange-flowered *Chuquiraga*, *Flotovia*, and many species of *Bugainvillea*. Here and there were dense round hillocks of a *Bolax* (Yareta) covered with resinous tears. But one tree, the Quenua (a species of *Polylepis*), was to be found here, and it occurred in still higher regions; its thin cinder-coloured top is supported by a twisted trunk, seldom more than 2 or 3 yards in height; its red bark divides into thin leaves, which are torn and blown away by the wind. The Indians have no other wood with which to construct their huts, and they are consequently as small as they can be. The doors are made of planks of a sort of Cactus (Carapaci).

A Mimosa, the branches of which spread out into a large green top, contrasting strongly with the rest of the vegetation of these plains, deserves notice, as it is a bush covering great spaces of ground where its appearance was hardly to be looked for. This is the country for Barley and Potatoes; the straw and grain of the former constitute the only food of the beasts of burden; for on the pasture-land the grass is so short, that it can only be eaten by sheep and lamas. A little lower the common fodder of the country is Lucern or Alfalfa (*Medicago sativa*), which is cultivated throughout Spanish America.

Continually advancing, I entered the valley of Cinti on the 14th of January; the strata of the rocks are seen everywhere on the lofty sides of this ravine, and their dull red colour contrasts strongly with the rich verdure the result of the industry of the Cintenos. It was with great pleasure that I saw French fruit trees in these parts. The Vine grows abundantly in company with the Peach, Apple, and Pear; at their feet are Melons and large beds of Strawberries. Cinti wine is perhaps the best made in America. Another product is the fruit of the Raquette or Tuna, which tastes something like an English Pear. Potatoes are quite as good here as in Europe. Of the indigenous trees the Molle (*Schinus Molle*), which is found cultivated in the south of Europe, is the only one worthy of note. By its appearance it brings to mind both the Acacia and Weeping Willow; its wood is reddish and of little durability.

I left Cinti on the 26th of January and proceeded to Tarija, distant about three days' journey.

The road emerging from the ravine of Cinti follows the base of a small Cordillera, over a slightly undulating plain as far as the village of Camataqui, which is joined by a similar plain with the small town of San Juan. A remarkably elegant shrub, the *Larrea divaricata* or Jarilla, covered with yellow flowers, particularly attracted my attention towards the latter end of this journey; it is one of the best sudorifics found in Bolivia; in the same localities are found the Molle already mentioned, and a *Dodonæa* (Chaca-tia) with viscous leaves.

Beyond San Juan is the large Puna of Iscaiachi, only approached through terrific ravines. It is difficult to imagine the disagreeable sensation produced by the chilling winds which sweep the higher plains, and are encountered the moment the latter are entered; it is like being suddenly transported to the Polar regions: I was not long exposed to them, for the next day I descended to the valley of Tarija,* at the same time making a good collection of plants, and the last of the season.

The next day, the 1st of February, I followed the course of the Rio de Tarija, which flows between two mountain chains, over a thick layer of alluvial soil, then covered with maize

* The mean height of this valley above the level of the sea is about 1770 yards. In June, the coldest month of the year, the thermometer falls nearly every night below the freezing point, and the mean temperature is about 13° C., the same as that of many places in the south of France.

stubble, and soon afterwards I entered the town with as many of my things as had escaped the accidents of this long and perilous journey.

One reason I had for going to the south of Bolivia was to look after some deposits of fossil bones which were reported to exist thereabouts; and the four months which I passed there were employed principally in endeavouring to find them.*

I had intended to proceed to the Republic of Paraguay, crossing the plain I before mentioned as the Gran Chaco, and which extends from the borders of the Rio Paraguay to the confines of Bolivia. The route which I am about to describe was undertaken with this view, but I was afterwards compelled to abandon it, in consequence of the failure of the Bolivian Government to render the assistance they had promised me.

With the above ideas I left Tarija on the 4th of June, 1846, for the Chaco, distant about sixty leagues to the east. My course lay along the Rio de Tarija, a tributary or the source of the Rio Vermejo, to Santa Ana, where there are some fine vineyards. From this place the road rises over vast, monotonous, and naked pasture land, on which I found but two plants in flower on the banks of a small rivulet, an *Epilobium* and a Rush. This region, known by the name of Puna de Polla, is not of very great extent; it forms a sort of barrier between the temperate district of Tarija and the tropical cantons which are further on.

The first trees I met with on the steep declivity which led to a warmer climate were Alders; they grew in snow; the first I had seen for three years. In the beautiful valley of Narvaés are large forests broken by fine prairies extending as far as San Luis, about 30 leagues from Tarija. From the neighbourhood of San Luis I brought away nearly 60 species of forest trees. Unluckily few were either in flower or in fruit. The greater number consist of Leguminous plants; one of the commonest is an Acacia (*A. Angico*) found throughout tropical America, and the bark of which is used for tanning leather; it is called Angico in Brazil, and Bilca or Sevil in Bolivia. The finest timber is furnished by the Cedro (*Cedrela Brasiliensis*), the Soto, the Quina-quina, the Laurel (a species of *Laurus*), and the Nogal (*Rhus juglandifolium*). Here too are found a *Pisonia* (Zapallo), a *Bugainvillea* (Huancar), a *Luhea* (Membrillo), several Myrtle-blooms (Barroso, Goyavo), Bignoniads (Tarco, Lapacho morado, Lapacho amarillo, &c.), a *Xanthoxylum* (Suiquilo), two

* I sent to the Paris Museum the fossil remains of fourteen mammals found in the alluvia of Tarija, amongst which were two species of mastodon, a mylodon, a megatherium, a horse, several ruminants, and other species, for the most part new.

Soapworts (Mongil, Chanchal), Spurgeworts (Lecheron del monte, Lecheron blanco), a *Mertensia* (Tala), &c. &c.

At a distance of two days' march from San Luis I observed a large number of Sterculiads (Soroche),* the trunks of which are remarkably fusiform, and are used by the Indians for making fermenting tubs; the tissue is so soft that it can be scooped out with a piece of wood. A Dragon tree, called Narvaés, is pretty common on several mountains in this part of the province; it grows 9 or 12 feet high, has a peculiar appearance, and is, they say, a cure for leprosy.

A low chain of mountains separates the unhealthy village of Carapari from the frontier of Bolivia; from its ridge, as from the walls of Fort Bourbon, I saw extended before me the immense Gran-Chaco. I slept that night, the 17th of July, in an Indian bamboo hut, and the next day I entered Villa-Rodrigo, which is colonized by some Bolivians, who have been drawn thither by the luxuriant pasture land. Two days afterwards I paid a visit to the great chiefs of this famous country, and they conducted me 30 leagues further inland, into the midst of the nations of the Tobas and Abas. There, as in Paraguay, immense tracts of country † are covered with the *Copernicia;* the sandy and slightly marshy soil in which they grow was, when I was there, covered with nitrous efflorescences, and the water was too brackish to be drinkable. A curious species of *Chara*, the seventh of this genus that I had met with in America, is common in this part of the country. The Algaroba (*Prosopis dulcis*) is, next to the Carandai, the commonest tree; the Tobas Indians make their Chicha ‡ from its seeds, whilst the Abas, who are more sedentary and industrious, use Maize for this purpose. Another plant of the same family as the preceding, and apparently a species of *Ormosia* (Chanar), forms beautiful woods on the banks of the Pilcomayo, which I had again to cross on this journey. Its drupes serve for the same purposes as the seeds of the Algaroba; but as they contain more sugar than the last, the spirit obtained from them is stronger than that yielded by the other. The Chiriguanos are much less tractable at the time when the Maize is ripe than at any other season; to obviate the inconvenience produced by a relaxation of the bowels, caused by the large quantities of fluid these Indians are constantly swal-

* This tree is unlike any other species of the same family that I ever saw, but I never met with it either in flower or in fruit.

† That part of the Chaco which adjoins Villa Rodrigo is one of the least elevated places of the centre of the continent: it is not more than 187 yards above the sea.

‡ This is the name given to all Indian fermented liquors. Starch is the base of them, but they are prepared in different ways.

lowing, they chew the flowers of a Bignoniad (Lapacho), one of the prettiest of their native trees.

I now retraced my steps to Tarija, visiting on my way the Chaneses Indians, a tribe of the Chiriguanos, inhabiting the valley of Itiuro, on the borders of the Argentine Republic.

On the 14th of August I was again in the valley of Cinti, which a scorching sun had completely deprived of the beautiful verdure I had so much admired six months before. The road to Chuquisaca extends nearly due north from this place, and crosses an arid country, consisting of an uninterrupted succession of rocky hill and dale of one uniform grey colour: the monotony of this scene is broken here and there by a hut inhabited by Indians whose life is one long lethargy, passively combating with cold and hunger. This canton forms part of the great table-land of Bolivia, situate between the Cordillera of the coast and that of the interior, and which, always rising, extends as far as the great Lake of Chuquito, where it is continued by the table-land of Peru.

After a two days' journey in this wretched country I reached the bed of a small river called the Mataco; and further on I, for the third time, crossed the Pilcomayo; I then passed through the town of Ystala, situate a few leagues only from the capital, where I arrived on the 19th of August, and where I learnt that my proposed expedition to the Paraguay had to be abandoned.

The climate of Chuquisaca is, notwithstanding its great elevation (2844 yards), delightful,* and although there is scarcely a tree that can be said to be indigenous, a large proportion of those introduced grows well: I saw there many Palms, one of which could not have been less than 60 feet high. Early in October I went to Potosi, about 90 miles from the capital and 12,000 feet above the level of the sea. Whilst approaching this town I felt, for the first time, that oppression which is due to the rarefaction of the air, but which is sometimes attributed to an emanation from the earth; the Spaniards call it *soroche*. The country all around presents one dismal aspect of pebbles and broken rock, without any vegetation whatever, except here and there where the Indians have laboriously cleared small spaces on the mountain sides from the larger stones, and succeeded in rearing a little barley. Nearer the town, however, in places which it has been possible to irrigate, some fields of Lucern may be seen. The Cerro de Potosi itself is iron-coloured, and its anomalous appearance seems to indicate an origin different from that of the

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* The mean temperature of this town has not, that I know of, been ascertained; but I should not think it could be far from 13° C.: that of Potosi is probably 9° lower.

neighbouring mountains. The only plants I found in flower here were a curious stemless Composite and a dwarf *Loasa* (Urtiga), with brilliant red flowers.

After a fortnight's absence from Chuquisaca I returned and prepared to start for Cochabamba, and to proceed thence by the valleys of the interior to La Paz. The country between Chuquisaca and Cochabamba is of no botanical interest; the first 6 leagues of the road lie in a deep ravine enclosed by magnificent but barren mountains; 9 leagues more bring the traveller to the Rio Grande, which I had already crossed twice since entering Bolivia; it forms the boundary between Chuquisaca and Cochabamba. A little further on I entered a series of valleys dotted with small houses and covered with fields of Maize, which forms one of the principal sources of wealth in this department.

The environs of Cochabamba are reputed to be so beautiful that I was quite amazed to find myself close to the town without having seen anything but a series of almost barren ugly hills and fields of round flints. I did not then know that the celebrated part was on the other side of the town; it consists of a long string of meadows and kitchen-gardens edged with pyramidal willows, and lying between the town and some grey stony mountains like those which I saw on my arrival. It is more like Gentilly, near Paris, than any place I know; the willows of Cala-Cala being there replaced by poplars, not very unlike them in appearance. The climate of Cochabamba is hotter than that of most of the other elevated towns in Bolivia, and consequently many fruits are successfully cultivated here which are not met with in other towns unless imported into them. Peaches (Durasnos) are very abundant, but they are not nearly so good as our own, doubtless because the people have never thought of growing them except on standards. Strawberries are large, but have little taste. The Pine Apples, Plantains, and Corossols (*Anona muricata*), which are found in the market, are brought from the deep valleys, called Yungas,* situate on the eastern side of the great Cordillera of the Andes, the snow-white tops of which are, as it were, above the town. On the 20th of November I crossed this chain by the pass called Llave, or the Key. The vegetation which I met with here was very like that I had observed whilst on the mountains in the provinces of Tomina and Cinti; there was *Geranium* or *Erodium*, forming, as it were, a carpet, Violets, stemless Composites, Crowfoots, *Luzula*, and a little lower, some *Calceolarias* and two beautiful Gesnerads, with yellow or scarlet flowers hanging in tufts over the damp sides of the rocks.

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* The mean temperature of these valleys is 20° to 22° C.

Further on I gathered a magnificent species of *Tacsonia* with pink flowers.

Upon the crest of the Cordillera begins the province of Ayopaya; every part of it which I visited is above the limits of the high forest vegetation. As far as Morochata in particular, the steep face of the mountain on which the road runs, presents nothing to the eye except a little alpine grass, or the bare surface of the sandstone or schistous rocks of which it is composed. The miserable inhabitants of this canton cultivate nothing but Barley and Potatoes; but round Palca, the capital of the province, there are fields of corn and even Maize, and at the same height a great number of shrubs, especially of spiny Mimosas.

From Palca I went to Ynquisivi, the chief town of the province of the same name. As I advanced vegetation became more abundant and more diversified; every step I took brought me nearer a tropical climate; but the descent is so gradual that the limits occupied by the different plants are not nearly so well marked as in other places I have seen. The *Cactus* is very abundant here, and either alone or in company with Mimosas forms large forests. When descending towards the bed of the Rio Ayopaya, I remarked on one of these succulent plants a leafless Loranth of a brick-red colour. From the river last mentioned the road passes into the bed of the Rio Cato, which has to be followed upwards for several leagues before the beautiful village of Ynquisivi can be reached. This place is on a verdant platform half way up a very steep mountain, at the foot of which is a roaring torrent.

The interminable zigzag of the roads in these countries renders it difficult to ascertain, without actual measurement, the amount of its general slope. Without however knowing this, the changes of temperature in each new place showed me that I was gradually approaching the domains of tropical nature. I found, indeed, near Suri, 7 leagues from Ynquisivi, Plantains and Cecropias, then, a little lower, Cinchonas, then Palms and Arborescent Ferns which I had not seen for a very long time. The parts of these mountains which are most exposed to the south have been long since cleared of their forests and planted with Coca,* which I saw here for the first time alive: its im-

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* The Coca (*Erythroxylon coca*) is a bushy shrub $1\frac{1}{2}$ foot to 2 feet in height, with pale-green leaves, small, simple, and marked with three longitudinal nerves; its flowers are white, with very little scent; its fruit is a drupe, at first green, and then intensely red.

As a horizontal piece of ground of any extent is unknown in the countries where the coca is grown, it is always found on the sloping sides of the mountains, and exposed as much as possible to the rays of the sun. To portance may be judged of from the fact that the Indians of Bolivia consume annually 6 millions of kilogrammes of its dried leaves.

The continual rains which had lately fallen rendered the route I had to pursue nearly impassable.

On the 28th I passed through the village of Carcuata, and the next day that of Circuata, from which the Rio de la Paz is distant a few leagues. The forests which cover the mountains here are very picturesque, but not so magnificent as those of Brazil. I met with several species of *Cinchona*. The valley of Canamina, which is entered as soon as Circuata is left, is very fertile, and not only the Coca but the Coffee-tree, Sugar-cane, and Pineapples are cultivated in it. A verdant forest, watered by the clear Rio Miguilla, separates Canamina from the Rio de la Paz, the muddy water of which flows between two immense banks and separates the province of Ynquisivi from that of Yungas, of which Chulumani is the capital.

To reach this town I had again to cross two small rivers, the Puri and the Solacama; I then proceeded to Ocobaya to look for a particular species of Quinquina which I was told grew there. The species turned out to be *Cinchona amygdalifolia*: it grows

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effect this the mountain sides are cut into a series of narrow ledges, on each of which is a row of coca bushes. The ledges are kept up by little stone walls, which not only prevent the earth from slipping and drying too much, but also protect the growing point and root of the young plants from the too scorching rays, by their slight projection above the level of the earth. This arrangement facilitates, too, the frequent irrigations which the coca, in some seasons, requires. The leaves are gathered three, and sometimes, but rarely, four times a year—in March, July, and November; and what is very strange, the plant, accustomed to these periodical disturbances, which represent so many winters, goes several times through all the phases it would naturally go through but once in the course of the year; so that it produces fresh flowers and fruit, as well as fresh leaves. Of these three gatherings, the first is the most productive. The seeds, too, ripen best in March: they are sown soon after they are gathered, and spring up a week or a fortnight afterwards.

After a certain number of years the soil of the coca plantations becomes exhausted; it is then abandoned, and is re-converted by Nature into forest. I well remember descending the side of a mountain to reach a quinquina which had attracted my notice, and finding, to my great surprise, a flight of well-made steps, which were nothing but the ledges of an old coca plantation, covered at the time of which I speak with large trees loaded with parasites, climbers, and spiny palms.

As soon as the leaves are gathered they are spread on a floor composed of slabs of black schist, and left to dry in the burning rays of the sun.

The Indians never chew the coca leaf alone: it seems that some alkali is necessary to develop its properties. The ashes of plants furnish the alkali, which is obtained in some places from the *Cereus*, in others from the *Chenopodium Quinoa*, or else from a *Gomphrena* called Moco-moco, which is very common in all the temperate parts of Bolivia, and which is also used in the manufacture of soap.

on the top of a very high mountain, in the midst of a thick forest, the characteristic features of which are due to Bamboos and Tree Ferns.

In this canton the roads are everywhere far above deep valleys, and the mountain sides, even the steepest, are, to a certain height, covered with Coca plantations as far as the eye can reach. Indigo occurs abundantly in all these places, and the forests are full of curious and useful plants. I need only mention the Incienso, a species of *Clusia* which discharges, when wounded, a pale-yellow resin used for incense: the Matico (*Piper matico*), the aromatic and astringent leaves of which have a great reputation as vulneraries; the Aristolochia, called Vejuco, discovered by Haënke, who says it is an infallible cure for serpent-bites; a *Myrica* (Arbol de cera), from the fruits of which the inhabitants of Yungas extract wax for candle-making; lastly, the Cargua-Cargua (*Cascarilla magnifolia*), or pseudo Quinquina, which is generally at the bottom of the valleys, whilst the true Quinquina, with bitter, febrifugal bark, is found in more elevated places.

Leaving Chulumani I proceeded to Chirca and then to Yanacache, situated in a romantic spot on the side of a Cordillera, the snow-white crest of which rises almost perpendicularly above the forest which more immediately surrounds the town. I then passed on through Milluguaia to Coripata, from the environs of which the best Coca in all Bolivia is obtained; the road leading from Coripata to Coroïco passes through magnificent plantations of this valuable shrub. Between the town and river Coroïco the descent is very steep and frightfully rugged; after passing this the traveller comes to a magnificent road which takes him up to the regions of perpetual snow, and which had been, when I was there, but lately thrown open to the public. It follows the bed of the Coroïco, and then goes through one of the most broken countries it is possible to conceive. Often cut out of the solid rock, it in many places has the appearance of being suspended over tremendous precipices and of resting against the almost vertical side of the mountain. Accustomed to the dangerous paths of the southern Cordillera, I was surprised to find myself moving with such ease in the midst of these abysses, which I had now full leisure to contemplate. The mountain rises everywhere straight up, and its damp sides are covered with a vegetation which, hanging down in festoons, often conceals natural caverns; below flows the Coroïco along its rocky bed. A thick fog hid the higher parts of this glorious scenery, and into it I myself soon entered.

The plants of this region are interesting in the highest degree. I had in a very short time got beyond the Coca district, as the *Erythroxylon* does not grow at a greater elevation than

1300 yards; but the Quinquinas accompanied me as far as the borders of the forests, which appeared to me to rise higher here than in any other part of Bolivia which I had seen; this arises, perhaps, from the shelter due to the position of the mountains. Several of these trees were in full flower, and perfumed the air to such an extent that I was enabled to find them by their scent alone. A little higher up I found a few houses and some fields of barley; from this place the mountain rises still more rapidly, and the Coroïco becomes a furious torrent, scarcely contained by its rocky bed. On the banks are thickets bathed with perpetual dew, and under them grow three or four species of *Fuchsia* and a magnificent climbing *Mutisia;* there too I found a red flowered *Loasa* and a blue and yellow flowered frutescent Milkwort; several species of *Rubus* and a *Buddleia* with sweet-scented golden yellow panicles were a little higher up. The next day the picture changed; the Coroïco, which I still followed, was reduced to a murmuring brook; and higher still it was lost amongst the many streamlets produced by the melting of the snow with which the top of the mountain was covered. I had left all vegetation far below, and was surrounded by nothing but granite rocks, the grey black colour of which was only contrasted with a few patches of red or yellow Lichens growing upon them. Here and there might, perhaps, be found a few tufts of a hard rush-leaved grass (*Deyeuxia rigida*), which contrived to exist in spite of an almost perpetual frost. This was the last flowering plant I saw on this side the Andes: I was considerably above the limit of perpetual snow, but the plant was still to be seen clinging to the rocks where the snow itself could not lodge.* As the day broke, the haze which at first covered the mountains cleared away, and their rugged snow-clad summits shone with so much brilliancy that the eye could hardly bear to look at them. The thermometer stood at $+15°$ C. when I passed the snowy region. The ridge passed, I came upon an extensive sandy plain in which is a number of small lakes or marshes, the sources of the Rio de la Paz. On this side of the mountain the road follows the course of the latter river, as it did that of the Coroïco on the other side; both these rivers spring from the same glaciers, and after following very different routes again come together in the bed of the Rio Beni.

As far as La Paz, situate on one of the highest points of the Bolivian table-land, 3,720 yards above the sea, the descent from the Cordillera is gradual and offers nothing which demands special notice; it is one great Puna, covered with the scanty and

* The last woody plant I saw in this ascent was a Buckwheat, *Mühlenbeckia rupestris*, N.

short vegetation * of these regions, and which supports nothing but the Alpaca. Near the town I found a narrow slip of wheat and barley and of beans in flower, but these plants seemed quite out of their element on the banks of a torrent and amongst rugged barren rocks.

La Paz, in spite of its rather rigorous climate,† and the sterility of its neighbourhood, ought to have one of the finest markets in Bolivia, for it is connected with the fertile province of Yungas not only by the road along which I had come, and which was made for the sole purpose of facilitating the extraction of Coca, but also by the bed of its river, a still more direct route. The banks of this stream afford the only place where the inhabitants of La Paz can cultivate any plants; and near the town the ground fit for this purpose is very limited in extent, although lower down, where the climate is milder, it occupies a larger area and yields most of the products of the south of France. At no greater distance than 4 leagues from the town there are magnificent vineyards, abundance of Figs, and a little lower, near the base of the majestic Illimani, there is a plantation of olive-trees.

The rainy season, which had already set in, compelled me to abandon my plan of visiting the provinces of Sorata and Caupolican, or Apolobamba, and instead, I determined to pay a visit to the famous lake of Chuquito or Titicaca, and so to arrive at Arequipa.

Accordingly on the 11th of January, 1847, I left La Paz, and crossed a Puna, the vegetation of which consisted of thin tufts of a yellow grass left even by the Llamas, until I came to Tiahuanaco, from which the lake is 4 leagues distant, as is also its outlet the Desaguadero, which separates Bolivia from Peru. I directed my steps to the village of Guarina, crossing some tolerably high hills and then a plain in part inundated by the late rains. Several streams which flow into the lake also cross this district; these I passed on a curious contrivance of two great cylinders or bundles of rushes tied together and rising to a point at their extremities. This rush, very like our *Scirpus lacustris*, is very common near the lake, and was the largest plant I had met with since leaving La Paz. The most common vegetables of this country are the potato, barley, Quinoa, and the Ulluco. On the 20th I arrived at the strait of Tiquina, which joins the two

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* The grasses which form the pasturages of the Punas belong to the genera *Stipa, Festuca, Bromus, Deyeuxia, Eragrostis, Poa, Agrostis, Chondrosium, Clomena, Trisetum*, &c.

† The mean temperature of this town is, according to Mr. Pentland, about 9·5° C. In the hottest month, December, the thermometer is seldom higher than 18° C.; and in the coldest month, June, it very seldom freezes in the daytime.

portions into which the lake is divided, and which I crossed to reach the village of Copa Cabana. The temperature of the islands of this lake, or rather inland sea, is apparently different from that of the mainland on its borders; in one of them, the Isla de Titicaca, maize, though very poor, is occasionally cultivated. A plant of the order Eupatoriaceæ is the commonest wild plant of this country; the famous ruins of the temple of the Moon, in the island Cuati, are situated in a little wood of *Polylepis.* The peninsula of Copa Cabana enjoys many of the advantages of the island climate, though in a less degree, for maize does not ripen there. The native vegetation is, however, more highly developed in this place than in any other of the same region with which I am acquainted. Besides the *Polylepis* there is a *Buddleia*, called, from its resemblance to the olive, the wild Oliva, equally characteristic of this country. Lastly, I observed in the same peninsula a large green-flowered currant, a *Cassia*, a frutescent *Solanum*, a *Discaria*, and above all the *Cantua buxifolia*, which, with its long purple corolla, is the principal botanical ornament of the district. Leaving these pretty places I entered the republic of Peru, and came, by following the west bank as far as Puno, into sandy plains partially covered by the little *Ephedra humilis*, which scarcely projects beyond the soil in which its orange fruit is almost wholly buried.

Whilst at Puno I visited the celebrated Mine del Manto: on the 3rd of February I left for Arequipa, where I arrived on the 8th. On this journey I made an interesting collection of plants inhabiting the Punas. On the 5th I passed a series of small lakes, enclosed by the mountains, and without any apparent outlet; beyond these I travelled between mountains covered with snow upon the highest point of this part of Peru. On the opposite side is an immense plain of white gravel, so barren that I only found a single plant, *Senecio adenotrichius*, and that was growing through the skull of a Llama. This plain, which is constantly swept by hurricanes, is called the Pampa de los Confites from the small fragments of quartz scattered over its surface. On the 7th I began to descend towards Arequipa, following for some distance the Rio Blanco, which falls into the Pacific. The atmosphere was so obscured by the snow which was falling as I passed that I could hardly catch a glimpse of its white-fronted cone.* The highest point of the mountain, over which the road passes, is called Alto de los Huesos; to get there the traveller

* I ascended this mountain, which is, according to Mr. Pentland, not less than 6000 yards above the level of the sea: I was twelve hours getting up the cone. The last plant I saw on my ascent was a species of *Bolax*, which grew among the cinders.

has to pass over a gradual slope composed of cinders, arranged with a regularity almost artificial. On the opposite side there is a similar but shorter slope, which is soon replaced by broken ground cleft by deep ravines. There are several plants to enliven this scene; amongst them are a large yellow-flowered Cistus, an *Adesmia* with a resinous smell and a violet-haired fruit, and the *Mutisia viciæfolia*, with orange-red flower-heads, and which is equally common in the ravine of Cuzco.

The town of Arequipa is situate in the midst of a sandy plain, 1600 yards above the level of the sea, and in one of the most beautiful climates in the world. Its mean temperature is about 14° C. Its soil, except where it is artificially irrigated and cultivated, is bare and sterile. Corn, Maize, Lucern, several vegetables of temperate climates, and especially the Potato, are cultivated in the artificially prepared spots, as are also several kinds of fruit, viz., the Apple, Pear, Peach, Grape, and Mulberry. Strawberries, Melons, and other Cucurbits are abundant. The Plantain and Corossol tree (*Anona muricata*) grow at Uchumayo, a town 4 leagues from Arequipa, and lower down than it. In the valley of Vitor, 12 leagues distant, there are abundant supplies of the products of hot countries.

At the end of April I left Arequipa, where the rains had detained me, and took the road to Puno: thence I went north, turned the extremity of the lake which I had not yet seen, and passing through the villages of Huancané, Vilque, and Moho, re-entered Bolivia on the 11th of May: throughout the whole of this route I crossed nothing but large plains, bearing barley, Quinoa, and potatoes, and broken by a few low hills. Continuing on the borders of the lake in a south-easterly direction, I ascended, beyond the village of Carabuco, some barren hills, a little higher than those I had just seen, and from which I could distinguish the peak of the Illampo or Sorata, the highest mountain in Bolivia. Arrived at the village of Ancoraimes I changed my course and followed an inlet of the lake which extends to the foot of the Cordillera; here I found, amongst other interesting plants, some beautiful Calceolarias and a *Cerastium*. A long ridge of mountains covered with snow next presented itself, and the road, after crossing it, follows a large stream which rushes down to the valley of Hilabaya, separated by another but lower ridge from that of Sorata. I well remember the trembling of the knees with which I was attacked, and which was occasioned by my rapid passage through so many differences of temperature; the bitter cold of the morning soon decreased, and in the place of the poor grass of the Puna succeeded more succulent plants, shrubs, bushes, and at last small trees. In the region of the shrubs is grown a large quantity of *Oxalis tuberosa*, the tubers of which, after being deprived of part of their water and acidity by exposure to the sun,* are eaten instead of potatoes, which do not grow well in the valleys hereabouts.

On the 15th of May I arrived at Sorata, which I had been told was situate in the midst of a country rich in Quinquinas; but the Illampo, on the sides of which the small capital of the province of Larecaja is situated, does not present on this side any forest, unless indeed the poor woods (Matorrales), through which I passed on my way to Hilabaya, are dignified by that name. I thought it better under these circumstances to proceed to Tipoani and Guanai, from which Sorata is separated by the great Cordillera.

Ascending then the sides of the Illampo as far as the perpetual snow, I gained the eastern side and then followed the course of the Rio Tipoani. I need not describe this journey, which though extremely difficult was very interesting, as much from its scenery as its vegetation, which in these damp valleys much resembles that of the province of Jungas. Before arriving at Tipoani the forests become less thick, and are soon replaced by regular Campos broken, as in Brazil, by different-sized masses of tall vegetation, and only distinguished from those already described in the greater irregularity of the ground; these are the Pajonales of the Bolivians; the meadow Quinquina (*Cinchona Josephiana*) is one of their principal ornaments.

On the 1st of May I left the unhealthy town of Tipoani on a raft of seven poles tied together, on which I was swiftly carried by the torrent to Guanai, a village of the Lecos Indians, situate at the confluence of the Rio Mapiri. The next day I continued my voyage along the latter river as far as Tumache, where I was told I should find some virgin forests of Quinquina. A long day's journey over steep mountains, covered with thick impenetrable forests, had to be undertaken before I could attain my object. I was, however, successful in finding a species of *Cinchona*, which I afterwards named *C. Boliviana*, growing in company with a *Laplacea*, the bark of which resembles that of some Quinquinas, and is used for the purposes of adulteration; on this account I gave it the name of *L. quinoderma*. Several species of Palms and arborescent Ferns abound in the same places.

Regaining Guanai, I again took to my raft and forced my way along against the current of the Rio Mapiri, until I came to the village of the same name: from this place I made my way through Climbers and Bamboos, which filled the forests hereabouts, in the direction of Apolobamba. It was whilst on this

* This, if continued long enough, converts all the acid matter of the tuber into saccharine substances, just as we see in the ripening of fruit.

journey that I found, amongst many interesting plants, *Cinchona micrantha*, and a species of *Cascarilla*, to which I gave the name of *C. Carua*. On leaving Mapiri I was glad to find the hot damp forests, in which I had lately been travelling, give place to smiling Pajonales, with their green turf and large shrubs, amongst which were the magnificent *Lasiandra Fontanesiana*, then in full flower, and the frutescent variety of *Cinchona Calisaya*, with its pink panicles of sweet scented flowers.

Near Aten I again saw Coca plantations, which are kept by the inhabitants of the province of Caupolican, to make up for the continually diminishing commerce of bark, which is threatened with destruction in consequence of the increasing scarcity of Quinquina trees.

Aten is separated from Apolobamba by a magnificent plain, dotted with coppices, in which I found a new species of Cinchona, *C. asperifolia*. Leaving the last named town, which is the capital of the province, I made for the Punas, passing through the valley of the Rio Tuiche and the region of perpetual snow. This journey was too similar to those already described to require any special notice. The six days' march carried me above the forest vegetation, and it was only here and there that I saw some half frozen bushes, and an orange-flowered stinging stemmed *Loasa*. The waters of the Rio Tuiche, like those of other streams which rise from glaciers, were here of a milky whiteness, and the heat from which I had lately suffered was replaced by chilling blasts. In this dismal cold region is the wretched village of Pelechuco. Five more leagues passed and I was near the top of the Cordillera, the peaks of which were all covered with enormous masses of pale green ice, threatening every instant to fall down the abyss they overhung. At the foot of these glaciers I found a curious Composite, fashioned, one would think, expressly for such places; the Indians call it Quea-quea (Cotton-cotton), in consequence of all its parts, and more especially its flowers, being covered with a thick layer of cotton used by the natives for lampwicks, and as a substitute for amadou.

The western slope of the Cordillera of Pelechuco is very gradual, forming naked plains dotted with small lakes of black water, and covered with a scarcely perceptible turf, which nevertheless supports thousands of Alpacas and Llamas which are reared in this part of Bolivia and some of the neighbouring points of Peru. These Punas, which are much higher than the summit of Mont Blanc, are probably the most elevated inhabited parts of the globe. My thermometer placed in the sun fell one morning to $-10°$ C. On the 1st of June I rejoined my caravan, which I had left on the borders of the lake.

I was compelled to travel 80 leagues in order to get a passport from the President of Bolivia; this done I again visited the ruins of Tiahuanaco and entered the Peruvian territory by the province of Carabaya. On the 22nd of June I quitted the village of Moho, through which I had before passed, and on the 24th I was for the fifth time on the crest of the Andes, which I crossed by one of the most picturesque but bitterly cold passes I remember to have ever met with; on the evening of the same day I was, however, once more in a delightful climate at the pretty village of Sina. At Quiaca I found guides to conduct me to the valley of San Juan de l'Oro. Leaving Quiaca for the large forests, I passed small woods of Myrtles, *Befaria*, Melastomads, and *Datura*. On the evening of the 3rd day from my departure I came to a curious pass which merits a short description; it was a deep gallery, hollowed in the top of a steep and very rugged mountain: the continual moisture had so softened the soil that to move along was extremely difficult—so much so that I at one time thought I should remain for ever in the mud. The vegetation was peculiar; the whole ravine was covered with a thick carpet of *Sphagnum*, upon which a *Genlisea* balanced its large lilac flowers in the midst of Droseras; Lycopods and Ferns of every shape were there, with Orchids, Melastomads, and Heathworts.

From San Juan de l'Oro I was compelled to go to a place called Tambopata to find a guide, which I succeeded in doing. He was an intelligent Cascarillero, and we established ourselves on a little promontory at the confluence of two rivers, from whence we made daily excursions into the neighbouring country. I found 15 species of trees to which my especial attention was directed, but my small stock of paper compelled me to leave behind many plants I should have liked to have brought away. One of the most remarkable trees in these forests was a Stellate, afterwards named *Gomphosia chlorantha;* it forms on the top of the mountains large woods, sometimes alone, sometimes in company with a large *Hedyosmum*, called Chilca, and the curious tree I afterwards named *Elæagia Mariæ*, which recalls the common name of Aceite-Maria by which it is known in the province of Carabaya. The *Triplaris*, facetiously called by the Bolivians Palo Santo, is very common in the low parts of the forests, where its red tops contrast strangely with the brilliant green by which they are surrounded.

Departing from Tambopata and the Villa San Juan de l'Oro,*

* Not a trace either of this town or of San Gaban, the ancient capital of the department of Puno, is to be found, though both are laid down in the most recent maps.

I crossed over to the valley of Sandia and followed it to the town of the same name. Most of the forests in this canton appeared to me to have been formerly destroyed to make way for Coca plantations. I saw several specimens of *Cinchona Calisaya*, which seemed to have sprung from old stocks. Leaving Sandia I passed the Cordillera and came upon the Punas of the great table-land of Carabaya. From Crucero, the capital of the province, I pushed on to the interesting town of Cuzco. On my way I passed the village of Macusani, where the mule animal called Alpa Vigogne was first born, and shortly after I crossed a great ridge of the Andes by a most magnificent pass. Continuing my route for many leagues through red sandstone rocks, curiously cut by the continued action of water, I reached the bottom of the valley known by the name of Quebrada del Cuzco. The river which flows through it is called lower down the Rio Vilcamayo, and its climate is mild enough to enable Maize to ripen. A there days' journey through this pleasant valley brought me to the ancient capital of the Incas, where I arrived on the 31st of July. On the 7th of August I proceeded to the valley of Santa Ana, interesting for its forests, which, it is said, contain plenty of Quinquinas. The valley in question is that of the Rio Vilcamayo, which is named differently in different parts of its course; as is well known, it joins the Apurimac, in the Pampa of the Sacramento, and the two together form the Ucayale. Leaving Cuzco I entered the lovely valley of Urubamba (another synonyme of Vilcamayo), in which is the village of Ollantaitambo, so celebrated for its ruins. A little beyond this point the road suddenly quits the valley and rises, on the right, towards the snows of the Cordillera. The limits of the forest vegetation are here marked by several interesting plants, amongst which are some leafless Fuchsias, a magnificent variegated *Witheringia** (*W. superba*, N.), and a red flowered Currant. Near the crest of the mountain, in a fog so thick that I could not see a yard before me, I gathered the pretty *Ranunculus Krapfia*. On the other side, where the ravine of Santa Ana begins, there is a large forest of *Polylepis*, shaggy with tresses of Tillandsias and other Epiphytes, but which soon make way for trees of another description: lower down the whole valley was covered with plantations of Coca, Mandioc, Plantain, Avocado Pears, Cotton trees, Cacao trees, and Coffee trees, with fields of Maize and Sugar Cane. On the 12th I arrived at the farm of Icharate, where, in company with M. Delondre, I made several pleasant excursions; on the

* This fine tree, which has already been raised from seeds sent home by me, may perhaps support the cold of our winters. Its flowers are not unlike those of the *Fritillaria Meleagris*, but they are smaller.

15th I proceeded to Cocabambilla and visited the forests, where grows the *Cinchona scrobiculata*, one of the species observed by MM. Humboldt and Bonpland in the province of Jaën, on the frontiers of the Republic of the Equator.

At Santa Ana my travels in America may be said to have come to an end, and I there bid farewell to the vegetation of the Tropics, for after my return to Cuzco I saw in America few trees besides Willows, the *Schinus* and Pear trees of Arequipa, or the Dates and Olives of Pisco and of Lima.

On the 29th of August I started for Arequipa, where I arrived on the 7th of December, after crossing a country very like that which I passed on my way from Puno.

Finally, on the 31st of October, I crossed the 30 leagues of sand which separate Arequipa from Ysla, and on the 10th of November I embarked for Lima, and thence, on the 8th of December, for Europe. I returned to France on the 29th of March, 1848, after an absence of five years.

REPORT FROM THE COUNCIL

TO THE

ANNIVERSARY MEETING, MAY 1, 1851.

UPON rendering an account of their proceedings for the past year, the Council of the Horticultural Society think it advisable, in the first place, to present to the Meeting the following

Report from the Garden Committee.

"The Garden Committee report that they have been diligently occupied during the year in executing the trust committed to them by the Council, as will be seen by the following statement, which embodies the principal subjects that have occupied their attention.

At the period of the establishment of the Garden, as complete a collection as possible was formed of the trees and shrubs which are hardy enough to bear the climate of Middlesex without protection. In the course of the twenty-five years which have elapsed since these trees were planted, great changes have been successively made in the objects of the Society and in the arrangements of the Garden. A Committee, which was appointed by the Fellows of the Society in the year 1830 to examine the affairs of the Society, particularly insisted upon the importance of not allowing the Garden to be occupied by plants of mere botanical interest, and large quantities of species have been since that time removed as soon as it was ascertained that they did not bear any direct relation to the objects of horticulture. To a certain extent this has been effected in the Arboretum itself; but the Committee, of opinion that a large number of unimportant trees and shrubs still found places in the Garden, without in any way contributing to its beauty, ordered all the worthless species and all the deformed specimens of common trees to be removed, and they believe that the appearance of the Garden will be found to have been greatly improved by the measure.

In connection with this proceeding, and in compliance with the express desire of the Council, they found it necessary to re-arrange and complete the shrubbery adjoining a long broad walk, at present little known, which runs round the south-east and south sides of the Garden, near the boundary fence. This walk they have caused to be completely gravelled, and furnished with seats at short intervals, and they believe it will now become a favourite resort of visitors.

In carrying out the latter operation, it became necessary to determine what should be the future destiny of a thicket of trees, spoken of in former Reports under the name of the "Miscellaneous Fruit Quarter." The Committee found the collection to consist, for the most part, of duplicate trees, or of varieties of no value, such as cherry-plums, horse chesnuts, quinces, elder bushes, and half-wild fruit-bearing plants, through which the walk just mentioned passed in its course to the north and eastward till it joined the large iron conservatory. In the opinion of the Committee this place required to be laid out upon a wholly different plan. They therefore directed the greater part of the trees to be felled, and the bushes to be removed. It having been found that on this spot gravel, of which large quantities would be required for the alterations contemplated by the Committee, could be obtained in abundance, a favourable opportunity appeared to present itself of taking advantage of the inequalities of the ground that would necessarily result from digging gravel to form a flower-garden with an irregular surface. This was accordingly decided upon; the garden has been completed, and will, in the present year, in the month of June, be the scene of an Exhibition of American plants by Mr. Hosea Waterer, of Knap Hill, to which Fellows of the Society will have access daily, except Sundays, without payment; and all other persons upon the presentation of tickets, sold in Regent-street and the Garden at 1*s*. each.

The Garden Committee have also taken into consideration the importance of keeping the mowed ground in such a state of order as would render it at all times fit for the inspection of visitors of all ranks. The practice had hitherto been to mow the lawn carefully and constantly during the season from May to August, at which time the Garden is most frequented by visiters; then to mow it less carefully till the month of September, and to allow it to remain unmown during the winter and early spring. This practice has arisen in part from motives of economy, and in part from an opinion that a winter's rest would enable the turf better to withstand the effects of trampling by the large number of visiters to the Exhibitions in June and July. The Garden Committee are of opinion that this rest is unnecessary, and injurious to the appearance of the Garden. They therefore resolved upon the special employment of four labouring men, as mowers, all the year round; and, in consideration of this addition of force, reduced the permanent establishment by two men, and by all extra labour for mowing, unless in the week during which the Exhibitions take place; and they anticipate from the measure a diminution of cost as well as a better condition of the turf.

The department in which the propagation of plants for distribution among the Fellows of the Society takes place has, for many years, been confided to the especial management of Mr. Donald Munro, lately the Society's chief gardener. The increasing age of this officer having rendered the duty, added to his other responsibilities, more than he could advantageously execute, the Committee resolved upon recommending to the Council that Mr. Munro should be relieved of his charge in the Garden, and that in consideration of his long and faithful services for 30 years, he should be allowed a retiring pension of 5*l.* per month. The Council having acquiesced in this arrangement, the Committee determined to divide the duties of the Distribution Department between the two remaining Superintendents, each of whom, upon Mr. Munro's retirement, became head of the division of the Garden entrusted to his care. The Superintendent of the Ornamental Department, upon assuming his charge, represented that the means at his disposal were not such as, in his opinion, would enable him to discharge his distribution duties as efficiently as the interests of the Society required: the Committee have therefore caused a new house, 63 feet long, in two departments, to be constructed for the propagation of plants; a range of cold pits, 75 feet long, to be built for protecting plants; and certain old and incommodious houses to be altered and enlarged. In this way they expect that the distribution of plants will acquire additional activity, and be more productive of advantage to the Fellows of the Society.

During the past year the Committee find that the distribution has been as follows:—

1850–51.	Plants.	Seeds.	Cuttings.
To Members	5,788	40,159	1,743
To Foreign Countries, Correspondents, &c.	471	146	206
To Her Majesty's Colonies	..	117	..
Total	6,259	40,422	1,949

These have been divided among the applicants in the following proportions:—

The plants among 314 applicants, making 19 plants to each applicant.

The cuttings among 110 applicants, making 17 cuttings to each applicant.

The number of packets of seeds given to each applicant cannot be ascertained.

The number of plants distributed from April 30, 1849, to May 1, 1850, averaged 16 each among 368 applicants.

While remodelling the Distribution Department, the Committee necessarily directed their attention to the charge for labour of other descriptions, which they have thought unequal to the results obtained from it. This they believe has, in a great degree, arisen from the system of filling up all the permanent places in the Garden with young men, usually about twenty years old, recommended by Fellows of the Society, possessing little skill as gardeners, and inferior in physical powers to the ordinary labourers of the neighbourhood. The Committee therefore recommended, and the Council acquiesced in, the limitation of the number of men employed in the Garden upon the recommendation of Fellows and for no other reason, to eight, all of whom are to be of the full age of twenty-two when received into the Garden ; the remainder of the men to consist of more skilful persons, with higher wages than before, and of mere labourers. This arrangement has been carried out from the 1st of the present month, and the Committee are of opinion that it will not be attended with increased expense, although it will introduce more efficiency among the workmen.

No collector of plants being now in the employment of the Society, and the Society's subscription to the Scotch Expedition to Oregon, mentioned in the last Report, not having yet produced a result, the Committee have possessed no other means of raising new plants for distribution than such as have been furnished by the liberality of the correspondents of the Society. Among these are to be specially mentioned a box of Koordistan acorns, transmitted by H. H. Layard, Esq., the discoverer of the antiquities of Nineveh, and which it is hoped will prove of considerable importance ; seeds of the magnificent new Rhodoleia Championi of Hong Kong, from C. J. Braine, Esq. and Capt. Champion ; Sikkim Larch seeds, from Dr. Hooker ; and seeds of the Witheringia superba of Weddell, from J. B. Pentland, Esq.

To these must be added the following :—

From the Honourable Court of Directors of the East India Company, Lilium Wallichianum and various Orchids.

From Capt. Elliot, 6 kinds of Seeds from Greece, some small Oaks, an Amaryllis Bulb, and 4 other Plants.

From G. U. Skinner, Esq., Zamia Nuts, a few Orchids, and 2 papers of Asclepias Seed.

From H. F. Hance, Esq., Viola Patrinii, from Hong Kong.

From J. E. Winterbottom, Esq., a collection of Seeds from the North of India.

From Dr. von Siebold, Deutzia crenata, and 56 other Ornamental Plants.
From Dr. Fischer, Weigela Middendorffiana, and 17 other Plants.
From Mr. D. Moore, Lilium Wallichianum, and a collection of common Herbaceous Plants.
From J. A. Tinne, Esq., Alsophila ferox, and 19 other Plants from Demerara.
From the Administrators of the Museum of Natural History, Paris, Catalpa Bungeana, and 3 other Plants.
From J. Anderson, Esq., of Edinburgh, 3 hybrid Veronicas.
From R. Strachey, Esq., 22 kinds of Indian Seeds, and roots of 2 Liliums.
From H. C. Calvert, Esq., 4 kinds of Bulbs, and 24 kinds of Erzeroom Seeds.
From J. Miers, Esq., Seed of Lapageria rosea.
From S. Garrard, Esq., 22 kinds of Australian Seeds.
From Colonel Reid, R.E., 26 kinds of Cape Seeds.
From Mr. Ayres, Seed of Campanula Vidalii.
From W. W. Salmon, Esq., Seed of a Creeper from South Africa.
From Nurserymen in correspondence with the Society, several Plants of interest.

In the hope of obtaining seeds and plants from the North of China and Japan, the Council have placed the sum of 50*l.* at the disposal of Mr. Rutherford Alcock, Her Majesty's Consul at Shanghae, and a zealous promoter of science in all its branches.

In conclusion, the Committee have to report that the number of Visitors to the Garden, exclusive of the days of Exhibition, has been, from April 1, 1850, to March 31, 1851, 6772; and that various lectures on subjects interesting to gardeners have been given in the reading-room, the library of which has been increased by the following presents:—

From Sir Walter Trevelyan, Bart.:—

Abercrombie on Gardening. 8vo. 1809.
Speechly on the Vine. 8vo. 1796.
Planting and Rural Ornament. 2 vols. 8vo. 1796.
Forsyth's Nomenclator. 8vo. 1794.
Kyle on the Peach. 8vo. 1787.
Kennedy's Gardening. 8vo. 1777.

From the Vice-Secretary:—

The Finchley Manuals of Industry. No. II.
How to lay out a small Garden. By E. Kemp. 12mo. 1850.

From Mr. Donald Munro:—

Gardener's Chronicle for 1846. Unbound and incomplete.
" " for 1847. Unbound and complete.
" " for 1849. Half-bound.

From N. Lindley, Esq.:—

A Copy of De Morgan's First Notions of Logic.

Professor Lindley has also continued to give away Prizes to the men who most distinguish themselves in his examinations, in which he has been assisted by a contribution of 10*s.* from Mr. Wood of Nottingham."

From these statements it will be perceived that the Council have been called upon to sanction an unusual amount of expenditure, of which they now proceed to render an account:—

	£.	s.	d.
1. The expense of works in the general improvement of the Arboretum is estimated at . .	89	7	10
2. The cost of labour and materials for the New Flower Garden	312	10	4
3. A new Propagating House	246	10	0
4. Various Repairs and Alterations of Houses in rendering the Distribution Department more efficient	179	16	10
5. To which has to be added, for the completion of Works mentioned in the last Report, and then in progress	215	18	2
	£1044	3	2

Nevertheless the Council have the satisfaction to report that, notwithstanding this very large increase of the Society's means of usefulness, the debt has been increased to the extent of only 111*l.* 6*s.* 7*d.*,* as will be seen upon examining the Balance-sheet now produced.

				£.	s.	d.
* Expenditure, as detailed				7,550	5	1
Less Income ,, . . .	£7,425	3	6			
Add deduction from Medals . .	13	15	0			
				7,438	18	6
Deficit 1850–51				£111	6	7

which agrees with the account of Addition to Debt at the foot of the Balance-sheet.

AUDITED ACCOUNT OF THE HORTICULTURAL SOCIETY OF LONDON.

Receipts, Payments, and Liabilities from the 1st of April, 1850, to the 31st of March, 1851.

RECEIPTS.

		£. s. d.
To compositions for life from Fellows, 2 at 40 Guineas each		84 0 0
To annual subscriptions		2825 6 8
To admission fees from Fellows		88 4 0
To Quarterly Journal sold		69 13 0
To Transactions and Fruit Catalogue sold		15 14 3
To rent of apartments let off in Regent Street		150 0 0
To garden produce sold		14 0 8
To receipts from Fellows for garden charges		35 1 6
To miscellaneous receipts		40 19 5
To Garden Exhibitions, 1850		4102 4 0
		7425 3 6
To Sir W. P. Call and Co. on loan, 30th Nov., 1850.		1000 0 0
To Balance at Banker's, 1 April, 1850	£230 6 7	
ditto with Vice-Secretary, ditto	3 9 8	
		233 16 3
	£	8658 19 9

PAYMENTS AND LIABILITIES.

		Payments. £. s. d.	Liabilities. £. s. d.
By interest on loan notes, &c.		287 8 2	
By rents, taxes, rates, &c., Regent Street and Chiswick		228 0 0	427 16 10
By repairs, furniture, &c., Regent Street		6 10 5	17 1 3
By housekeeping expenses ditto		27 3 5	8 8 0
By salaries and wages, collector's poundage, &c.		801 19 0	211 15 10
By cost of Quarterly Journal		102 10 11	200 16 3
By cost of Transactions and Fruit Catalogues		8 17 8	1 6 0
By library charges		11 5 0	
By printing, stationery, &c.		46 7 3	9 11 3
By foreign missions and imports		30 11 5	
By expenses of meetings, postage, carriage, &c.		66 4 11	
By garden labour		1077 19 6	
By implements, mats, seeds, &c.		80 6 1	36 2 9
By tan, dung, &c.		50 1 11	
By coals and coke for garden		3 10 0	125 10 7
By miscellaneous expenses at garden		116 1 5	24 2 0
By garden repairs		69 17 11	22 14 6
By distribution expenses		104 5 9	66 9 4
By Exhibition expenses, 1850		1049 14 2	57 7 11
By new works at garden		874 15 9	169 7 5
		5043 10 8	1378 9 11
By medals' account :—			
Balance outstanding, 1 April, 1850	£388 9 0		
Awarded since	1128 4 6		
	£1516 13 6		
less deductions	13 15 0		
	£1502 18 6	1009 0 0	493 18 6
			1872 8 5
By outstanding accounts, 1 April, 1850, paid off		1479 12 6	
By Sir W. P. Call and Co., Loan, 30th Jan., 1850, repaid		1000 0 0	
By Balance at Banker's	£117 13 0		
ditto with Vice-Secretary	9 3 7		
		126 16 7	
		8658 19 9	

11 *April*, 1851.

This account has been examined, and, being compared with the Vouchers, found correct.

SAMUEL F. GRAY,
CONRAD LODDIGES, } Auditors.

A. DUNCAN, Accountant,
10, Tokenhouse Yard.

	£. s. d.	£. s. d.
Amount of Debt 1st *April*, 1851, *viz.*,		
To Creditors on Loan Notes	5400 0 0	
To Sir W. P. Call and Co. on Loan, 30th Nov., 1850	1000 0 0	
To Liabilities, as above	1872 8 5	
	8272 8 5	
Less Cash Balance	126 16 7	
		8145 11 10

Upon analysing the items in the Balance-sheet, and comparing them with the corresponding items in the accounts of last year, it will be found that the receipts have been less by the sum of 77*l*. 9*s*. 8*d*., as shown by the following statement:—

Receipts.	1849–50.			1850–51.		
	£.	*s.*	*d.*	£.	*s.*	*d.*
Compositions for life from Fellows . . .	84	0	0	84	0	0
Annual Subscriptions	2963	5	6	2825	6	8
Admission fees from Fellows	176	8	0	88	4	0
Transactions and Fruit Catalogue sold . .	31	15	9	15	14	3
Quarterly Journal sold	66	6	11	69	13	0
Rent of Apartments let off in Regent-street .	150	0	0	150	0	0
Garden Produce sold	17	15	9	14	0	8
Receipts from Members for garden charges .	42	1	0	35	1	6
Miscellaneous receipts	6	6	7	40	19	5
Garden Exhibitions, 1848	3937	15	0	4102	4	0
Dividends on 3 per cent. Consols	26	18	8	. .		
	7502	13	2	7425	3	6

This diminution is caused chiefly by a falling off in the receipts from Annual Subscriptions of 137*l*. 18*s*. 10*d*., owing to a large amount of arrears having been collected in 1849–50, leaving a smaller amount to be received in 1850–51; and also by a decrease of 88*l*. 4*s*. in the amount of Admission Fees received, partly in consequence of their reduction from 6*l*. 6*s*. to 2*l*. 2*s*.* Against this there is an increase in the receipts from Garden Exhibitions of 164*l*. 9*s*., arising from the whole of the receipts for 1850 being included in the above account of 1850–51; whilst only a portion of the receipts for 1849 is entered in the account of 1849–50, the remainder having been entered in the account of 1848–9, as is shown hereafter under the head of Exhibitions.

The particulars of the EXPENDITURE in 1849–50 and 1850–51 will be found in the following table:—

* The number of Fellows elected in the present year is 22.

Expenditure.	1849–50.			1850–51.		
	£.	s.	d.	£.	s.	d.
Interest on loan notes, &c.	279	7	4	287	8	2
Rents, rates, taxes, &c., Regent-street and Chiswick	660	17	6	655	16	10
Repairs, furniture, &c., Regent-street . . .	30	6	1	23	11	8
Housekeeping Expenses ditto . . .	33	14	7	35	11	5
Salaries, collector's poundage, &c. . . .	1086	5	2	1013	14	10
Cost of Quarterly Journal	370	15	4	303	7	2
Cost of Transactions and Fruit Catalogues .	7	10	11	10	3	8
Library charges	18	0	0	11	5	0
Printing, stationery, &c.	68	2	1	55	18	6
Foreign missions and imports	15	5	3	30	11	5
Expenses of meetings, postage, carriage, &c.	132	5	6	66	4	11
Garden labour	1010	15	0	1077	19	6
Implements, mats, seeds, &c.	113	15	5	116	8	10
Tan, dung, &c.	28	6	1	50	1	11
Coals and coke for garden	147	16	1	129	0	7
Miscellaneous expenses at garden	183	13	2	140	3	5
Garden repairs	107	6	11	92	12	5
Distribution expenses	214	13	8	170	15	1
Exhibition expenses, 1848	1562	10	10	1107	2	1
Cost of medals awarded	1038	1	6	1128	4	6
New works at garden	231	18	1	1044	3	2
Law expenses, 1846 to 1849	51	7	10	..		
	7392	14	4	7550	5	1

Of these charges 5 only are in excess of the previous year, namely: 1. New works, already reported on. 2. Cost of medals, which exceeds that of last year by the sum of 90*l.* 3*s.* 3. Manure, &c., in which an increased expenditure of 21*l.* 15*s.* 10*d.* was indispensable. 4. Garden labour, an apparent increase of 67*l.* 4*s.* 6*d.*, nearly accounted for by the Garden clerk's wages, amounting to 59*l.* 16*s.*, having been transferred to this head from that of Salaries, where it formerly stood; and 5. Foreign imports, which have cost 15*l.* 6*s.* 2*d.* more than in the last year, on account of the Council's subscription of 20*l.* to the Scotch Expedition to Oregon.

On the other hand, salaries are reduced by 72*l.* 10*s.* 4*d.*; the cost of the Journal by 67*l.* 8*s.* 2*d.*; expense of meetings by 66*l.* 0*s.* 7*d.*; miscellaneous Garden expenses by 43*l.* 9*s.* 9*d.*; and the cost of distribution by 43*l.* 18*s.* 7*d.*

With respect to the financial result of the Exhibitions in the Garden, the Council have to report that the receipts of 1850 fell short of those of 1849 by the sum of 138*l.* 3*s.*, as follows:—

	£.	s.	d.
EXHIBITIONS, 1849.			
Receipts to March 31, 1849, entered in Accounts of 1848-49	302	12	0
Receipts since, entered in Accounts of 1849-50 . . .	3,937	15	0
	4,240	7	0
EXHIBITIONS, 1850.			
Total Receipts, entered in Accounts of 1850-51 . . .	4,102	4	0
Decrease . .	138	3	0

On the other hand, the expenses of 1850, compared with those of 1849, have been reduced by the sum of 414*l.* 8*s.* 3*d.* Deducting from this amount the sum of 297*l.* 8*s.* 9*d.*, paid in 1849 for new tents, the net reduction will be 116*l.* 19*s.* 6*d.*, notwithstanding an increase of 81*l.* 10*s.* in the medals awarded.

The following table shows the comparative expenditure on account of Exhibitions in the years 1848, 1849, and 1850:—

	1848.			1849.			1850.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Miscellaneous timber	29	1	10	50	18	1	23	10	2
Repairs of tents	17	18	3	..			..		
Miscellaneous repairs, ironmongery, &c.	14	1	9	27	1	3	32	15	4
Oil, paint, &c.	9	13	9	13	11	1	11	7	0
Turf, gravel, &c., and road repairs .	3	19	6	7	6	0	8	11	3
Handbarrows, water-pots, &c. . .	17	9	4	17	15	7	7	9	0
Carpenters, painters, tent-pitchers, &c.	138	14	1	146	6	10	126	4	7
Extra labour for New Exhibitors' Yard and Alterations	..			..			52	9	0
Miscellaneous labour beyond the ordinary service of the Garden . .	251	2	10	255	14	2	188	13	7
Crockery, Linen, &c.	12	5	0	10	0	6	9	17	11
Miscellaneous printing	90	15	0	39	8	2	31	13	6
Admission tickets	43	10	0	37	15	0	37	15	0
Advertisements	76	2	6	86	16	0	86	13	6
Judges	39	18	0	27	6	0	30	9	0
Extra clerks and temporary rooms .	56	9	0	54	7	0	28	11	6
Police	115	11	0	112	6	0	60	11	0
Bands and all musical expenses . .	306	17	0	277	2	0	270	6	0
Provisions for exhibitors, police, &c.	56	17	3	57	2	0	55	10	2
Watering roads	28	5	0	28	5	0	..		
Miscellaneous expenses, including stationery, carriage, postage, &c.	65	18	0	56	10	11	44	14	7
Cost of new tents	..			297	8	9	..		
	1374	9	1	1603	0	4	1107	2	1
Medals awarded	1204	15	0	984	15	0	1066*	5	0
	2579	4	1	2587	15	4	2173	7	1

* This is part of the sum of 1128*l.* 4*s.* 6*d.* entered in the balance sheet as medals awarded; the balance of 61*l.* 19*s.* 6*d.* being for awards at ordinary meetings in Regent Street.

With a view to giving the Fellows of the Society greater facilities for inspecting the objects exhibited on these occasions, the Council have directed a gate to be opened at half-past twelve o'clock to Fellows, attended by one friend having an admission ticket; or to the wife or sister of a Fellow and one friend, both having tickets, provided the ticket of the former bears the signature of the Fellow she represents. And in order to enable this operation to be carried out advantageously, the Garden will not be opened to the Public till two o'clock, instead of at one o'clock, as heretofore.

The Council have also judged it an act of becoming courtesy to remove from the foreigners likely to visit England this year all impediments in the way of their visiting the Society's Exhibitions; and with this view have authorized foreign ministers and consuls to issue vouchers to persons of the nation they represent, which vouchers will be exchangeable in Regent Street for tickets at the rate of 3*s*. 6*d*. each.

In conclusion, the Council would only refer to the intimation made in their last Report, that it will be necessary, if the Society intends to renew the lease of the Garden, to give notice of that intention before September next to his Grace the Duke of Devonshire, and to pay a fine of 450*l*. for renewal. It will be for the succeeding Council to take this question into early consideration.

ORIGINAL COMMUNICATIONS.

XVII.—*On the Cultivation of Celery.* By James Duncan, C.M.H.S., Gardener to Joseph Martineau, Esq., F.H.S., Basing Park, Alton.

(Communicated March 17, 1851.)

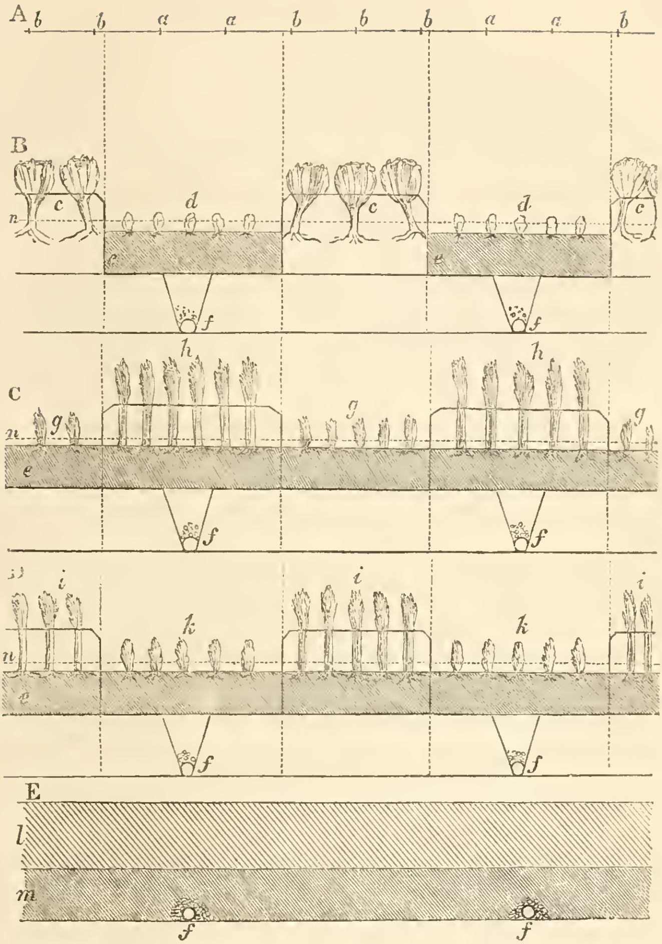
To cultivate the same area of ground for any lengthened period, so as to produce in tolerable perfection the varieties of vegetables usually grown for the consumption of a family, requires the adoption of a well-regulated system, by which not only a proper rotation of crops can be maintained, but it is also essential as a means of successful cultivation that the earth be well pulverized and aërated as often as the nature of the several crops will admit of it; and, when the soil is of an obstinate or sterile character, the necessity for this will be the more readily apparent. In all farm operations the value of a proper rotation of crops is fully recognised and acted on—how much more necessary then is such a system in garden practice, where the nature of the crops cultivated assimilates so very closely! And as the turnip crop forms the basis of the field system of cultivation, so, in like manner, I have chosen the celery crop as that on which to found my gardening routine, because by the particular mode I adopt in the cultivation of this vegetable, the greatest scope is given for a thorough turning and aëration of the soil, exposing it alike to the winter's frosts and the summer's sun, by which the most obdurate and sterile staple becomes friable, and consequently better fitted for all general purposes of culture.

In the month of June the broccoli and cauliflower section of the Brassica family is planted, and so arranged that the celery trenches for the next season's crop may be formed as soon as the cauliflowers have perfected their growth, and in this operation the mould is placed among the stems of the broccoli, which, with after covering, effectually protects them from the severity of the winter; and when the ground is in a condition to require draining, these trenches afford a ready means for the performance of the operation. The manure is placed in the trenches during winter, whereby an advantage is gained in having this kind of work performed at a less busy season than early spring or summer. But the plan also affords space for the production of early esculents. For the kinds that require a rich medium for perfect development, or such as seakale or rhubarb, which need, in addition to a slight bottom heat, an extra accumulation of matter as a means by which to blanch the stalks of the leaves, the situation is equally appropriate. The trenches form too a ready receptacle for such plants as are required for the summer decoration of the parterre. Cuttings struck in hot beds in early spring, or plants which have been kept in crowded places during the depth of winter, planted on these gently warm beds towards the end of March, and protected from frosts by glass or other covering, soon become strong and well-rooted, and are moved with much facility to their proper situations when the planting season has arrived. After the broccoli has been removed the ridges are also available for crops of such vegetables as spinach, lettuce, peas, radishes, &c., the only conditions necessary being that they should be cleared from the ground previous to earthing the successional crops of celery as they require it.

The annexed diagram, representing a course of celery culture, will probably convey a more accurate idea of the system pursued than any mere description, however elaborate.

The object I seek to attain in the cultivation of this useful esculent, is sticks of a medium size, crisp, solid, and perfectly blanched—that being the description of celery most useful for every edible purpose, and which I produce by planting somewhat closely on a bed of very rich material, kept in a tolerably moist condition by being frequently saturated with liquid manure. Blanching under such circumstances is readily accomplished by ordinary means.

The kinds of celery I cultivate are those which have usually been obtained from the shops under the names of Manchester, Seymour's, and Cole's, all of which I consider may be classed according to colour, with the solid red and solid white. The only distinct varieties which have come under my notice are the Italian or upright, the curled, the variegated, and possibly the Céleri Turc. I am aware that in the neighbourhood of some of the large manufacturing towns the artisans cultivate celery with considerable care, and that they boast of possessing several sorts of celebrity; their names, however, are so purely local as to induce the belief, that, as at Manchester and other places, cultivation under very favourable circumstances has been alone the means of producing these monster growths we sometimes hear of.



A represents a section of ground planted with broccoli and cauliflower.—*b b*, broccoli *a a*, cauliflower.

B represents the ground after the cauliflower has been removed and the celery trenches prepared for under-cropping, the broccoli stems being earthed up as a protection from frost.—*c c c*, protected broccoli; *n n n*, ground level; *d d*, trenches for celery and under-cropping; *e e e*, manure-bed; *f f*, drain-pipes covered over with rough materials, and forming a connexion with the main drains.

C represents the first crop of celery earthed up after the whole of the under-crops have been removed from the ground.—*h h*, the first celery crop; *g g g*, the second crop, planted on a bed of manure in the trenches formed by the operation of earthing up the first crop.

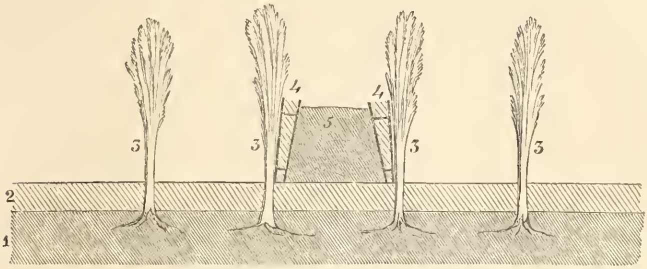
D represents the second crop, earthed up from the material on which the first crop had been grown, and the third succession planted on a new bed formed on the space formerly occupied by the first crop.—*i i i*, the second crop; *k k*, the third crop, which will ultimately be earthed from the material occupied by the second crop.

E represents the ground trenched and thoroughly mixed with the rich material so abundantly used in the cultivation of the celery crop, the subsoil being broken up as low as the drainage, but not mixed with the top soil.—*l*, top soil; *m*, subsoil.

I raise the plants from successive sowings, made respectively in the first and last weeks of February, the second week in March, and finally in the first week in April; the two first crops are raised in well drained 14-inch pots, placed near the glass in a hot bed, or other warm situation. When the plants are sufficiently large they are pricked out on a somewhat spent hotbed under glass, and well inured to the weather before being planted out in the trenches; the two last crops are sown on a slightly warm bed under glass, and some are also sown in the open ground at the latter period; when the plants from these sowings are sufficiently advanced, they are either pricked into beds of rich mould or are at once transplanted into their permanent situations, provided the early crops have been cleared from the trenches previously prepared for their growth.

The earthing up or blanching process is usually effected by three different operations: the first takes place when the plants have grown 9 or 10 inches in height; the small leaves immediately above the roots and all embryo suckers are very carefully removed. After that the bed is completely saturated with rich liquid manure, but subsequently to this period I do not consider it requisite that any artificial watering should take place; the beds are then covered with about four inches of mould from the ridges, which helps to keep the plants in an erect position, and acts like a mulching on the roots, thereby preventing in some measure the evaporation of moisture from the bed. Some three weeks before the early crop is required for use the second earthing takes place, and is performed in the following manner by two operators: two boards some eight or nine inches in depth, and equal in length to the width of the bed, are placed edgeways between the rows, each board resting against the plants in either row, so as to form at once space for the reception of the mould and a protection to the leaves whilst the operation of earthing is being performed. When the required quantity of soil has been deposited the boards are carefully withdrawn and placed between the next two rows, and so the work proceeds until all has been completed. When the soil is of a very wet, tenacious, or repugnant character, dry ashes, fine mould, or other material can readily be introduced next the plants, for which purpose double boards properly adjusted and fixed to each other form a ready medium by which to introduce the material, thus:—

Section across the bed, showing the Mode of Earthing Celery with double boards.



1, Manure-bed; 2, First earthing; 3, Celery Plants; 4, Vacuum between the adjusted boards to receive fine blanching material; 5, Common earth from the ridges.

When sufficient blanching material has been deposited, the boards are carefully withdrawn and placed in the opposite row; and it will be readily understood that the fine mould which had passed through the vacuum formed between the boards, will be in immediate connexion with the leaves of the plants, the common earth placed in the centre of the row enabling it to maintain that position. These boards can, of course, be readily set any required distance apart, that distance being determined by the quantity of blanching material at command. This mode, whether applied to single rows or the more economical system of bed culture, I consider to be at least equal in its effects to any advantage that can be derived from the use of tiles—and this altogether apart from any consideration of the original expense of such ware, or the frequent breakage arising from the action of frost or other inevitable causes; and where, as at a ducal establishment I was formerly connected with, 12,000 plants were annually grown, the item for such dilapidations would amount to something considerable, and that too without conferring any equivalent benefit.

The third and final earthing of the early crops is accomplished at intervals of 10 or 12 days before the celery is required for use—placing the mould high and close about the leaves. I have, however, found a different system to be advantageous with celery intended for winter use. Some time towards the latter part of October, when the weather is dry and favourable, the plants are fully earthed up, but the soil is neither put so high nor is so closely packed to the leaves as is recommended for the earlier crops, as I have found it to keep better under such conditions: after the winter has fairly set in, I have a sufficient quantity for a fortnight's consumption covered over with leaves which had previously been heated, and from which cause they will readily remain in flakes of some 6 inches in thickness, and resist alike the action of frost or moisture. The covering over a day's consumption is merely removed with a fork so much further on to the bed, and this takes place from day to day. When, however, severe frosts set in, the whole of the ridges are covered over in the same manner, but the protection is removed on the recurrence of favourable weather in order that the plants should not suffer from being too closely excluded from the atmosphere.

It will be perceived from the system here recommended that an enormous mass of vegetable matter can readily be obtained from a very limited portion of ground—that from the mode of arrangement the operations necessary for the cultivation of one crop become subservient to that of another—that the soil, from being so very frequently turned and aërated in fine weather, becomes fully disintegrated, and finally mixed with so large a portion of rich material, it is in a very favourable condition for the succeeding crop—and that such a system carried through any part of a garden must inevitably change its condition, however obdurate or sterile the nature of the soil may be. Moreover, this concentrated mode of cultivation economizes not only labour, but manure and water also; the plants too being in close proximity afford a mutual shelter, and consequently a quicker growth ensues than under circumstances of greater exposure, and on this altogether depends that crispness and solidity so desirable in this esculent.

A root crop is that which usually follows in the routine, being not only of a totally different character to the crops of the previous season, but from the circumstance of the ground having been cultivated so deeply, and so frequently and thoroughly aërated, it might be considered to be in a state well adapted for their growth, and more especially the tap rooted sections of that class. I have this season, however, been induced to change that routine from the circumstance of the site being very favourable for a permanent crop, in much request here, and it is now being planted with Wilmot's late red currant, with cauliflowers between the rows, which will be again interlined with the successional plants on which the early crops of strawberries are growing so soon as they have been removed from the forcing-houses.

NEW PLANTS, ETC., FROM THE SOCIETY'S GARDEN.

10. Rhamnus croceus. *Nuttall, in Torrey and Gray's Flora of North America*, i. 261.

Raised from seeds received from Hartweg in January, 1848, and marked "a dwarf evergreen shrub, near the sea-shore, Monterey."

A small evergreen bush, first described by Mr. Nuttall, who found it on bushy hills and in thickets near Monterey, and who describes it as "A much-branched thorny shrub, with yellow wood; the whole plant imparted a yellow colour to water. Leaves about ½ an inch long, lucid, when dry of a bright yellowish-brown beneath: petioles about 1 line long. Fascicles 2-6-flowered: pedicels as long as the petioles. Sepals ovate, with 1 middle and 2 marginal nerves. Stamens nearly as long as the sepals. Ovary ovate. Styles often distinct below the middle. Fruit greenish or yellowish, usually (by abortion) 1-seeded. Seed with a longitudinal furrow on one side."

In the Garden it proves to be a neat small-leaved evergreen, which, if hardy, would be a useful shrubbery plant; but near London it is tender. It flowers in June.

11. Calycanthus occidentalis. *Hooker*, *Botany of Beechey's Voyage*, p. 340, t. 84.

Raised from seeds sent home by Hartweg from California, under the name of Calycanthus macrophyllus, and said to be a shrub 6 feet high, growing along rivulets near Sonoma.

A pale green bush; leaves oblong, acuminate, smooth, and coloured alike on both sides, with short stalks; obtuse or slightly cordate at the base, somewhat scabrous above. Flowers solitary, brownish red, larger than usual, with a subacid unpleasant odour. Bracts numerous, subulate, revolute, green. Sepals and petals linear-lanceolate, obtuse, the outer spreading or even rolled back, the inner erect, few, of unequal lengths, incurved, completely concealing the stamens.

This species is rather tender, with a handsomer foliage than other "Carolina Allspices," but without their delicious fragrance. It is more an object of botanical than horticultural interest. It flowers in June and July.

12. Epidendrum coriifolium.*

A native of Central America, presented to the Society by G. U. Skinner, Esq.

This singular plant is, in all its parts, of a tough, thick, leathery texture, and is generally glazed, as it were, with a shining exudation. The narrow stiff leaves are blunt, about 6 inches long, concave, with a sharp midrib. The spike, which is terminal, and about 4 inches long, consists of hard amplexicaul keeled bracts

* E. *coriifolium* (Euepidendrum); foliis angustis coriaceis subdistichis carinatis concavis obtusis, spicâ densâ terminali, bracteis coriaceis carinatis herbaceis distichis ovario longioribus, sepalis lateralibus crassis carinatis ovalibus, petalis linearibus spathulatis, labello subrotundo plano emarginato per medium calloso.

Epidendrum coriifolium.

pressed close to the flowers, and forming a kind of cone before they expand. The flowers are pale green, very firm and leathery, with a broad roundish convex lip, having an elevated callosity along the middle. The lateral sepals, which are particularly thick, have a serrated keel at the back.

It is a species of no beauty, nearly related to *Ep. rigidum*, but its leaves are much longer and narrower, and the flowers 3 or 4 times as large, and extremely coriaceous. It flowers in March or April in the stove.

13. CEANOTHUS CUNEATUS. *Nuttall, in Torrey and Gray's Flora of North America*, vol. i. p. 267.

Raised from seeds received from Hartweg in June, 1848, marked Ceanothus sp., with white flowers, a shrub 6 or 8 feet high, from the Sacramento mountains. It is tender, and will not live in the open border. It flowers in May.

This shrub is described as follows by Mr. Nuttall:—"A shrub 6 to 10 feet high, with somewhat thorny greyish terete branches, very closely interwoven, sometimes forming thickets. Leaves $\frac{1}{2}$ an inch or more in length, and about 2 lines wide; very rarely with 1 or 2 teeth near the extremity; the numerous regular, simple, and oblique veins rather conspicuous on the lower surface. Flowers in small axillary umbels: the peduncles and pedicels increasing in length as the fruit ripens. Calyx and corolla white: petals cucullate, unguiculate. Styles united above the middle, and then spreading. Fruit as large as an ordinary pea, sub-globose; the exocarp somewhat pulpy, with 3 rather soft horn-like projections from the summit of the angles: the coherent base of the calyx unusually large. Seeds even on both sides, black, polished. The whole plant (like several succeeding species) exhales a balsamic odour, and the mature fruit is covered with a bitter varnish."

It is said to grow as far north as "the dry gravelly islands and bars of the Wahlamut river above the falls," in Oregon; but it is best known from more southern regions, Hartweg's discovery of it in California having been anticipated by the naturalists with Captain Beechey, and by Dr. Coulter, of whose dried plants it is No. 110. In our Gardens it betrays a tender climate, for it is far more impatient of cold than the other Californian species, than which it is much less attractive, for its scanty white flowers produce a shabby appearance, for which the leaves and scrubby aspect of the species do not compensate.

14. Eucalyptus coccifera. *J. Hooker, in London Journal of Botany*, vi. 477.

This plant was exhibited in flower at the June meeting of the Society by Messrs. Veitch, under the name of Eucalyptus montana. It has lived for many years in the Garden against a south wall without being injured, but the plants in the open borders dwindled away and died.

According to Messrs. Veitch it is perfectly hardy at Exeter, where it already forms a fine open spreading tree, 20 feet high, and from 15 to 18 feet through. It has grown there for eleven years, and when in flower in June looks like an apple-tree or pear-tree loaded with blossoms. According to Dr. Hooker it is

Eucalyptus coccifera.

a species inhabiting the highest mountains of Van Diemen's Land, where it becomes a bush, or small tree, about 10 feet high.

It is both Nos. 411 and 1076 of Mr. Gunn's collections, and appears to be sometimes glaucous, sometimes green.

In the Garden it has a thick bluish bloom spread over every part. The branches are purplish brown, and slightly rugged. The leaves oblong, more or less narrow, long-stalked, usually equal sided, and most commonly extended at the point into a long and slender awn, by which it is readily recognized.

The flowers are produced on short compressed peduncles in clusters of three to five; the tube of the calyx is pear-shaped, and the lid rugged and convex, but slightly concave in the centre. The fruit when ripe is nearly hemispherical, with a slightly-raised even border.

As far as can be at present ascertained, this may be expected to prove one of the hardiest of the Van Diemen's Island trees.

XVIII.—*A short Account of the Cultivation of the Victoria Water Lily in an open heated pond.* By J. Weeks, F.H.S., King's Road, Chelsea.

(Communicated June 12, 1851.)

A CIRCULAR pond, 21 feet in diameter and 3½ feet deep, was constructed for this queen of aquatics after the following manner:—When the earth was thrown out to the required depth and width, the bottom and sides were coated with well prepared clay to the thickness of 2 feet, in order to make the whole water-tight; over that a layer of loose bricks was placed for the purpose of keeping the water clear, and giving the pond a neat appearance. Since then it has been encircled by rockwork, which protects it from cold draughts. The water in the pond is heated by pipes connected with a boiler, which also heats a range of houses. The length of piping in the pond is 84 feet; the flow pipe is 3 inches in the bore, and the return pipe 2 inches. With this quantity of piping the temperature can be kept at from 75° to 90°, but the regular warmth is about 76°. The plant is placed in the pond in the centre of the piping in an oval pit or tub, 8 feet by 6 feet, built with *loose* bricks for the purpose of allowing the heated water to permeate the compost, which consists of loam, turfy peat, and river sand. A constant stream of clear cold water flows into the pond, the supply to which is regulated by a stop-cock. There is also a waste pipe which can be elevated or depressed according to the quantity of water required in the pond. In this way the plant has always plenty of good *fresh* water to grow in. A temporary frame is provided for placing over the plant, but this is removed at all times when the weather is favourable, and the plant is then fully exposed, which is the case almost every day in summer. The Victoria was placed in the pond on the 3rd of March, on a very cold, wet day, from the effects of which it did not however suffer in the least, and it has succeeded well ever since, increasing daily in size and strength, and throwing out roots in all directions, many of which come to the surface of the water. Flowering commenced on the 16th of May, and blossoms still continue to be produced. A worse season than the present could, however, scarcely have been selected for trying the experiment, which has hitherto been perfectly successful. The trial may be said to have proved that those who possess a range of houses, or even a single house heated by a boiler, can enjoy the beauties of this truly regal plant, together with those of other tender water lilies and stove aquatics, at a trifling expense.

XIX.—*Protecting Fruit Blossoms.* By Robert Errington, C.M.H.S., Gardener to Sir Philip de Malpas Grey Egerton, Bt., M.P., F.H.S., Oulton Park, Tarporley, Cheshire.

(Communicated June 3, 1851.)

Many of the readers of this Journal are doubtless aware of the conflicting character of the opinions of both theorists and practical men as to the propriety of what is commonly termed the "protection of fruit blossoms;" and it is strange that this question, which has been mooted constantly for these last twenty years, is yet, it would appear, scarcely settled in a conclusive way. The fact is—I would deferentially suggest—that an amount of protection when the blossoms begin to unfold, which will ward off the rigour of unusually severe weather for the period, is only a complemental procedure to a practice of far more importance which should be connected therewith; I mean RETARDATION OF THE BLOSSOMS.

Nevertheless, although this course has been often pointed to, during the last three years especially, yet few at present would seem to fall in with the practice; albeit nothing that I have heard has been found to oppose it, either in theory or experience. We may readily take a lesson in this from the flower garden or the shrubbery. Have we not repeatedly seen a covering applied to such precarious shrubs as the tree pæony, or, at least, heard of experienced cultivators planting it in a situation free from the sudden excitements of intense and long continued sunlight?

Many other such matters might be urged as pointing to the benefits derivable from this practice; but a common sense view of the affair alone might be presumed to settle it. It was always understood of hot walls, applied to the culture of the peach, nectarine, and apricot, that good practitioners hesitated to avail themselves of the heat to *excite* their trees into blossom; but that such having actually commenced through the mere rising warmth of the spring, the flues were put in action merely to ward off the rigour of the night; making, however, a liberal use of them in the autumn to complete the ripening of the wood.

Apricots commence blooming, for the most part, in the beginning of March; peaches and nectarines a few weeks later: but at whatever period such trees may blossom, who is he that would not prefer a later period still?—that is to say, as to the average of seasons. The later the period of blossoming the greater the chances of a crop; this may be fairly taken as an axiom in horticultural affairs: indeed the whole question turns on this view of the subject. In further confirmation of such an opinion I would remark that such arguments carry additional weight from the circumstance of our very best fruit catalogues—even that of the Horticultural Society itself—sometimes dwelling on the advantages of late bloomers escaping the spring frosts.

I would therefore respectfully advise those who feel an interest in the matter to consider well whether such arguments possess in reality weight. To retard safely, however, an early beginning is necessary. To wait until the bud is half developed is to arrest that reciprocation between root and branch which has already commenced, and on which the developing bud depends in a great degree for its vital action. This lively motion in the sap will be obvious to any one who considers for a moment the phenomena connected with the bleeding of vines or birch trees in the act of tapping for the purposes of wine making, and in the peeling of oak bark ; all of which may be placed in the same category. All these, I say, sufficiently attest the activity of the fluids at a very early period, even to the most unscientific observer ; and it is by no means too much to infer, that a considerable portion of the damage occurring to fruit blossoms in early spring results from the arrest of the fluids through fluctuations in atmospheric temperature.

To retard therefore in earnest is simply to prolong the departure of the winter, and thus to increase the chances of a genial atmosphere. It is well known that the earth becomes, through the daily increasing power of the solar rays, a reservoir of heat, and that this accumulated warmth serves, by radiation, to qualify the circumambient atmosphere during the night. Now, by a *very early* retardation this accumulation is very much impeded ; and hence a tendency in the buds to remain nearly stationary for a much longer period. It will be found good practice, then, to apply coverings at once protective and retarding in the end of January ; for by that period the sun at intervals exercises much influence, especially on the southern walls of gardens. How often have we seen the blossom buds of peaches, nectarines, &c., look truly alarming through their much advanced state in the course of February !—indeed it is astonishing what an amount of solar heat will at times be generated near the surface of a south wall when the sun shines on it for hours in the absence of wind. A canvas covering, after the manner of a conservative wall, will doubtless be found the best policy in the end ; especially if the wall possess a good coping of some 15 inches ; the canvas working as a curtain.

Spruce boughs are, however, excellent things, for they possess the desirable property of casting their leaves in a progressive way, and that, too, in the very period in which such a change in their opacity becomes really necessary.

I would now beg to advert to another and collateral point of no mean consequence in the course suggested, and that is that by such a retarding course the root action becomes, if not in advance of that of the branch, at least in action, through an increased accession of warmth. Now in this we see a real bottom heat, according to the sense in which "bottom heat" ought to be alone received; that is to say in its relation to the atmosphere, and not as a specific and absolute condition. Propagators, fruit forcers, and cultivators of all kinds fly to this in most emergencies; and it is indeed so important a principle as to be mixed up less or more with all our gardening processes.

XX.—*Report upon some Experiments undertaken at the suggestion of Professor Lindley, to ascertain the Comparative Evaporating Properties of Evergreen and Deciduous Trees.* By J. B. Lawes, Esq., of Rothamstead.

In the month of December, 1849, I selected from a nursery garden three plants, each of the twelve varieties named below; they were fine healthy plants, of a size well adapted for transplanting; and although the three plants of a similar description resembled each other as nearly as it was possible to determine by the eye, the nature of the varieties prevented any close agreement between plants of a different species. For instance, the Ash, Larch, Oak, Sycamore, had each one stem of small branches, while the two Berberies, the Laurels, the Yew, were bushy shrubs. One plant of each sort was planted in a garden, another was reserved for the experiments to be recorded, and a third was weighed after having the earth washed carefully from the root. The following Table will give some idea of the comparative size of the plants under experiment:—

	Weight of Plant.		Weight of Green Leaves.	
	In ozs. and grs.		In ozs. and grs.	
Spruce Fir	15	160		
Portugal Laurel	18	..	3	350
Evergreen Berbery	3	160	1	132
Yew	22	330		
Holly	16	10	1	316
Common Laurel	24	260	9	121
Ilex	4	280	0	434
Larch	4	170		
Oak	2	370		
Deciduous Berbery	7	240		
Ash	4	40		
Sycamore	2	24		

Zinc pots about 20 inches deep and 36 inches in circumference were filled with good garden mould, mixed with loam, and a tree was planted in each on the 22nd of December: they weighed about 42 lbs. each; on the surface of the pot a zinc plate was fixed, having a hole to admit the stem; these plates did not fit very close, and a certain amount of the water evaporated is due to this cause. Towards the end of April a piece of oilskin was placed over the zinc plate, being fastened round the stem of the tree by India rubber string, and also around the pot below the opening with an elastic band, which effectually prevented all escape of water except through the trees. The plants were placed in an open shed protected from the rain, and were supplied with water from time to time as they seemed to require it; the weights were taken by means of the apparatus described in the Journal of the Horticultural Society of January, 1850. Upon referring to Table I. it will be seen that a considerable falling off in the water evaporated is apparent at the period when the oilskin was put over the openings and the air perfectly excluded. Part of the plants were covered April 14th, and the remainder April 24th; it appears to me probable that the reduction in the water evaporated is not entirely due to the water being prevented from escaping through the hole in the lid, but it is partly due to an injurious effect upon the plant itself, some of them having evidently suffered. With the exception of the Ilex, which declined from the commencement, and appeared to be dead, or nearly so, in the spring, all the plants are alive at this time, but not equally healthy. The Yew has been perfectly healthy all the year; shoots about 2 inches long have been produced from each stem; it is quite as vigorous as one exactly similar planted in the garden. Evergreen Berbery, perfectly healthy, lost all its leaves in the spring, and produced fresh ones quite equal to that in the garden. Portugal Laurel, about the same as when planted, has not grown. Common Laurel, a great many leaves fallen at various times, which have not been reproduced; the garden plant much healthier. Spruce Fir produced young shoots about 2 inches long, which are now green, but the remainder of the plant is brown, and I should think would die, if not removed. Holly very healthy, a little grown, quite equal to the garden plant. Larch grew well at first, but in the summer the leaves were covered with spots of turpentine, and the colour of the leaves was unhealthy; I should doubt whether it would live another year. Sycamore tolerably healthy, but some of the leaves mildewed. Oak and Ash about the same, tolerably healthy. Berberis D. healthy all the year. Table No. II., in which the water evaporated is divided into periods of four months, shows very clearly the peculiar properties of Evergreen and Deciduous trees. Of the six Evergreen plants, the water evaporated during the first four months was 44 per cent. of the water evaporated during the following four months; while in the Deciduous plants it was only 14 per cent.: this would account for the large percentage of loss when Evergreens are transplanted in winter. In Table IV., where the water evaporated is divided into three portions, the comparative proportion of the two classes of plants is still more clearly shown.

Table I.

Loss of Water obtained by Weighing various Plants during a Period of Twelve Months.—Actual Results of Loss in Grains.

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
SPRUCE FIR.					
Dec. 22 to Jan. 3 .	11	4,620	420·0	30·50	1·18
Jan. 3 to Jan. 13 .	10	1,415	141·5	32·15	0·06
Jan. 13 to Jan. 23 .	10	2,645	264·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	2,320	210·9	31·18	0·24
Feb. 3 to Feb. 13 .	10	3,195	319·5	40·95	1·40
Feb. 13 to Feb. 23 .	10	3,645	364·5	44·20	2·00
Feb. 23 to Mar. 5 .	10	2,660	266·0	41·65	1·60
Mar. 5 to Mar. 15 .	10	3,140	314·0	39·80	3·70
Mar. 15 to Mar. 25 .	10	3,330	333·0	35·35	4·76
Mar. 25 to Apr. 4 .	10	6,160	616·0	40·40	5·46
Apr. 4 to Apr. 14 .	10	3,110	311·0	49·35	2·03
Apr. 14 to Apr. 24 .	10	2,505	250·5	47·75	2·50
Apr. 24 to May 4 .	10	3,295	329·5	45·60	9·66
May 4 to May 14 .	10	2,480	248·0	47·40	3·00
May 14 to May 24 .	10	2,880	288·0	52·75	4·30
May 24 to June 3 .	10	4,550	455·0	56·30	5·13
June 3 to June 13 .	10	5,520	552·0	59·10	8·80
June 13 to June 23 .	10	8,800	880·0	56·55	9·86
June 23 to July 23 .	30	17,670	589·0	61·96	4·61
July 23 to Aug. 22 .	30	11,300	376·6	62·13	2·10
Aug. 22 to Sept. 21 .	30	11,260	375·3	53·90	4·97
Sept. 21 to Oct. 21 .	30	11,680	389·3	49·21	2·21
Oct. 21 to Nov. 20 .	30	4,530	151·0	43·86	1·18
Nov. 20 to Dec. 31 .	41	1,640	40·0	38·57	0·18

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
PORTUGAL LAUREL.					
Dec. 22 to Jan. 3 .	11	3,960	360	30·50	1·18
Jan. 3 to Jan. 13 .	10	1,300	130	32·15	0·06
Jan. 13 to Jan. 23 .	10	1,840	184	28·20	0·86
Jan. 23 to Feb. 3 .	11	1,760	160	31·18	0·24
Feb. 3 to Feb. 13 .	10	3,550	355	40·95	1·40
Feb. 13 to Feb. 23 .	10	3,400	340	44·20	2·00
Feb. 23 to Mar. 5 .	10	3,010	301	41·65	1·60
Mar. 5 to Mar. 15 .	10	3,440	344	39·80	3·70
Mar. 15 to Mar. 25 .	10	5,190	519	35·35	4·76
Mar. 25 to Apr. 4 .	10	4,230	423	40·40	5·46
Apr. 4 to Apr. 14 .	10	4,740	474	49·35	2·03
Apr. 14 to Apr. 24 .	10	3,320	332	47·75	2·50
Apr. 24 to May 4 .	10	3,900	390	45·60	9·66
May 4 to May 14 .	10	3,510	351	47·40	3·00
May 14 to May 24 .	10	5,080	508	52·75	4·30
May 24 to June 3 .	10	8,540	854	56·30	5·13
June 3 to June 13 .	10	9,120	912	59·10	8·80
June 13 to June 23 .	10	11,160	1116	56·55	9·86
June 23 to July 23 .	30	30,390	1013	61·96	4·61
July 23 to Aug. 22 .	30	31,840	1061·3	62·13	2·10
Aug. 22 to Sept. 21 .	30	26,670	889	53·90	4·97
Sept. 21 to Oct. 21 .	30	18,520	617·3	49·21	2·21
Oct. 21 to Nov. 20 .	30	5,660	188·7	43·86	1·18
Nov. 20 to Dec. 31 .	41	2,270	55·3	38·57	0·18
EVERGREEN BERBERIS.					
Dec. 22 to Jan. 3 .	11	1,810	164·5	30·50	1·18
Jan. 3 to Jan. 13 .	10	745	74·5	32·15	0·06
Jan. 13 to Jan. 23 .	10	810	81·0	28·20	0·86
Jan. 23 to Feb. 3 .	11	875	79·5	31·18	0·24
Feb. 3 to Feb. 13 .	10	1,860	186·0	40·95	1·40
Feb. 13 to Feb. 23 .	10	2,940	294	44·20	2·00
Feb. 23 to Mar. 5 .	10	1,670	167	41·65	1·60
Mar. 5 to Mar. 15 .	10	2,180	218	39·80	3·70
Mar. 15 to Mar. 25 .	10	3,320	332	35·35	4·76
Mar. 25 to Apr. 4 .	10	2,660	266	40·40	5·46
Apr. 4 to Apr. 14 .	10	2,620	262	49·35	2·03
Apr. 14 to Apr. 24 .	10	3,040	304	47·75	2·50
Apr. 24 to May 4 .	10	2,330	233	45·60	9·66
May 4 to May 14 .	10	1,640	164	47·40	3·00
May 14 to May 24 .	10	2,870	287	52·75	4·30
May 24 to June 3 .	10	5,950	595	56·30	5·13
June 3 to June 13 .	10	9,020	902	59·10	8·80
June 13 to June 23 .	10	7,750	775	56·55	9·86
June 23 to July 23 .	30	31,160	1038·6	61·96	4·61
July 23 to Aug. 22 .	30	26,180	872·7	62·13	2·10
Aug. 22 to Sept. 21 .	30	22,510	750·3	53·90	4·97
Sept. 21 to Oct. 21 .	30	17,170	572·3	49·21	2·21
Oct. 21 to Nov. 20 .	30	5,540	184·7	43·86	1·18
Nov. 20 to Dec. 31 .	41	1,700	41·4	38·57	0·18

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
		YEW.			
Dec. 22 to Jan. 3 .	11	3,720	338·2	30·50	1·18
Jan. 3 to Jan. 13 .	10	1,795	179·5	32·15	0·06
Jan. 13 to Jan. 23 .	10	1,985	198·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	2,420	220	31·18	0·24
Feb. 3 to Feb. 13 .	10	3,650	365	40·95	1·40
Feb. 13 to Feb. 23 .	10	4,630	463	44·20	2·00
Feb. 23 to Mar. 5 .	10	4,300	430	41·65	1·60
Mar. 5 to Mar. 15 .	10	4,800	480	39·80	3·70
Mar. 15 to Mar. 25 .	10	5,370	537	35·35	4·76
Mar. 25 to Apr. 4 .	10	7,480	748	40·40	5·46
Apr. 4 to Apr. 14 .	10	7,090	709	49·35	2·03
Apr. 14 to Apr. 24 .	10	8,160	816	47·75	2·50
Apr. 24 to May 4 .	10	8,700	870	45·60	9·66
May 4 to May 14 .	10	4,450	445	47·40	3·00
May 14 to May 24 .	10	7,020	702	52·75	4·30
May 24 to June 3 .	10	9,750	975	56·30	5·13
June 3 to June 13 .	10	8,505	850·5	59·10	8·80
June 13 to June 23 .	10	9,555	955·5	56·55	9·86
June 23 to July 23 .	30	30,370	1012·3	61·96	4·61
July 23 to Aug. 22 .	30	24,285	809·5	62·13	2·10
Aug. 22 to Sept. 21 .	30	21,845	728·1	53·90	4·97
Sept. 21 to Oct. 21 .	30	20,060	668·6	49·21	2·21
Oct. 21 to Nov. 20 .	30	6,590	219·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	730	17·8	38·57	0·18
		HOLLY.			
Dec. 22 to Jan. 3 .	11	1,800	163·6	30·50	1·18
Jan. 3 to Jan. 13 .	10	610	61·0	32·15	0·06
Jan. 13 to Jan. 23 .	10	845	84·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	1,125	102·2	31·18	0·24
Feb. 3 to Feb. 13 .	10	2,070	207	40·95	1·40
Feb. 13 to Feb. 23 .	10	2,760	276	44·20	2·00
Feb. 23 to Mar. 5 .	10	1,820	182	41·65	1·60
Mar. 5 to Mar. 15 .	10	2,640	264	39·80	3·70
Mar. 15 to Mar. 25 .	10	3,200	320	35·35	4·76
Mar. 25 to Apr. 4 .	10	2,590	259	40·40	5·46
Apr. 4 to Apr. 14 .	10	2,620	262	49·35	2·03
Apr. 14 to Apr. 24 .	10	1,700	170	47·75	2·50
Apr. 24 to May 4 .	10	2,300	230	45·60	9·66
May 4 to May 14 .	10	1,400	140	47·40	3·00
May 14 to May 24 .	10	2,130	213	52·75	4·30
May 24 to June 3 .	10	3,225	322	56·30	5·13
June 3 to June 13 .	10	2,915	291·5	59·10	8·80
June 13 to June 23 .	10	2,370	237	56·55	9·86
June 23 to July 23 .	30	9,140	304·7	61·96	4·61
July 23 to Aug. 22 .	30	10,100	336·6	62·13	2·10
Aug. 22 to Sept. 21 .	30	7,150	238·3	53·90	4·97
Sept. 21 to Oct. 21 .	30	7,820	260·6	49·21	2·21
Oct. 21 to Nov. 20 .	30	3,780	126	43·86	1·18
Nov. 20 to Dec. 31 .	41	1,500	37·3	38·57	0·18

COMMON LAUREL.

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
Dec. 22 to Jan. 3 .	11	2,718	247	30·50	1·18
Jan. 3 to Jan. 13 .	10	1,802	180·2	32·15	0·06
Jan. 13 to Jan. 23 .	10	1,895	189·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	2,415	219·5	31·18	0·24
Feb. 3 to Feb. 13 .	10	3,715	371·5	40·95	1·40
Feb. 13 to Feb. 23 .	10	3,895	389·5	44·20	2·00
Feb. 23 to Mar. 5 .	10	3,250	325	41·65	1·60
Mar. 5 to Mar. 15 .	10	4,270	427	39·80	3·70
Mar. 15 to Mar. 25 .	10	4,910	491	35·35	4·76
Mar. 25 to Apr. 4 .	10	4,890	489	40·40	5·46
Apr. 4 to Apr. 14 .	10	5,460	546	49·35	2·03
Apr. 14 to Apr. 24 .	10	4,220	422	47·75	2·50
Apr. 24 to May 4 .	10	7,160	716	45·60	9·66
May 4 to May 14 .	10	8,240	824	47·40	3·00
May 14 to May 24 .	10	12,375	1237·5	52·75	4·30
May 24 to June 3 .	10	13,795	1379·5	56·30	5·13
June 3 to June 13 .	10	12,590	1259	59·10	8·80
June 13 to June 23 .	10	11,590	1159	56·55	9·86
June 23 to July 23 .	30	37,450	1248·3	61·96	4·61
July 23 to Aug. 22 .	30	26,640	888	62·13	2·10
Aug. 22 to Sept. 21 .	30	22,940	764·6	53·90	4·97
Sept. 21 to Oct. 21 .	30	16,520	550·6	49·21	2·21
Oct. 21 to Nov. 20 .	30	6,110	203·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	2,030	49·5	38·57	0·18

ILEX.

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
Dec. 22 to Jan. 3 .	11	980	89·1	30·50	1·18
Jan. 3 to Jan. 13 .	10	370	37	32·15	0·06
Jan. 13 to Jan. 23 .	10	820	82	28·20	0·86
Jan. 23 to Feb. 3 .	11	580	52·7	31·18	0·24
Feb. 3 to Feb. 13 .	10	240	24	40·95	1·40
Feb. 13 to Feb. 23 .	10	1,350	135	44·20	2·00
Feb. 23 to Mar. 5 .	10	580	58	41·65	1·60
Mar. 5 to Mar. 15 .	10	1,130	113	39·80	3·70
Mar. 15 to Mar. 25 .	10	2,600	260	35·35	4·76
Mar. 25 to Apr. 4 .	10	1,020	102	40·40	5·46
Apr. 4 to Apr. 14 .	10	1,130	113	49·35	2·03
Apr. 14 to Apr. 24 .	10	160	16	47·75	2·50
Apr. 24 to May 4 .	10	330	33	45·60	9·66
May 4 to May 14 .	10	240	24	47·40	3·00
May 14 to May 24 .	10	260	26	52·75	4·30
May 24 to June 3 .	10	650	65	56·30	5·13
June 3 to June 13 .	10	234	23·4	59·10	8·80
June 13 to June 23 .	10	296	29·6	56·55	9·86
June 23 to July 23 .	30	480	16	61·96	4·61
July 23 to Aug. 22 .	30	600	20	62·13	2·10
Aug. 22 to Sept. 21 .	30	180	6	53·90	4·97
Sept. 21 to Oct. 21 .	30	800	26·6	49·21	2·21
Oct. 21 to Nov. 20 .	30	140	4·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	360	8·7	38·57	0·18

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
LARCH.					
Dec. 22 to Jan. 3 .	11	640	58·1	30·50	1·18
Jan. 3 to Jan. 13 .	10	100	10	32·15	0·06
Jan. 13 to Jan. 23 .	10	125	12·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	215	19·5	31·18	0·24
Feb. 3 to Feb. 13 .	10	610	61	40·95	1·40
Feb. 13 to Feb. 23 .	10	1,070	107	44·20	2·00
Feb. 23 to Mar. 5 .	10	450	45	41·65	1·60
Mar. 5 to Mar. 15 .	10	1,040	104	39·80	3·70
Mar. 15 to Mar. 25 .	10	2,040	204	35·35	4·76
Mar. 25 to Apr. 4 .	10	1,440	144	40·40	5·46
Apr. 4 to Apr. 14 .	10	1,580	158	49·35	2·03
Apr. 14 to Apr. 24 .	10	2,260	226	47·75	2·50
Apr. 24 to May 4 .	10	960	96	45·60	9·66
May 4 to May 14 .	10	720	72	47·40	3·00
May 14 to May 24 .	10	1,270	127	52·75	4·30
May 24 to June 3 .	10	1,680	168	56·30	5·13
June 3 to June 13 .	10	2,160	216	59·10	8·80
June 13 to June 23 .	10	3,000	300	56·55	9·86
June 23 to July 23 .	30	16,690	556·3	61·96	4·61
July 23 to Aug. 22 .	30	26.050	868·3	62·13	2·10
Aug. 22 to Sept. 21 .	30	24,850	828·3	53·90	4·97
Sept. 21 to Oct. 21 .	30	21,580	719·3	49·21	2·21
Oct. 21 to Nov. 20 .	30	3,320	110·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	450	40·9	38·57	0 18
OAK.					
Dec. 22 to Jan. 3 .	11	660	60	30·50	1·18
Jan. 3 to Jan. 13 .	10	150	15	32·15	0·06
Jan. 13 to Jan. 23 .	10	125	12·5	28·20	0·86
Jan. 23 to Feb. 3 .	11	155	14·1	31·18	0·24
Feb. 3 to Feb. 13 .	10	190	19	40·95	1·40
Feb. 13 to Feb. 23 .	10	200	20	44·20	2·00
Feb. 23 to Mar. 5 .	10	390	39	41·65	1·60
Mar. 5 to Mar. 15 .	10	790	79	39·80	3·70
Mar. 15 to Mar. 25 .	10	2,110	211	35·35	4·76
Mar. 25 to Apr. 4 .	10	1,290	129	40·40	5·46
Apr. 4 to Apr. 14 .	10	900	90	49·35	2·03
Apr. 14 to Apr. 24 .	10	1,550	155	47·75	2·50
Apr. 24 to May 4 .	10	10	1	45·60	9·66
May 4 to May 14 .	10	210	21	47·40	3·00
May 14 to May 24 .	10	270	27	52·75	4·30
May 24 to June 3 .	10	1,220	122	56·30	5·13
June 3 to June 13 .	10	1,590	159	59·10	8·80
June 13 to June 23 .	10	2,390	239	56·55	9·86
June 23 to July 23 .	30	11,710	390·3	61·96	4·61
July 23 to Aug. 22 .	30	17,650	588·3	62·13	2·10
Aug. 22 to Sept. 21 .	30	17,730	591	53·90	4·97
Sept. 21 to Oct. 21 .	30	13,950	465	49·21	2·21
Oct. 21 to Nov. 20 .	30	4,460	148·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	890	21·7	38·57	0·18

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
DECIDUOUS BERBERIS.					
Dec. 22 to Jan. 3 .	11	820	74·5	30·50	1·18
Jan. 3 to Jan. 13 .	10	155	15·5	32·15	0·06
Jan. 13 to Jan. 23 .	10	190	19	28·20	0·86
Jan. 23 to Feb. 3 .	11	185	16·8	31·18	0·24
Feb. 3 to Feb. 13 .	10	530	53	40·95	1·40
Feb. 13 to Feb. 23 .	10	825	82·5	44·20	2·00
Feb. 23 to Mar. 5 .	10	375	37·5	41·65	1·60
Mar. 5 to Mar. 15 .	10	1,240	124	39·80	3·70
Mar. 15 to Mar. 25 .	10	2,460	246	35·35	4·76
Mar. 25 to Apr. 4 .	10	3,350	335	40·40	5·46
Apr. 4 to Apr. 14 .	10	1,080	108	49·35	2·03
Apr. 14 to Apr. 24 .	10	530	53	47·75	2·50
Apr. 24 to May 4 .	10	2,370	237	45·60	9·66
May 4 to May 14 .	10	3,180	318	47·40	3·00
May 14 to May 24 .	10	5,895	589·5	52·75	4·30
May 24 to June 3 .	10	9,105	910·5	56·30	5·13
June 3 to June 13 .	10	9,514	951·4	59·10	8·80
June 13 to June 23 .	10	10,236	1023·6	56·55	9·86
June 23 to July 23 .	30	31,870	1062·3	61·96	4·61
July 23 to Aug. 22 .	30	30,020	1000·6	62·13	2·10
Aug. 22 to Sept. 21 .	30	32,990	1099·6	53·90	4·97
Sept. 21 to Oct. 21 .	30	28,770	959	49·21	2·21
Oct. 21 to Nov. 20 .	30	3,770	125·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	550	13·4	38·57	0·18
ASH.					
Dec. 22 to Jan. 3 .	10	1,290	107·2	30·50	1·18
Jan. 3 to Jan. 13 .	10	110	10	32·15	0·06
Jan. 13 to Jan. 23 .	10	100	10	28·20	0·86
Jan. 23 to Feb. 3 .	10	100	9	31·18	0·24
Feb. 3 to Feb. 13 .	10	690	69	40·95	1·40
Feb. 13 to Feb. 23 .	10	390	39	44·20	2·00
Feb. 23 to Mar. 5 .	10	280	28	41·65	1·60
Mar. 5 to Mar. 15 .	10	830	83	39·80	3·70
Mar. 15 to Mar. 25 .	10	1,830	183	35·35	4·76
Mar. 25 to Apr. 4 .	10	1,290	129	40·40	5·46
Apr. 4 to Apr. 14 .	10	650	65	49·35	2·03
Apr. 14 to Apr. 24 .	10	340	34	47·75	2·50
Apr. 24 to May 4 .	10	345	34·5	45·60	9·66
May 4 to May 14 .	10	535	53·5	47·40	3·00
May 14 to May 24 .	10	1,560	156	52·75	4·30
May 24 to June 3 .	10	5,560	556	56·30	5·13
June 3 to June 13 .	10	7,850	785	59·10	8·80
June 13 to June 23 .	10	10,360	1036	56·55	9·86
June 23 to July 23 .	30	30,210	1007	61·96	4·61
July 23 to Aug. 22 .	30	25,500	850	62·13	2·10
Aug. 22 to Sept. 21 .	30	21,500	716·6	53·90	4·97
Sept. 21 to Oct. 21 .	30	2,400	80	49·21	2·21
Oct. 21 to Nov. 20 .	30	840	28	43·86	1·18
Nov. 20 to Dec. 31 .	41	720	17·5	38·57	0·18

Date.	Number of Days.	Number of Grains Evaporated.	Loss per Diem.	Mean Temperature of Day.	Hygrometer.
		SYCAMORE.			
Dec. 22 to Jan. 3 .	11	620	56·3	30·50	1·18
Jan. 3 to Jan. 13 .	10	240	24	32·15	0·06
Jan. 13 to Jan. 23 .	10	140	14	28·20	0·86
Jan. 23 to Feb. 3 .	11	160	14·5	31·18	0·24
Feb. 3 to Feb. 13 .	10	250	25	40·95	1·40
Feb. 13 to Feb. 23 .	10	610	61	44·20	2·00
Feb. 23 to Mar. 5 .	10	890	89	41·65	1·60
Mar. 5 to Mar. 15 .	10	1,280	128	39·80	3·70
Mar. 15 to Mar. 25 .	10	2,380	238	35·35	4·76
Mar. 25 to Apr. 4 .	10	1,430	143	40·40	5·46
Apr. 4 to Apr. 14 .	10	1,650	165	49·35	2·03
Apr. 14 to Apr. 24 .	10	80	8	47·75	2·50
Apr. 24 to May 4 .	10	200	20	45·60	9·66
May 4 to May 14 .	10	210	21	47·40	3·00
May 14 to May 24 .	10	720	72	52·75	4·30
May 24 to June 3 .	10	4,420	442	56·30	5·13
June 3 to June 13 .	10	6,360	636	59·10	8·80
June 13 to June 23 .	10	8,070	807	56·55	9·86
June 23 to July 23 .	30	27,410	913·6	61·96	4·61
July 23 to Aug. 22 .	30	27,990	933	62·13	2·10
Aug. 22 to Sept. 21 .	30	26,890	896·3	53·90	4·97
Sept. 21 to Oct. 21 .	30	19,150	638·3	49·21	2·21
Oct. 21 to Nov. 20 .	30	1,580	52·6	43·86	1·18
Nov. 20 to Dec. 31 .	41	680	16·5	38·57	0·18

TABLE II.

Water Evaporated in periods of Four Months by various Plants—Grains.

	December 22 to April 24.	April 24 to August 22.	August 22 to December 31.
Spruce Fir	38·725	56·595	29·110
Portugal Laurel . . .	39·740	104·040	53·022
Evergreen Berberis . .	24·530	85·910	46·920
Yew	55·400	102·635	49·225
Holly	23·780	33·580	20·250
Common Laurel . . .	43·440	129·840	47·600
Ilex	10·970	3·090	1·480
Larch	11·570	52·530	50·200
Oak	8·510	35·050	37·030
Deciduous Berberis . .	11·740	102·190	66·080
Ash	7·900	81·920	25·470
Sycamore	9·730	75·380	48·300

Table III.

Water Evaporated in Twelve Months by various Plants—Grains.

	Water supplied to Soil.	Water obtained from Soil.	Total Evaporated.
Spruce Fir	91·400	33·030	124·430
Portugal Laurel . . .	156·400	40·502	196·902
Evergreen Berberis . .	123·900	33·460	157·360
Yew	171·400	35·860	207·260
Holly	61·400	16·210	77·610
Common Laurel . . .	181·400	39·480	220·880
Ilex	13·400	2·100	15·540
Larch	87·400	26·900	114·300
Oak	57·400	23·190	80·590
Deciduous Berberis . .	137·400	42·610	180·010
Ash	102·400	12·890	115·290
Sycamore	97·400	36·010	133·410

Table IV.

Table showing the Period of the Year in which Evergreen and Deciduous Plants Evaporate 100 Parts of Water.

	Evergreen.	Deciduous.
Four Months to April 24	23	8
,, August 22	52½	56
,, December 31 . . .	24½	36
	100	100

J. B. Lawes.

Note upon the preceding Experiments.

The evaporating power of the leaves is one of the most important properties of plants, for on the healthy performance of this function depends not merely the vigour and development of the plant, but also indeed its very existence. Every new fact, therefore, which in any way tends to elucidate the chemical or physiological nature of the leaves, or which throws light upon the mode in which they act, and the effects produced by the various agents to the influence of which they are naturally subject, is highly interesting. The preceding experiments were undertaken with a view to ascertain the ratio which exists between the evaporating power of different leaves, contrasting together in particular those of evergreens and those of deciduous plants. Before making one or two remarks which these experiments suggest, it will perhaps not be out of place to say a few words respecting some former investigations on the same subject.

It is more than a hundred and fifty years since Dr. Woodward published in the 20th volume of the Philosophical Transactions of the Royal Society, an account of some experiments on vegetation, having for their especial object the evaporating power of the leaves; these experiments were curious, and excited a good deal of interest at the time they were published. Some of the conclusions drawn from them were tolerably accurate, but from the vague and uncertain views which were then generally entertained respecting the growth and nourishment of plants, the very facts themselves became to a very great extent mystified and confused, so that their practical value was greatly diminished. Dr. Woodward's experiments were made with weighed bottles of water, having a piece of parchment tied over their mouths, in which a small aperture was made just sufficient to admit the stem of a plant, but not so small as to confine or impede its growth. As the water evaporated, fresh was added from time to time, a register being kept of the quantity added, as well as of that which was lost by evaporation. The plants were placed side by side in a window, where they were equally exposed to sunshine; and the experiment was continued from the 20th of July, 1691, to the 5th of October in the same year. The following was the result of one of these comparative experiments:—

——	Original Weight.	Final Weight.	Water Evaporated.
	Grains.	Grains.	Grains.
Spearmint, in spring water . . .	27	42	2558
Ditto, in rain water.	28	45	3004
Ditto, in Thames water	28	54	2493
Nightshade, in spring water . . .	49	106	3708
Lathyris, in spring water	98	101	2501

Proceeding to compare together the increase in weight of the plant with the quantity of water it had given off, Dr. Woodward showed that in the case of the three plants of Spearmint, it was respectively as 1 to 170, to 171, and to 95; whilst in the instance of the Nightshade it was as 1 to 65, and in that of the Lathyris as 1 to 714. It is evident, however, that from such experiments no very satisfactory or accurate conclusion could well be drawn; they were repeated and varied in different ways, and similar results were obtained. One of the most curious of these experiments was an attempt to ascertain more exactly the precise effect of different kinds of water on the growth and evaporating power of the same plant ; in this case six plants of Spearmint were suffered to grow in weighed bottles of water for eight weeks ; the results were as follows :—

Spearmint.	Original Weight.	Increase.	Water Evaporated	Ratio of Increase to Evaporation.
	Grains.	Grains.	Grains.	
1. In Hyde Park water . . .	127	128	14190	1 to 110
2. Ditto	110	139	13140	1 to 94
3. Ditto, with ½ an oz. of soil .	74	168	10731	1 to 63
4. Ditto, with ½ an oz. of garden soil	92	284	14950	1 to 52
5. Distilled water	114	41	8803	1 to 214
6. Hyde Park water, concentrated by evaporation . .	81	94	4344	1 to 46

It was the common belief of many naturalists at this time that the increase in weight of plants was in direct proportion to the quantity of water which passed through them, or rather to the proportion of it which became fixed in their organs in the process of being absorbed by the roots and given off by the leaves. In the experiment just mentioned, the last plant increased most in proportion to the quantity of water evaporated, but the fourth was the one which grew most luxuriantly, and it was also the one which absorbed the largest quantity of water in comparison to its weight. The plant fed with distilled water grew least of all, whilst that fed with spring water containing a portion of garden soil was by far the most flourishing.

These experiments of Woodward's led Dr. Stephen Hales to make a number of curious and interesting observations on the evaporating power of the leaves of plants, which he published in 1727, in the first volume of his celebrated Statical Essays. Those which more immediately relate to the present subject will be found in the first chapter, "on the quantity of moisture imbibed and perspired by plants and trees." Hales's most celebrated experiment was made in 1724 with a healthy full-grown Sunflower, more than a yard high, and which had been purposely planted when young in a suitable flowerpot. The mode in which the experiment was conducted is best given in his own words :—"I covered the pot with a plate of thin milled lead, and cemented all the joints fast, so that no vapour could pass, but only air, through a small glass tube, 9 inches long, which was fixed purposely near the stem of the plant, to make a free communication with the outward air and that under the leaden plate. I cemented also another short glass tube into the plate, 2 inches long, and 1 inch in diameter. Through this tube I watered the plant, and then stopped it up with a cork; I also stopped up the hole at the bottom of the pot with a cork."

Matters being thus arranged, the plant received a weighed supply of water, and being itself weighed twice a day for a fortnight, the rate of evaporation was easily observed. By another comparative experiment Dr. Hales ascertained the quantity of water evaporated every day by the porous earthen pot, and subtracted it from the whole daily loss sustained by the Sunflower. The result showed that on an average the plant evaporated 20 ounces or 34 cubic inches of water in a 12 hours day; the maximum proportion being 30 ounces. This was certainly a very interesting and remarkable experiment, and it was rendered all the more so by the careful and minute details which accompanied its publication; including the bulk and length of the roots, and the exact size of the leaves. Hales also measured the rate of evaporation of a Cabbage, a Vine, a young Apple tree, and a Lemon tree. The result of these experiments is expressed in the following table:—

——	Entire Surface of Leaves.	Water Perspired in 12 hours.	Ratio of Evaporation to Surface of Plant.
	Square inches.	Ounces.	
Sunflower	5616	20	$\frac{1}{165}$
Cabbage	2736	19	$\frac{1}{80}$
Vine	1820	$5\frac{1}{2}$	$\frac{1}{191}$
Apple-tree	1589	9	$\frac{1}{102}$
Lemon-tree	2557	$10\frac{1}{3}$	$\frac{1}{248}$

The practical conclusion drawn from these experiments was, that the Cabbage evaporated the greatest quantity of water, and the Lemon tree the least. On repeating it with other plants Dr. Hales found that in all cases evergreens perspired less than those plants which shed their leaves in the winter, a fact which he endeavoured to explain by observing, that "as they perspire less, so they are better able to survive the winter's cold." At the same time that he made these experiments he also made a number of other highly interesting ones, on the force with which plants absorb water, and many similar points connected with this part of their economy.

A third series of experiments was made by Mr. Miller in 1726, at the Chelsea Botanic Garden, at the suggestion of Dr. Hales, in which the subjects of experiment were a Musa, an Aloe, and an Apple tree. The plants were growing in glazed earthen-ware pots, made without any holes at the bottom, so that there was no need to make any correction for the water lost by evaporation; the plants were weighed three times a day for some weeks, and the thermometer was noted at each weighing. The chief facts observed were, that the plants perspired more of a morning than of an afternoon; that they very often absorbed moisture by the leaves during the night; and that the proportion perspired was generally in the direct proportion of the temperature of the day.

These simple experiments are, all of them, perfectly satisfactory, and as far as they go, are no doubt quite trustworthy. It is remarkable that during the last 130 years hardly a single new fact of much importance has been added to this department of vegetable physiology, and that our knowledge of this important branch of the economy of vegetation is very little extended beyond what it was at the time of Hales. One reason of this certainly is, that the observers who followed him began to refine upon the simple mode of experimenting which he employed, and introduced complicated and unnatural forms of experiment, the results of which are, for the most part, of but little value. Thus the numerous and laborious experiments of Bonnet, undertaken chiefly at the suggestion of Calandrini, to ascertain the relative power of absorbing moisture by the superior and inferior surfaces of the leaf, were far from satisfactory, because, though his object was to measure the power of absorbing aqueous vapour, his experiments in fact all tended to a different effect, namely, the power of the leaves to absorb water, when placed in contact with it, by the upper or lower surface. The experiments of Bonnet, even on the direct absorption of water, do not really give a true indication of the evaporating power of the leaves, because they were made on single leaves and not on entire plants; they consequently did not fairly represent the sound and perfect leaves of a growing plant.

The very numerous series of experiments, on the evaporation from leaves, detailed in the preceding pages, are highly valuable, because they extend over a considerable period of time, and therefore are less under the influence of the various interfering causes which generally introduce errors into such investigations. At the same time, however, they are by no means unexceptionable, for there are several matters connected with them which are open to doubt and uncertainty. The first great condition of all such experiments in every case is, that the plants must be brought into a healthy condition at the commencement of the experiment, and kept in a healthy state all through it; if the plant is rendered sickly and unhealthy by the conditions of the experiment, it is plain that, the circumstances being forced and unnatural, they cannot be expected to yield satisfactory results. Now, in the preceding experiments, the plants were unquestionably injured by the treatment they received, and what is still worse, they were injured to an unequal extent, some of them being rendered far more sickly than the others. If means cannot be devised to prevent the evaporation of moisture from the surface of the soil without tying bandages round the stem, it is far better to calculate the amount of water thus lost, as Hales did, and subtract it from the total loss at each weighing. If all the other circumstances are perfectly similar, this loss would not vary much ; it would be pretty nearly constant with each of the different plants. It is also to be remarked, that in thus absolutely preventing all evaporation from the enclosed soil, excepting that which took place through the leaves of the plant, the soil was altogether cut off from contact with the external air, and thus another, and by no means unimportant condition was introduced.

In experiments of this sort it is very desirable not to commence them the very day the plants have been transplanted ; some little time should be allowed to elapse before the experiment is begun, so that the plants may become accustomed to the new conditions under which they are placed ; and in every case where possible two or three similar plants should be taken for each experiment, instead of single individuals.

For the most part the experimental results are pretty nearly what might have been expected, though of course there are exceptions and irregularities, which must be attributed to special interfering causes. There would seem to be a remarkable difference between the several plants, as regards the relation existing between the temperature and the rate of evaporation, independent of the dryness or moisture of the air. On comparing the tables together, it will be found that in the case of the Portugal Laurel, Holly, Larch, and Sycamore, the maximum evaporation occurs at the same time as the maximum of temperature, namely, between the 23rd of July and the 22nd of August. This, however, is not the case with the other plants. In the case of the Oak and the Deciduous Berberis, the maximum evaporation occurs after the greatest heat, the greatest quantity of water being evaporated between the 22nd of August and the 21st of September, though the average temperature then was more than 8 degrees lower than it had been during the previous four weeks. Exactly the reverse is the case with the remaining plants, for the maximum evaporation with the Spruce-Fir, Evergreen Berberis, Yew, Laurel, and Ash, in each instance preceded the maximum of heat. On referring to the table showing the evaporation from the Evergreen Berberis, it will be found that from the 23rd of June to the 23rd of July, when the average temperature was below 62°, the daily loss of water was 1038 grains, whilst in the following month, though the thermometer was then above 62°, the daily evaporation was only 872 grains. A similar effect may be observed with regard to the Yew. In July, with a temperature below 62°, the daily loss was 1012 grains; in August, with an average temperature above 62°, the daily evaporation was only 809 grains. It is evident, therefore, from these experiments, that evaporation is not a mere index of temperature, but that it depends on vitality, influenced by heat, light, and other causes.

XXI.—*On the Cultivation of the Fig-tree under Glass.* By Henry Bailey, C.M.H.S., Gardener to G. Harcourt, Esq., F.H.S., Nuneham, Oxford.

Those persons who have only tasted this fruit when ripened on the open wall in the generally sunless climate of this country, have but little idea of its excellence when perfected under brighter skies and more genial solar influence, or assisted by glass and fire-heat. In addition to the certainty of getting them well ripened under glass, there is the further advantage of securing two crops in the year of rich, jelly-like fruit; while those on the external walls frequently (*in dull seasons*) do not ripen well, and are mawkish and insipid. Strange as it appears, the fig is less cultivated in England than it deserves to be, even in our largest establishments. The writer would invite the attention of gentlemen to the propriety and advantage of devoting a portion of their glass to this fruit, which he assures them will gratefully repay any extra care bestowed upon it; and having succeeded in its management, he begs with deference to lay before the Society a few hints derived from his own practice and observation.

Three years ago there existed upon a south wall at this place a large fig-tree, of the brown Ischia kind, over which it was thought desirable to build a house, which should also be used for the culture of figs in pots, conjointly with that of the tree upon the back wall: the house placed over it being 48 feet long by 13 feet in width, and the fig-tree at the present time not only covering that space to a height of 13½ feet, but extending across the ends of the house.

As soon as the house was erected, it became necessary to consider what would be the course of treatment best suited to further the end in view, viz. by artificially lengthening the period of summer to enable it to ripen the figs produced by the second flow of the sap, which figs do not ripen in the open air in this country, and which Mr. Wickham, in the Transactions of the Society some years ago, aptly denominated as "*sterilizing incumbrances.*"

The tree was trained in the fan-shaped manner, and it was found necessary on re-training it to remove many old and sterile branches to make room for younger bearing wood; this, with the facilities afforded for root extension by the border inside the house not being dug as before, induced a state of luxuriance incompatible with productiveness; and it was found at the end of the first season not to have been so fruitful as it might have been, in other words, it had not yet adapted itself to the new circumstances under which it was placed.

It now became obvious that some control must be exercised over the roots; accordingly, in September, 1850, a trench was opened, and every root cut clean off within a circle of 2 feet 6 inches from the centre of the main stem; a wall of bricks was then built round the roots, the interstices of which were filled with concrete. In November the tree was cautiously pruned, retaining a good supply of the young wood, and removing a barren old branch *occasionally.* In training, the points of the young shoots were *reversed;* and this completed, a bed of oak-leaves, about a yard in height, was introduced, placing them upon the surface of the ground, at about 5 feet distance from the tree, for the purpose of plunging dwarf figs in pots. The moist and genial exhalations from this, when turned, *which was frequently done*, were found most congenial to the swelling and bursting of the buds. On the 1st of February, 1851, the fire was lighted, and a humid atmosphere maintained at a night temperature of 55° in very mild weather, and 50° when the external temperature was low. The small compass to which the roots were confined was kept well supplied with tepid water, and the figs soon showed themselves abundantly on the ends of the previous year's shoots. During the day the temperature was allowed to rise from 10 to 20 degrees higher than at night, and in dull weather more fire was used during the period of light than in that of darkness. Copious syringings were given in this state; but when the fruit became of the size of walnuts (as they are used for pickling) it was discontinued, being found injurious to its skin from and after that age, turning them black and causing them to rot. As soon as the young growths had extended to three or four joints they were stopped, and soon showed embryo fruits at the axils of every leaf: these have formed the principal crop, but by the time the first crop was over, the shoots which were first stopped began to ripen the second crop, and thus we have had a constant supply of fine fruit up to the time of gathering the first out-of-door ones; and the tree now presents an abundance of short-jointed well-ripened shoots, at the extremities of which the first crop for next year will be produced.

In the course of treatment pursued I have arrived at the following conclusions :—

1st. That the recommendations of old authors with regard to making borders for this tree are unnecessary, as the largest trees are capable of growing in the least imaginable quantity of earth upon a well-drained hillock of brickbats and old mortar rubbish, or on natural rocks.

2ndly. That although generally considered a gross feeder, soft pond-water in *copious supply* during the swelling of the fruit seems to contain enough of nutritive matter for its demands, as trees treated to the often recommended and potent *liquid manure* have not produced figs equal in size to those I am speaking of. But be it remembered that I speak not of cold spring-water from a pump, but of that from a stagnant pond, softened and chilled by exposure, and presenting an almost *gelatinous appearance from the multitude of animalculæ* with which it is teeming.

3rdly. One difficulty presents itself in the cultivation of figs which I have at last triumphed over. It is well known that the foliage is much subject to the attacks of red spider (Arurus telurius), and syringing sharply to keep this pest in subjection is necessary; but after the fruit has advanced to its last stage of swelling, dryness is indispensable to its perfection : bright solar light and an arid atmosphere are the conditions essential to produce well-ripened figs, and the red spider must be kept down by applying sulphur to the flues, or any surface upon which the sun can shine and cause its fumes to be exhaled. So tender is the skin, and such is the disposition of ripe figs to mouldiness, that every vestige of moisture must be avoided during the ripening period; although the root-watering must not cease, it should only be done early in the morning, when the dampness arising from it is soon dispelled by the admission of air.

4thly. There is no fruit more benefited than this by full exposure to light. To insure this it would not be wise to strip off the leaves to some extent, as I have seen practised, but rather in pruning to preserve only that amount of foliage which can perform its allotted functions properly. Those who would secure the happy medium between luxuriance and languor must have the roots under control.

5thly. The finest figs, and the greatest quantity of them, are produced at the extremities of the longest branches : to increase the amount of such space is most desirable. The fig-tree in question, after reaching the top of the house, is incurved under the top light about 18 inches: this gives great facility for getting well coloured fruit without shading the tree. I was led to adopt this plan from seeing the fine productive state of the figs trained under the roof of a house at Lord Ashburton's seat, The Grange.

6thly. One word on figs in pots. I have found the best kinds for this purpose to be the Violette, White Marseilles, Black Marseilles, and Lee's Perpetual.

After they have filled the pots with roots in which it is intended to fruit them, they should annually have a portion of their roots pared away, and be repotted in *good* loam, lime-rubbish, and dung. They should be plunged in a gentle bottom of heat on a bed of leaves, be well supplied with water, and constantly pinched to make them bushy and full of short spurs. It is disadvantageous to place them under the shade of vines, and it may be laid down as an axiom in fig-culture, that they cannot have too much sun in the British Isles.

The fig-tree in question ripened its first fruit on the 25th of April, from which period it has gone on bearing till the present time, August 26, and it has now many dozens to ripen, which assisted by fire-heat, will continue till November.

August 26th, 1851.

XXII.—*Contributions to a History of the Relation between Climate and Vegetation in various Parts of the Globe.*

No. 12.—*Sketch of the Climate and Vegetation of the Himalaya.* By Thomas Thomson, M.D., Assistant Surgeon in the H.E.I.C. Service, Bengal Establishment.

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The great range of the Himalaya, when taken in conjunction with the still more elevated mountains behind, which are in no-wise distinguishable from it, constitutes the most stupendous mass of mountains in the world, not only from containing the highest peaks, but also, and still more remarkably, as presenting by far the greatest area of elevated land.

This gigantic mountain mass lies to the north of the great plain of India, from which it rises on the whole very abruptly. It has a direction very nearly from east to west, its west extremity is however little more northerly than the east, the latitude rising from 26° at the east, to 33° at the west extremity.

The mountain chain to which the name of Himalaya is most properly applied, may be considered as bounded at the south by the plains of India, and on the north by the rivers Indus and Burrampooter, which have their sources in the same spot, and run one to the east, the other to the west, among lofty mountains, till they enter the Indian flat country. Nearly in the centre of this chain, in the most westerly part of Nepal proper, lies the point of separation between the two great river systems, that of the Indus and that of the Burrampooter, constituting a north and south axis, which, when better known, will probably prove to be the grand axis of Asia.

From this centre the chain of the Himalaya extends to nearly an equal distance in both directions, the central axis of the chain being the line of water-shed between the streams which run toward the plains of India on the south, and those which flow toward the Burrampooter and Indus on the north. This line of water-shed or central axis will, on inspection of a map, be seen to be in general somewhat to the north of half way between the two boundary lines of the chain, so that the distance from the axis to the plains of India is greater than from the same place to the northern rivers. The mean width of the whole chain may be stated roughly to average about 150 miles, of which 90 are to the south of the line of water-shed, and 60 to the north of it.

From the central axis of the chain lateral ranges of mountains run both to the north and to the south, stretching in the latter direction as far as the plains of India, and separated from one another by deep narrow valleys, which extend far into the interior of the mass of mountains.

The number of lateral chains of the first class, which form the line of division or water-shed between the basins of the great rivers on the south side of the central axis of the Himalaya, is about fourteen, separating from one another in a series from left to right the waters of the Jhelum, the Chenab, the Beas, the Ravi, the Sutlej, the Jumna, the Ganges, the Gogra, the Gandak, the Kosi, the Teesta, and the Subhansheri. These great chains, like the central axis, throw off lateral branches, which separate from one another the different branches, by the union of which within the mountains the great rivers are formed.

The elevation of the central axis of the Himalaya is probably at a mean about 18,000 or 20,000 feet; it is nearly uniform at about these elevations throughout a great part of the chain, but gradually diminishes toward both ends. Like all mountain chains, it presents alternations of high and low portions, the lower parts, or passes as they are called, from their affording the means of passage to travellers from one side to the other, being at the upper extremities of the river basins. These passes are, with a few exceptions, rarely under 17,000 or 18,000 feet. The lateral chains, starting from the more elevated portions of the central axis between the passes, gradually diminish in elevation as they approach the plains of India, not however with any exact uniformity of progression, for it is not unfrequent to find them rise into lofty peaks considerably more elevated than any known part of the central axis. The greater part of the giant peaks, which rise to an elevation of 26,000 or 28,000 feet, are situated in this manner, not on the central axis, but to the south of it; it is however by no means improbable that masses of equal elevation not yet measured or observed may occur behind them, it being unquestionable that the general elevation of the country continues to increase as we advance to the north, and that we have not yet (except in one place) attained to any point from which a descent is commenced towards the northern plains.

The direction of the principal lateral chains and of their included valleys, is on the whole perpendicular to the main axis, but with an inclination from the centre; those on the extreme east inclining to the eastward, while those on the extreme west have a very westerly direction. There are certain anomalies in the courses of the rivers, particularly at the north-west extremity of the chain; which, however, may be overlooked in a view so general and cursory of these rivers as must necessarily be taken on the present occasion. The most marked of these peculiarities may be observed in the course of the Sutlej, which runs for a very considerable part of its course nearly parallel to the Indus before it turns toward the plains, thus separating the western part of the Himalayan chain almost from its very origin into two branches, one of which separates the Sutlej from the Indus; the other to the south of, and nearly parallel to, the other, divides the basin of the Sutlej from that of the Jumna and Ganges.

From the great depth of the valleys which separate the different mountain chains, it but seldom happens that any road crosses from one valley to another, a traveller has therefore, in general, excellent opportunities of studying the direction and ramifications of the different chains, either in following the course of the valleys, or by travelling along the top of the ridges. In both cases he will find that his course is an undulating one, each chain and each branch of a chain being a curve, which bends first to one side and afterwards to the other, giving off generally a spur on the convex side, while the head of a valley insinuates itself into the concavity.

After these few words on the physical structure of the mountains, the vegetation of which it is my wish briefly to describe, it will still be necessary to devote a few minutes to the subject of climate and humidity, before I can proceed to my proper subject.

Situated in the most southern part of the temperate zone, and bounding on the north a great peninsula, which extends far into the torrid zone, the base of the Himalaya to the south possesses an almost tropical climate, tempered however, when the sun is on the tropic of Capricorn, by a moderately cool winter, and variously modified in different parts of the chain by the degree of humidity, a most important matter to be taken into consideration in every question connected with the phenomena of vegetable life.

The source of humidity in the Himalaya is almost entirely the Bay of Bengal, which is situated about 5° to the south of the eastern extremity of the chain; and the wind which carries the humid atmosphere along the chain, is that which is known to nautical meteorologists as the south-west monsoon, a wind which begins to blow in the open sea about the month of April, but whose effects are not felt in the far interior before the month of June. This wind, though constant in its direction at sea, is not so in its inland course; at the head of the Bay of Bengal it is almost a south wind. It blows from the sea nearly due north towards the Himalaya, striking in its course upon the low chain of the Khasya hills, whose maximum elevation is scarcely 7000 feet.

Upon this range the first force of the monsoon is expended, and the annual fall of rain at Churra Poonjee, elevated 4000 feet on its southern slope, amounts to about 500 inches. This range, which has its origin among the mountain ranges of the south of China and north of Burmah, lies to the south of the Burrampooter, and, following the course of that river, terminates in the concavity of its great bend, where it turns down toward the sea. The Khasya mountains do not therefore entirely run across the Bay of Bengal, so as to intercept the force of the monsoon from the whole of the Himalaya, a part of which wind, laden to saturation with moisture at a temperature of nearly 90° F., blows due north from the Bay of Bengal upon the district of Sikkim, which is on that account the most rainy part of the whole range of the Himalaya, for, on the one hand, the more eastern parts of the chain are protected by the Khasya range, and on the other, the more westerly parts are more distant from the source of moisture, and therefore receive a less share of it. The interception of the moisture from the province of Bootan and the independent states north of Assam, by the Khasya range, has this curious effect, that the lower ranges of this portion of the Himalaya are dry and arid, while above 7000 feet, to which elevation only the hills to the south attain, the climate is very much more humid.

The diminution in the amount of moisture in proceeding to the westward along the Himalaya from Sikkim is extremely gradual, but also, so far as our present rather limited number of observations go, very regular. The effects of the south-west or rainy monsoon diminish step by step, as we advance westward, till on arriving at the valley of the Indus at the western extremity of the Himalaya, it ceases to be observed at all. In these most western portions of the chain, very little rain falls at any season of the year, and the little which does occur falls in the spring months, and is therefore quite independent of the regular monsoon.

It is also worthy of note, that in the more western parts of the chain the climate is extremely dry at all periods of the year, except during the monsoon or rainy season, as it is called in India, while to the eastward the climate of the mountains shares to a considerable extent the more equable and always moist climate of Bengal.

The most important point of all, however, regarding the climate in respect of its effects on vegetation, which requires to be borne in mind, is that a very great portion of the rain which falls is deposited on the first range of mountains upon which the rain wind strikes. I have already pointed out that this is the case with the Khasya range, and it is there highly strikingly illustrated by the fact, that it is only on the very south side of the hills that the rain-fall is so enormous, the fall twenty miles north of Churra being probably less than half what it is there.

This tendency of the rain-fall to exhaust itself very considerably on the first range of mountains to which it has access, is peculiarly important in a mountain chain 150 miles in width, its effect being that the upper part of all the large valleys, and especially the interior valleys and their ramifications, are much more dry than those adjacent to the plains of India. Even in the most humid part of the Himalaya, in Sikkim, this difference is extremely marked, and in the more dry parts to the west, (the extreme east interior is not known,) the inner valleys are so dry that rain is scarcely ever known to fall.

In close connection with the increase of aridity, as we advance from the plains of India to the interior of the mountains, I may mention the increased elevation of the line of perpetual congelation, which has evidently the same cause. In the outer lofty ranges of the Himalaya, the snow line is met with at about 16,000 feet, while in the Tibetan part of the chain many ridges of 20,000 feet of elevation are almost entirely bare of snow.

Having thus alluded in very brief and general terms to the most prominent physical features of the mountain chain of Himalaya, I shall proceed to describe, as rapidly as is consistent with clearness, the general character of the vegetation which is to be observed in its different parts at all elevations, from the plains of

India to the uppermost limit of vegetable life. This would be an easy task if the vegetation were uniform throughout the whole chain, but owing to the great variations of climate to which I have just adverted, there is a very great difference in this respect, few indeed of the plants of the eastern extremity of the Himalaya being identical with those which occur in the far west. In general terms, it may be said, that to the eastward the vegetation is very much more luxuriant and tropical, and that it changes very gradually in advancing to the westward, in exact proportion to the diminution in the quantity of rain. The same gradual transition in the vegetable world may also be observed in advancing up the valleys, or in passing across the mountains from the outer valleys to those which are further removed from the Indian plain; though in the latter case, of course, the effects of gradually increasing elevation must be taken into consideration as partly the cause of the change, as well as the decrease of humidity.

The plains of northern India which skirt the base of the Himalaya do not (if we except the belt immediately at the base of the mountains) present by any means a rich flora. From their situation nearly on the tropics, their distance as a whole from the sea, and their proximity to the mountains, they are not very damp, and their climate has too decided a lowering of temperature in the cold season to permit them to be clothed with the dense forest vegetation which clothes the tropical plains of South America. They are in general open plains without much wood, and where not under cultivation, are covered either with a dense jungle of different species of Arundo and Saccharum, or with scattered trees of various tropical families, Acaciæ and Zizyphi being very common genera. Here and there only there are patches of forest, generally low and scrubby, and without much underwood, or any of the fine parasitical plants and ferns which are so ornamental in tropical woods.

In the lower parts of Bengal, the proximity of the sea somewhat modifies this general character; a number of ferns, one or two species of pothos, and a few Orchideæ, among which Vanda Roxburghii and a large and fine Cymbidium are the most common, are to be found. In the same way the valleys of Silhet and Assam are exceptional in character, but from their being inclosed with mountains of some elevation on all sides, they are scarcely to be regarded as part of the Indian plain, but may more properly be considered as wide mountain valleys, and they in fact closely resemble in vegetation the valleys of the larger Himalayan rivers in the east part of the chain.

Close to the foot of the chain of mountains throughout its whole course from east to west, there lies a belt of forest and swampy land, which is well known in India by the name of Terai, and which, where it is developed to any considerable extent, bears a very bad character for unhealthiness, and is indeed in many places quite impassable for Europeans at most seasons of the year. This forest belt seems to be due to the greater humidity of atmosphere, and at the same time greater equability of temperature, which is produced by the proximity of the mountains. Its width is very various, from forty or fifty miles, to which I believe it attains in some parts of Nepal, to eight or ten miles, which is a more common width. Westward of the Jumna it almost disappears, being represented by a line of swampy or marshy ground, and a low jungle of bushes of the common plain species of trees.

In this belt, which occupies the base of the mountains, the vegetation is of course quite tropical in character, and is too varied to be described in detail. Large cotton trees (Bombax) are in all parts of it particularly conspicuous from the immense size of their trunks, which are not cylindrical, but buttressed all round by immense plates which project far forward from the main trunk. Numerous fig trees of very various species are also common, especially to the eastward, where many fine forms of these magnificent trees everywhere meet the eye, along with species of Dillenia, Careya, Bauhinia, and Lagerströmia.

It is from the forest which lies along the foot of the Himalaya that a great part of the timber is derived which is consumed in northern India. In the most eastern part, the most valuable timber is furnished by Lagerströmia reginæ, and perhaps other allied species; further west, the *sâl* Patica robusta, the Shorea robusta of Roxburgh, is that which is most esteemed. The sâl extends from the valley of Assam as far west, I believe, as the Punjab, and is found not only in the forest tract, but also in hot valleys among the mountains. It belongs to a natural order (Dipterocarpeæ) which is peculiarly Indian, and which furnishes many valuable kinds of timber. None of the species, however, except the one under consideration, extend beyond the tropics; but they abound in the hilly countries of the peninsula as well as in the low ranges of the Malayan peninsula, and I believe in Java and other Indian islands. The sâl is so much valued that it has become in accessible places, from whence it can easily be conveyed to the plains, very scarce, and in the vicinity of large towns, where there is a great demand for timber, I believe almost extinct; it is therefore less commonly employed than the sissoo, a species of Dalbergia, which is particularly abundant along the foot of the mountains, more especially to the westward, growing in great profusion on gravelly soil, and yielding a most ornamental and valuable wood.

The forest belt which skirts the base of the mountains rests for the most part upon a dry gravelly soil, which slopes somewhat rapidly, though not perceptibly to the eye, toward the open plains, and is generally dry. Just outside the forest, or sometimes still interspersed with patches of wooded ground, there is generally a low swampy tract, which is lower than the country immediately beyond, and from which the water drains away slowly and with difficulty. This is the Terai *par excellence*, and is, from the constant dampness of the soil, and the dense heat of the summer, peculiarly unhealthy. It is too low and too unhealthy to be much cultivated, and is generally covered by a dense jungle of tall grasses, species principally of Saccharum, Arundo, Andropogon, and Anthistiria, which rise high enough to cover an elephant, and afford shelter during the greater part of the year for multitudes of tigers and other wild animals. At the commencement of the cold weather, this long grass is set on fire and burnt down by the inhabitants of the hills, who at that season descend to the level country to feed their cattle and flocks. It is again abandoned to itself at the commencement of the hot season, as soon as grassy vegetation has made sufficient progress in the mountains. These swampy tracts are a series of lateral valleys which run parallel to the base of the mountains, and which, from being very slightly inclined, present great obstacles to the escape of the water discharged into them by numerous streams from the mountains.

Along many parts of the Himalaya, a similar series of valleys, nearly parallel to the axis of the chain, but bounded externally by hills of from 2000 to 4000 feet in elevation, may be observed. These valleys are known in the western Himalaya by the name of Dhúns. One of the largest of them is the Deyra Dhún, well known to Indian travellers as being traversed en route to Masuri; a favourite hill station, and now celebrated as the seat of an extensive cultivation of tea in a climate which seems to suit admirably that valuable plant. The Deyra Dhún is in its centre or highest part, from which it slopes down both to east and west towards the Ganges and Jumna, about 2500 feet above the level of the sea, or 1500 feet above the level of the plains, immediately outside of its bounding range.

Other Dhúns occur all along the hills to the westward. They are bounded on the north by the ancient rocks of the Himalaya, but on their outer side always by the tertiary sandstones and conglomerates, now so well known from the labours of Falconer and Cautley, as the Sewalik formation. In the north of the Punjab there are often several series of these valleys, the innermost only resting on transition rocks, the others excavated out of the tertiary sandstones, which have there often a width of from 30 to 50 miles.

The vegetation of the low ranges of hills by which the Dhúns are bounded externally, does not deviate much, if at all, from the tropical type. They nowhere exceed an elevation of 4000 feet, which is not sufficient in isolated ridges to bring about a sufficient change of mean temperature, to produce much alteration in the vegetation. They are only known, I believe, to the westward of Nepal, and therefore, in the drier parts of the region, they are generally covered with trees the same as those of the forest belt, with, in addition, a good deal of Pinus longifolia, a subtropical species of Pine, and of a dwarf species of Phœnix, almost the only palm of the western Himalaya.

From these valleys where they exist, or from the open plains in other cases, the exterior ranges of the Himalaya generally rise abruptly to a height of 7000 or 8000 feet, in all parts of the chain, except at the point of exit of the great rivers, where of course the outline of the mountains is much modified. I shall probably better explain the structure of the mass of mountains, by saying that the lateral chain which separates any two adjacent river basins, generally terminates abruptly towards the plains in a bold promontory 7000 or 8000 feet in height, from which lateral branches parallel to the plains run in each direction, gradually diminishing in elevation till they are terminated by the great rivers. After the first sudden rise, the different ridges increase much more gradually, generally running nearly level for a number of miles, and then rising abruptly from 1000 to 2000 feet.

In ascending on the Himalaya (or indeed on any range of mountains) from the base to the line of perpetual snow, the change of vegetation is extremely gradual, and within a limited change of altitude barely perceptible, any division into groups must therefore be in a great measure arbitrary. Still some mode of subdivision is quite necessary for the purpose of description, as otherwise the mind would be puzzled by the multitude of facts. The less complicated, however, the mode of division is, the more intelligible it will be. It appears, therefore, quite sufficient to refer the forms of vegetation to three groups, similar to the three zones interposed between the equator and the pole—namely, tropical, temperate, and arctic; or, to use the term more commonly applied in the case of mountains, *alpine* vegetation.

There is so great a diversity in the vegetation of different parts of the Himalaya, that I should entirely fail were I to attempt to give any general idea of the vegetation of these different zones. I shall therefore select two particular spots, and by relating in some detail the gradual changes of the vegetation in each of these, I shall, I hope, be able to give a good idea of the general appearance of the phenomena of vegetable life.

The hill station of Darjiling is distant from the plains of Bengal a little more than 36 miles, the road following a ridge which ascends in the first 13 miles rapidly to about 7000 feet, and then runs gradually, with little change of level, for the remainder of the way. Throughout the whole distance the mountain sides are lined with dense forests; except in the early morning, an almost perpetual mist hangs over the trees, which collect and throw down from their foliage an abundant supply of moisture. On emerging from the dry belt of tropical forests, the ascent commences at once up a dry ridge, covered at first with the same species as grow upon the plain, species of Bombax, Terminalia; Sterculia, Emblica Duabanga, Alstonia, Gmelina, Bauhinia, and others are abundant, with many figs, some species of Artocarpus, and a proportion of Bamboos. By degrees a vegetation characteristic of mountain tracts, but still tropical, takes the place of those just mentioned. A Gordonia is extremely abundant, with numerous euphorbiaceous trees allied to Mappa, various species of Garcinia, the Toon (Cedrela toona or serrata), a variety of mimoseous trees, arboreous species of Vernonia and Helicia, beautiful Bauhiniæ, both erect and scandent, the latter climbing to the tops of the highest trees with a trunk nearly as thick as a man. The road runs along the top, or on one side of the ridge, looking down into deep valleys full of the densest forest. If we leave the road to enter into these dark and moist hollows, we find that there are occasionally small tracts of flat land along the banks of the streams, which, however, more frequently run through deep ravines, clothed with dense thickets of shade-loving trees, species of Laurel, Alder, Magnolia, being mixed with the giant figs, which often form a great part of the forest. In these more shady places the Plantain and Tree-fern luxuriate, and a dense brushwood covers the ground. Not unfrequently large tracts are covered with thickets of Calamus, a prickly palm which attaches itself by long hooked flagelli to the trees, and often presents a formidable barrier to the traveller who tries to penetrate into its recesses. The trunks of these trees are often clothed with a dense mass of Pothos, and of the huge leaved Scindapsus, completely encircling them all round, and converting them into leafy columns, while the wide-spreading branches of the higher trees bear a profusion of Orchideæ, which overspread them, even to the very top, and, when in flower, have a most gorgeous effect.

In shady valleys, as low as 2000 feet, appear the first specimens of Oaks and Chestnuts, which in the equable temperature of such places, descend much further on the mountain slopes than in the more arid and variable climate of the western Himalaya.

On attaining an elevation of about 6000 feet, the vegetation has become temperate. The purely tropical forms have almost entirely disappeared, and in their place the forest abounds in trees of temperate climes. Species of Oak, Holly, Cherry, Laurel, Rhododendron, Styrax, and Magnolia, of gigantic size, from the forest, densely covered with Mosses and Orchideæ, and with an underwood of species of Berberis, Daphne, Lonicera, many species of Vitis, and smaller species of Bamboo than those of the tropical region. Ferns are at such elevations extremely abundant.

From the station of Darjiling, the view in every direction overlooks mountain ranges, covered with dense forest, except in a few spots where partial clearances have been made for cultivation. No bare or grassy mountains meet the eye, no rocks or precipices afford any relief from the prevailing uniformity, which, but for the magnificence of the snowy mountains behind, would be undoubtedly monotonous and fatiguing.

The ascent from the plains of north-west India to Simla, is about the same length as that to Darjiling, but presents the most marked contrast in vegetation, being throughout bare and grassy. The road ascends at first in ten miles to an elevation of 6500 feet, then descends to about 1000 feet, and ascends gradually to 5000. The ascent commences from the Pinjore Dhún, a lateral valley which runs at the foot of the mountains from the Sutlej to the Jumna rivers. There is no forest in this valley, which is open, and to a great extent cultivated. The lower hills are covered with a shrubby vegetation characteristic of a dry climate. Species of Zizyphus, Carissa, Butea, Adhatoda, Bergera, Ægle, Flacourtia, and other common shrubs, with one species of bamboo, and only one fig. After the ascent commences, these bushes are only scattered at intervals over the hills, the greater part of the surface being bare and grassy. A similar open country extends all the way to Simla, except where a few fir-trees (Pinus longifolia) crest the ridges, and in the more shady ravines, which are lined with a few small trees.

The transition from tropical to temperate vegetation begins, in so far as it is indicated by the small amount of shrubby vegetation, at about 5000 feet, but on the more exposed slopes, plants of warm climates extend up 1000 feet higher, and the herbaceous vegetation, principally grasses, is entirely composed of tropical forms.

It is only on approaching Simla, and attaining a height of nearly 7000 feet, that forest vegetation commences; at that elevation, open forests of Oak, Rhododendron, and Andromeda, intermixed with several species of Pines, and a great number of temperate shrubs, of such genera as Rosa Rubus, Viburnum, Berberis, Spiraea, Lonicera, Indigofera, Prinsepia, Salix, Daphne, and others.

The view from Simla presents a very marked contrast with that from Darjiling. The general outline of the mountains is very much the same, but they are more rocky, and very generally bare ; the forests, which to the north are dense and abundant, occupying chiefly the north slopes of the mountains, so that in looking from the south the crest of the ridges only are seen to be wooded. The scenery, therefore, is more diversified than in the eastern Himalaya, and abstracting the snowy mountains, more pleasing to the eye.

Between the two extremes which I have described, every intermediate form may of course be met with, the law of alteration being apparently the following, that in advancing westward towards less humid climates, the lower hills, from about 6000 to 2000 feet, become more and more bare and grassy, while the lower levels and the base of the mountains retain a greater degree of damp and are clothed with forest. It would appear also that above 6000 or 7000 feet, up to 10,000 or 11,000 feet, at which elevation mountain ranges sensibly interrupt the passage of the moist atmosphere, the temperate ranges are more moist than those below them, which do not collect the clouds, and have a higher temperature, and consequently more powerful sun. To the eastward of Sikkim, the same phenomena are very well marked, the lower ranges being extremely dry and arid, while above 7000 feet, dense forest and a humid atmosphere prevail, just as in the mountains of Sikkim.

The valleys of the larger rivers which traverse the Himalaya from north to south have, of course, a much lower elevation than the mountains by which they are surrounded ; and up them, therefore, tropical vegetation penetrates very far into the interior. In the extreme west, the valleys of the Indus and Chenab, and even of the Sutlej, are up to the height of 5000 feet, which they do not attain till more than 100 miles from their exit into the plains, hot, dry, and tropical. Further east, the tropical forest stretches far up the valleys, and they are only bare for a small portion of their extent, and in the humid atmosphere of Sikkim they are densely wooded throughout. In that province, the valleys of the Teesta and its tributaries carry tropical vegetation far into the interior, almost within a day's journey of the line of perpetual snow, and the luxuriance of the dense and dripping forest requires to be seen to be understood.

The temperate region of the Himalaya may be said to extend from about 5000 feet, or a little above it, to the upper limit of arboreous vegetation; which, to the westward, is about 12,000 feet, to the east about 1000 feet higher. Above 9000 feet, however, the temperate region is characterized by many remarkable forms, which do not extend lower; these are generally, in the west especially, of very European type; but in the eastern flora it is at such levels that the magnificent Rhododendrons of Sikkim, which form so striking a part of its flora, principally occur. In this zone a great part of the trees are of European genera, Alders, Oaks, Birch, Hazel, Hornbeam, Horse-chestnut, and Cherry being characteristic forms. It is also especially the region of coniferous trees, very few of which extend either below or above it. The Pine which descends to the lowest level in the Himalaya, is Pinus longifolia, which is a common tree throughout the whole region from the mountains of the Punjab to the east of Bootan. It is confined in a great measure to the outer ranges of the mountains, and commences as low as 1000 feet above the level of the sea, rarely, if ever, attaining a greater elevation than 7000 feet. This tree appears to have a very great power of enduring varieties of climate, for it seems equally at home in the hot, damp valleys of Sikkim, surrounded by an entirely tropical vegetation; and on the dry, stony hills of the Punjab, where rain hardly ever falls, and it is at all seasons exposed to a powerful and scorching sun. The only other coniferous tree of low elevations in the Himalaya is Podocarpus, one species of which is a native of the lower ranges of Nepal and Sikkim.

Pinus excelsa, which is allied to P. strobus, and Pinus Smithiana, which is near abies, are the more common species of the central zone, which are distributed throughout the whole extent of the Himalaya. In the same zone, the Deodar (Cedrus deodara) is confined to the western mountains, not being, I believe, to be found indigenous in any part of Nepal; while P. Brunoniana, on the other hand, commences in the eastern parts of Kamaon, and extends as far east as Bootan. The most Alpine species of the family are P. Gerardiana, P. Webbiana, and several species of Juniper, of which all but the first, which is a western tree, seem universally distributed.

It would be needless to dwell at any length on the Alpine zone, because, luxuriant as is the vegetation, and beautiful as are the plants, the forms at least must be familiar to most of my auditors.

I must be content, in conclusion, with drawing your attention to the change produced in the vegetation in the temperate and sub-Alpine zones as we advance towards the interior of the mountains, in consequence of the diminution in the amount of rain.

If in travelling through the Himalaya we ascend a great river, the ascent is so very gradual, that the change of climate and of vegetation in ascending is almost imperceptible, and is only detected by careful observation. If, however, on the other hand, we cross a range of considerable elevation, and descend on its northern side into another valley, the transition is often very striking; and if the chain be sufficiently elevated to intercept the greater part of the rain, the contrast between its two sides is perfectly astonishing. When the transition is thus complete, the traveller leaves dense forests and common Himalayan vegetation on the one side, to find on the other a dry, barren, burnt up soil, with scattered Astragali, Boragineæ, and Cruciferæ, of forms quite characteristic of the flora of Siberia. Such is the vegetation of Tibet, which may be reached either suddenly by crossing a lofty pass, or gradually by ascending the Indus, the Chenab, the Sutlej, the Ganges, and many other of the Himalayan rivers. This arid vegetation is met on the Sutlej as low as 10,000 feet above the level of the sea, and is therefore in no way dependent upon mere altitude.

XXIII.—*Notices of certain Ornamental Plants lately introduced into England.* By Professor Lindley.

I. SAXE-GOTHÆA CONSPICUA. (Figs. A. and B.)

Generic Character. Genus *Coniferarum* monoicum.—Fl. masc. *Antheræ* spicatæ, 2-loculares, apice acuminatæ reflexæ.—Fl. fœm. *Strobilus* imbricatus, e squamis acuminatis liberis infra medium monospermis. *Ovulum* inversum, in foveâ squamæ semi-immersum; *tunicâ primâ* laxâ, ventre fissâ, *secundâ* foramine pervio, *nucleo* apice spongioso protruso. *Galbulus* carnosus, è squamis mucronatis, apice liberis, squarrosis, omninò connatis, plurimis abortientibus. *Semen* nucamentaceum, leviter triangulare, basi tunicæ primæ membranaceæ fissæ reliquiis vestitum.—Arbor *sempervirens*, Taxi *facie; foliis linearibus, planis, apiculatis, subtùs lineâ duplici pallidâ notatis.*

This remarkable plant, to which His Royal Highness Prince Albert has been pleased to permit one of his titles to be given, and which will probably rank among the most highly valued of our hardy evergreen trees, is a native of the mountains of Patagonia, where it was found by Mr. William Lobb, forming a beautiful tree 30 feet high. In the nursery of Messrs. Veitch, of Exeter, it has lived in the open air for four years without shelter, and has all the appearance of being well adapted to the climate of England. The country in which it grows is, indeed, more cold and stormy than any part of Great Britain, as is shown by the following account of it, given by Mr. Lobb in one of his letters to Messrs. Veitch :—

"During my absence I visited a great part of Chiloe, most of the islands in the Archipelago, and the coast of Patagonia for about 140 miles. I went up the Corcobado, Caylin, Alman, Comau, Reloncavi, and other places on the coast, frequently making excursions from the level of the sea to the line of perpetual snow. These bays generally run to the base of the central ridge of the Andes, and the rivers take their rise much further back in the interior. The whole country, from the Andes to the sea, is formed of a succession of ridges of mountains gradually rising from the sea to the central ridge. The whole is thickly wooded from the base to the snow line. Ascending the Andes of Comau, I observed from the water to a considerable elevation the forest is composed of a variety of trees, and a sort of cane so thickly matted together that it formed almost an impenetrable jungle. Further up, amongst the melting snows, vegetation becomes so much stunted in growth, that the trees, seen below 100 feet high and 8 feet in diameter, only attain the height of 6 inches.

"On reaching the summit no vegetation exists—nothing but scattered barren rocks which appear to rise amongst the snow, which is 30 feet in depth, and frozen so hard that on walking over it the foot makes but a slight impression.

"To the east, as far as the eye can command, it appears perfectly level. To the south, one sees the central ridge of the Andes stretching along for an immense distance, and covered with perpetual snow. To the west, the whole of the islands, from Guaytecas to the extent of the Archipelago, is evenly and distinctly to be seen.

"A little below this elevation the scenery is also singular and grand. Rocky precipices stand like perpendicular walls from 200 feet to 300 feet in height, over which roll the waters from the melting snows, which appear to the eye like lines of silver. Sometimes these waters rush down with such force, that rocks of many tons in weight are precipitated from their lofty stations to the depth of 2000 feet. In the forest below everything appears calm and tranquil; scarcely the sound of an animal is heard; sometimes a few butterflies and beetles meet the eye, but not a house or human being is seen. On the sandy tracts near the rivers, the lion or puma is frequently to be met with; but this animal is perfectly harmless if not attacked."

A.
Branch of Saxe-Gothæa conspicua.

B.
Fructification of Saxe-Gothæa.

It is from this wild and uninhabited country that many of the fine plants raised by Messrs. Veitch were obtained, and among them the *Saxe-Gothæa*, *Podocarpus nubigena*, *Fitz-Roya patagonica*, and *Libocedrus tetragona*. Of these he writes thus:—

"The two last (*Fitz-Roya* and *Libocedrus*) I never saw below the snow line. The former inhabits the rocky precipices, and the latter the swampy places between the mountains. The first grows to an enormous size, particularly about the winter snow line, where I have seen trees upwards of 100 feet high, and more than 8 feet in diameter. It may be traced from this elevation to the perpetual snows, where it is not more than 4 inches in height. With these grow the Yews (*Saxe-Gothæa* and *Podocarpus nubigena*), which are beautiful evergreen trees, and, as well as the others, afford excellent timber."

Saxe-Gothæa may be described as a genus with the male flowers of a Podocarp, the females of a Dammar, the fruit of a Juniper, the seed of a Dacrydium, and the habit of a Yew. Its fleshy fruit, composed of consolidated scales, enclosing nut-like seed, and forming what is technically called a Galbulus, places it near Juniperus, from which it more especially differs in its anthers not being peltate, nor its fruit composed of a single whorl of perfect scales, and in its ovule having two integuments instead of one. In the last respect it approaches Podocarpus, and especially Dacrydium; but the exterior integument of the seed is a ragged abortive membrane, enveloping the base only of the seed, instead of a well-defined cup. In a memorandum in my possession, by Sir William Hooker, I find this distinguished botanist comparing Saxe-Gothæa to a Podocarp with the flowers in a cone—a view which he was probably led to take by the condition of the ovule, and which may be regarded as the most philosophical mode of understanding the nature of this singular genus; to which Nageia may be said to be a slight approach, and which is not distinguishable by habit from a Podocarp.

In its systematic relations Saxe-Gothæa possesses great interest, forming as it does a direct transition from the one-flowered Taxads to the true imbricated Conifers, without, however, breaking down the boundary between those orders, as I understand them, but rather confirming the propriety of limiting the Coniferous order to those genera which really bear cones instead of single naked seeds. In the language of some naturalists, Saxe-Gothæa would be called an osculant genus between Taxads and Conifers.

The leaves of this plant have altogether the size and general appearance of the English Yew, *Taxus baccata;* but they are glaucous underneath, except upon the midrib and two narrow stripes within the edges, which are pale green. The male flowers consist of spikes appearing at the ends of the branches, in a raceme more or less elongated. These spikes (fig. B. 1) grow from within a few concave acute scales, which form a kind of involucre at the base. Each male is a solitary membranous anther, with a lanceolate, acuminate, reflexed appendage, and a pair of parallel cells opening longitudinally. The FEMALE FLOWERS form a small roundish, pedunculated, terminal, scaly imbricated cone (fig. B. 3). The scales are fleshy, firm, lanceolate, and contracted at their base, where they unite into a solid centre. All appear to be fertile, and to bear in a niche in the middle, where the contraction is, a single inverted ovule (fig. B. 4). The ovule is globular, with 2 integuments beyond the nucleus; the outer integument is loose and thin, and wraps round the ovule in such a way that its two edges cannot meet on the underside of the ovule;* the second integument is firm and fleshy; the nucleus is flask-shaped, and protrudes a fungous circular expansion through the foramen. The FRUIT (fig. B. 5) is formed, by the consolidation of the free scales of the cone, into a solid fleshy mass of a depressed form and very irregular surface, owing to many of the scales being abortive, and crushed by those whose seeds are able to swell; while the ends of the whole retain their original form somewhat, are free, rather spiny, and constitute so many tough, sharp tubercles. The SEED (fig. B. 6) is a pale brown, shining, ovate, brittle nut, with 2 very slight elevated lines, and a large irregular hilum; at the base it is invested with a short, thin, ragged membrane, which is the outer integument in its final condition. The nucleus lies half free in the interior, the fungous apex having shrivelled up and disappeared.

Explanation of the Cuts.—A, a branch with male and female flowers, natural size; B, various details of the fructification, more or less magnified; 1, a spike of male flowers; 2, a male or anther apart; 3, a twig and young cone; 4, a scale seen from the inside with the inverted ovule, showing the fungous foramen protruding beyond the primine (outer integument); 5, a ripe fruit; 6, a seed showing the 2 slight elevations upon the surface, and the remains of the ragged primine at the base.

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* Since this was written Sir W. Hooker has placed in my hands a sketch of the anatomy of the female flowers of Saxe-Gothæa, by Mr. B. Clarke, who describes the ovule thus:—"Its ovule has the same structure as that of Gnetum, as described by Mr. Griffith, viz.: it has 3 integuments; the internal protrudes, and forms a sort of stigma, not so obvious as in Gnetum; the external has constantly a fissure on its posterior, or rather inferior surface, which however does not close as in Gnetum when the ovule advances in growth, nor yet become succulent. Mr. Griffith describes the fissure in the external integument of Gnetum as constantly posterior; and if the ovules of the strobilus were erect, they would agree with Gnetum in this particular."

2. PODOCARPUS NUBIGENA.

P. *nubigena;* (Eupodocarpus) monoica foliis linearibus mucronatis subtus glaucis, pedunculis solitariis receptaculo oblique bilobo obovato brevioribus, fructibus oblongis oblique obtuse apiculatis.

This is one of the "Yews" mentioned by Mr. Lobb under Saxe-Gothæa, and in general aspect it sufficiently justifies the name. It is a plant with stiff, linear, deep-green leaves, having a broad double glaucous band on the underside. The male flowers are unknown. The fruit is drupaceous, and grows singly in the axils of the leaves on very short stalks; the receptacle is obovate, and obliquely 2-lobed; the nut oblong, slightly bossed, and curved inwards at the point.

No species of Podocarp yet discovered agrees with this. *P. Lamberti*, from Brazil, has leaves green on both sides, and globose fruit. *P. chilina* has broader leaves, also not glaucous, and fruit with very long stalks. *P. andina* has the fruit in spikes.

Messrs. Veitch possess only two small plants of this species.

3. FITZ-ROYA PATAGONICA, *J. D. Hooker.*

By this name Dr. Hooker proposes to distinguish one of the magnificent trees mentioned by Mr. Lobb under Saxe-Gothæa. When young, it is a graceful drooping evergreen shrub, with the habit of *Libocedrus tetragona*, to which it in fact approaches so nearly when old as not to be easily distinguishable unless in fruit. When young, the leaves are very spreading, linear, acute, decussate, narrowed at the base, flat, with 2 glaucous lines on the underside. When old, they become triangular, sessile, closely-imbricated scales, with very little appearance of glaucousness. The female flowers are little terminal stellate cones, remarkable for having the axis terminating in 3 soft clavate glands (or abortive scales). I have not examined them very carefully, but Mr. B. Clarke, with whose notes and sketches of this plant Sir W. Hooker has also favoured me, describes the fruit as consisting "of 9 scales, 3 in a whorl. The lower 3, which alternate with the uppermost leaves, are barren; the intermediate 3 only are fertile; the 3 uppermost alternate with the fertile and are flattened, but stand with their edges outwards. Each fertile scale has 3 erect seeds, surrounded by a broad wing, and ending in a narrow neck; the central seed is attached to the scale, the 2 lateral to the axil; sometimes 2 seeds are on the scale, and 3 on the axil." The male flowers are unknown; but as far as the females indicate distinctions, Fitz-Roya can be said to differ little from Thujopsis, except in the 3 terminal glands of the cone, and in 3 only of the scales being fertile.

Saxe-Gothæa conspicua, *Fitz-Roya patagonica*, *Libocedrus tetragona*, and *Podocarpus nubicola* are, no doubt, the four most interesting Conifers for this country, after *Araucaria imbricata*, which South America produces.

4. FAGUS OBLIQUA, *Mirbel.*

This is, probably, a hardy evergreen tree. Mr. Lobb says,—"It inhabits the slopes of the Andes, from the level of the sea to the line of perpetual snow. It in general attains the height of 40 to 50 feet, with a stem as straight and as smooth as the Pine." According to Captain King, as quoted in Hooker's 'Flora Antarctica,' this sort of Beech tree grows to a considerable size. The plant in cultivation grows freely in the open air at Exeter, and has a graceful appearance. In some respects the foliage is more like that of a Hornbeam than a Beech. The leaves are between lozenge shaped and lanceolate, serrated, with strong straight veins, and are of a beautiful pale green colour.

5. DESFONTAINEA SPINOSA, *Ruiz and Pavon.*

There is so much resemblance between this plant and a common Holly, that if its leaves were not opposite, it might be mistaken for one when not in flower. Its blossoms, however, of which one has been produced in Messrs. Veitch's Nursery, are almost 2 inches long, cylindrical, with a scarlet tube and a yellow border. As it naturally produces a great abundance of these brilliant blossoms, it must be a most charming plant when in fine condition. According to Dr. Hooker, the plant extends from the Andes under the equator, at the elevation of 12,000 feet, to the level of the sea, in Staten Island, in latitude 53° south. According to Mr. Lobb, it seldom grows more than 5 feet high; and, from the places in which it is found, he thinks it may be hardy. It will be better, however, to consider it, in the first instance, a plant that requires protection in winter.

6. PHILESIA BUXIFOLIA, *Lamarck.*

Among evergreen non-coniferous shrubs, this is probably the finest which Messrs. Veitch have imported, even although it should require a greenhouse. Dr. Hooker enumerates it "among the handsomest plants of the Antarctic American Flora; occurring along the coast, from the Strait of Magalhaens to Valdivia." Mr. Lobb writes of it thus:—

"The Philesia is a plant of very slow growth. In its native country it forms large masses on trunks of trees and rocks, throwing out long slender stems, which creep along beneath the decayed bark, and over rocks that are partly covered with soil. The roots, which proceed from the internodes of the stem, are few and brittle, and very difficult to preserve. No plant that I have seen requires so much care in moving."

In another place he writes:—

"It is a splendid thing, and probably the most valuable plant of my collections. It often covers trunks of trees and rocks. Sometimes it grows erect, but when found in that state it seldom exceeds a foot in height, and is always growing about the base of dwarf stunted wood, similar to coppice in England. The flowers are produced near the extremity of the branches, have a campanulate form, and are sometimes not less in size than the common Tulip, of a deep rose colour. The petals are thicker in substance than any other flower that I have seen. I have traced it from the level of the sea to the snow line, and it flowers more freely at a great elevation."

7. LAPAGERIA ROSEA, *Ruiz and Pavon.*

8. LUZURIAGA RADICANS, *Ruiz and Pavon.*

9. CALLIXENE POLYPHYLLA, *Hooker.*

All these are climbing plants from the south of Chili. *Lapageria* is of large growth, and scrambles over bushes in the woods of Chiloe, producing there firm, broad, dark-green leaves, and brilliant, rose-coloured, speckled, pendulous, campanulate flowers as large as a Tulip. In a conservatory where the roots have plenty of room to spread it has flowered with Messrs. Veitch, but is a plant of very difficult management. *Luzuriaga* and *Callixene* are much alike, and probably ought to be regarded as species of the same genus, as Kunth proposed, in which case the latter will become *Luzuriaga erecta.* They bear small, flat-ribbed, somewhat succulent leaves, arranged along the stems in 2 rows, and bearing on the underside white pendulous flowers in great abundance, whole coloured in *Luzuriaga*, speckled with brown in *Callixene*. Of these two Lobb says:—

"Like many others of these countries, they inhabit the cool shady woods, often covering the trunks of trees and rocks. The first, which is generally confined to trees, throws out branches in form much resembling the fronds of Ferns; the flowers are produced beneath, and assume a pendent position; the petals are snow white, and not unlike those of *Galanthus nivalis.* The flowers of both kinds are delightfully fragrant."

It would be a great gain to gardens if these three plants would prove hardy. Such experience, however, as has been gained respecting them is unfavourable to the supposition. Nevertheless, Mr. Lobb is of a different opinion, as will be seen by the following extract from his letters:—

"Respecting the hardiness of these things, if you look at their geographical position, it may be assumed that all from the elevated parts of the mainland are hardy, and I think that those from the low grounds will only require sheltered situations. The climate of Chiloe is much like that of Cornwall; it rains almost incessantly in the winter months, but it is never so cold in winter as it is in England. Frost often occurs, but of short duration. Summer is also wet and cold: the thermometer seldom rising beyond 65°; but although the frost is not so severe, the south winds are very cold and cutting, and I am inclined to think that if anything be required, it will be sheltered situations for those that inhabit the low grounds near the sea."

10. PERNETTYA CILIARIS, *Don.* (Fig. C.)

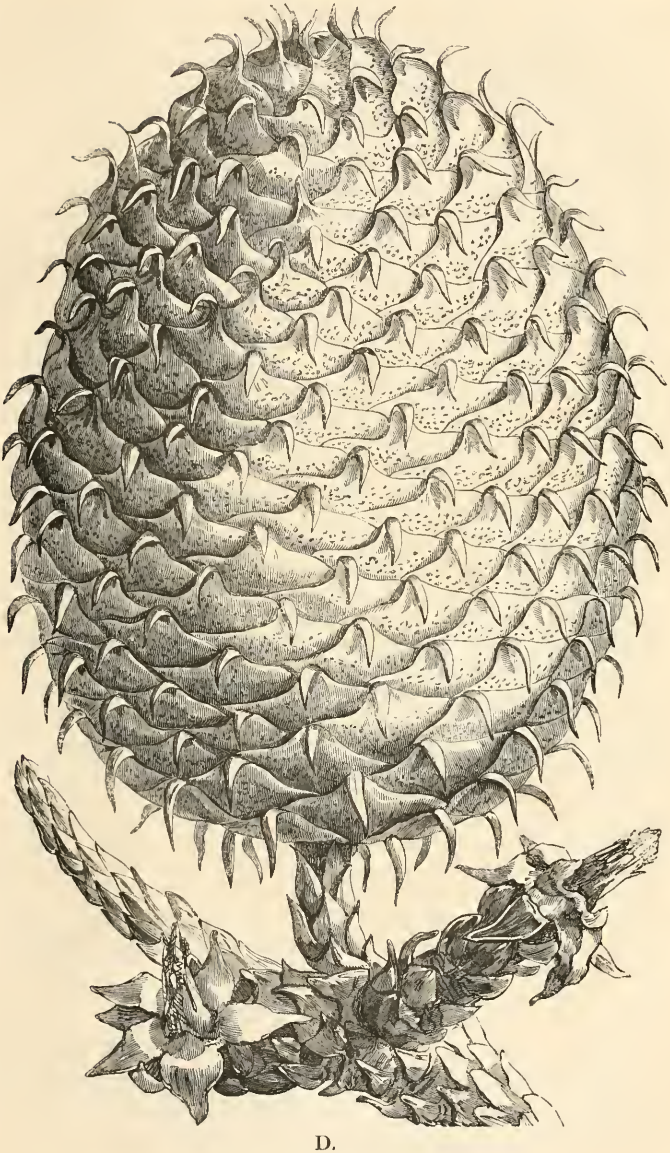
In the nursery of Messrs. Veitch there grows in the open air a dark-green low bush, with hard evergreen, ovate, serrated, wrinkled leaves, covered slightly with stiff brown hairs on the underside. The branches are clothed with similar hairs. In appearance it is not unlike *Vaccinium Arctostaphylos.* The flowers grow in numerous erect dense racemes, and are succeeded by piles of deep rich, reddish brown, depressed umbilicate berries, with a smooth calyx, the base of whose sepals is gibbous, fleshy, and hairless. The stalks are, however, hispid, and about twice as long as a smooth, pale, cucullate bract, which wraps round their base. The bush is said to have been obtained from Brazil, but it appears to agree altogether with the *Pernettya ciliaris* of Don, said to be from Mexico, of which I have seen no specimen in the many collections from that country. Mixed with the bright rosy berries of *P. mucronata* and *angustifolia*, this produces a very gay effect in the American border.

11. ARAUCARIA COOKII, *R. Brown.* (Fig. D.)

In the year 1850 Mr. Charles Moore, the Superintendent of the Botanic Garden, Sydney, was enabled to pay a short visit to New Caledonia and the neighbouring islands of the South Pacific, in H.M.S. 'Havannah;' and, notwithstanding many difficulties, succeeded, through the very great kindness of Captain Erskine, in collecting and bringing safe to Sydney a considerable number of very valuable plants, seeds, and specimens. Some of them have

C.

Pernettya ciliaris.



D.
Cone of Araucaria Cookii.

been brought to England alive by Captain Jones, of the 'St. George' merchantman; and among them the plant at the head of this article, which grows abundantly on the islands of Aniteura, New Hebrides, and New Caledonia. In a memorandum that accompanied the plant received by the Society, Mr. Moore remarks that the tree is "apparently distinct from *A. excelsa*. It differs from that species in having a more compact habit when old, and in being less rigid and more graceful when young, in the scales of the cone having a longer and more reflexed mucro, and in their gibbous, not wedge-shaped form, as in *A. excelsa*. In the island of Aniteura this plant has become scarce, the English traders having cut it down for ships' spars. I only saw one plant, and this was '*tabooed*,' or rendered sacred, by the natives; but in New Caledonia, on the south-east coast, whole forests composed of this alone were observed. In such situations the tops are not unlike basaltic columns, and were actually taken for such by the naturalists who accompanied Cook. A coral reef connects the Isle of Pines with that part." Mr. Moore adds, that it is "singular enough the first plant of this, noticed by Cook (described by that navigator, in his account of New Caledonia, 'as an elevation like a tower'), still stands, and is in a flourishing condition. Its appearance now is exactly that of a well-proportioned factory chimney of great height."

This plant is mentioned by D. Don in the Linnean Society's Transactions, vol. xviii. p. 164, as having been called *Araucaria Cookii* by Dr. Brown; it was once named *Cupressus columnaris* by Forster (*Florul. Austral.*, No. 351).

The accompanying figure of its cone shows at once how very distinct this is from either *A. excelsa* or *Cunninghamii*. In addition to the greater length of the reflexed appendages on the scales of *A. Cookii*, to which Mr. Moore has drawn attention, it is to be observed that the scales themselves do not terminate in a hard, woody, truncated extremity, as in those two species, but are wholly surrounded by a thin wing; the effect of which is to destroy the knobby appearance of their cones, and to give it a softness and evenness peculiar to itself.

Of this interesting plant the Society received two specimens in a living state, one of which was presented to the Royal Botanic Garden, Kew.

12. DAMMARA OBTUSA.

D. *obtusa;* foliis oblongis apice rotundatis, strobilis oblongo-cylindraceis (3-uncialibus), squamarum apicibus convexis arcte adpressis quadruplò latioribus quam longis.

Of this remarkable species a plant has been received alive.

It was found on the island of Aniteura, one of the New Hebrides, by Mr. Moore, who describes it as a tree similar in appearance to the Kauri of New Zealand (*Dammara Australis*), from which it is distinguished by the size and form of both leaves and cones. It grows to a great size, and produces a valuable timber, which is much used for ships' spars.

The leaves are nearly 4 inches long by $1\frac{1}{4}$ broad, very exactly oblong, with the end rounded off, without the least trace of point. The cone which I have received, and which seems to be full-grown, is 3 in. long by $1\frac{3}{4}$ in. wide, somewhat cylindrical, with the ends rounded. The ends of the scales are convex, about 4 times as broad as long, and quite different in that respect from the spreading points of the New Zealand Kauri.

Along with this Mr. Moore found two other Dammars equally distinct, but of which live plants have not yet arrived, though I understand them to be growing in the Botanic Garden, Sydney. One of these has willow-like leaves from 5 to 6 inches long and less than $\frac{1}{2}$ inch wide, narrowly lanceolate, acuminate, and slightly falcate. Its cones are unknown. The memorandum accompanying the dried specimen is as follows:—"A native of New Caledonia. In habit and appearance very unlike any other Dammar; by far the most elegant of the genus, and of much smaller size; seldom above 40 feet high. It has an erect compact growth, yet withal is graceful. In a range of country of some miles in extent, where it grows sparingly, not a cone could be found; but from information derived from an English settler, it produces a smaller rigid cone than *Dammara Australis*." This I would name after its enterprising discoverer, with the following character:—

D. *Moorii;* foliis augustè lanceolatis acuminatis subfalcatis tenuioribus.

The other has very large ovate-lanceolate leaves, 7 inches long by 2 broad, and cones much like those of a Cedar of Lebanon in size and form. Of this Mr. Moore says:—"A native of the island of Vanicolla, one of Queen Charlotte's group, allied to the Kauri of Amboyna (*Dammara alba*), but with larger cones and leaves. It is a noble-looking tree, somewhat stiff in habit, yet with wide-spreading branches. Some of the stems are at least 100 feet high." Its large leaves suggest the following name and specific character:—

D. *macrophylla:* foliis magnis ovato-lanceolatis acutis, strobilis sphæroideis (4-uncialibus), squamarum apicibus planis arctè adpressis quintuplo latoribus quam longis.

13. STENOCARPUS FORSTERI, *R. Brown.*

Of this a live plant has been received from Mr. Moore, who speaks of it as a small Proteaceous plant, not uncommon on the east coast of New Caledonia. It is a bush with obovate, retuse, flat, veinless, or slightly 3-ribbed leaves tapering to the base, and umbels of small apparently white flowers. It will not prove of any horticultural interest.

14. GEISSOIS RACEMOSA, *Labillardière.*

This is, probably, the finest stove plant that has been introduced for several years. One plant has reached the Garden in good health. Mr. Moore describes it as "a native of the east coast of New Caledonia, in bare, exposed situations. Leaves woolly and slightly serrated when young, entire and glaucous when the plant arrives at a flowering state. It is a small tree, bearing the flowers, which are of a crimson colour, on the old wood in great abundance."

The dried specimens sent home have opposite trifoliolate leaves of a firm leathery texture, with obovate, very obtuse leaflets, from 6 to 7 inches long and between 3 and 4 inches broad. Between each pair of leaves is a sessile, amplexicaul, smooth, roundish, leathery stipule. The racemes of flowers are from 8 to 12 inches long, with stalks even longer than themselves, and bearing a pair or two, or an additional whorl, of great glaucous stipules like those belonging to the leaves. The flowers are rich crimson, packed closely like a Combretum, with globular buds, 4 leathery ovate sepals, shaggy with hairs in the inside, and 8 stamens with crimson filaments nearly an inch long. When in flower these must produce a gorgeous effect, at least equal to that of *Combretum grandiflorum.*

From the above slight description, the botanical reader will see that this plant does not quite agree with Labillardière's figure and description; but I am unable to say that Mr. Moore's is a distinct species of *Geissois*, without the opportunity, which I do not possess, of instituting a comparison with authentic specimens.

I may take this opportunity of adding, that besides the plants just described, and many other rarities, Mr. Moore collected a very curious new *Dendrobium*,* an Epiphyte with

* D. *Mooreanum ;* (Dendrocoryne) caule clavato brevi sulcato apice triphyllo, foliis ovato-lanceolatis apice oblique emarginatis pedunculo 4-5-floro brevioribus, sepalis petalisque lanceolatis, labello breviore rhombeo acuto. —Found on the island of Aniteuna, on trees, at an elevation of 1200 feet.

handsome flowers as large as *D. Palpebræ*; *Stravadium album*, a beautiful tree with pendent spikes of large white flowers, sometimes as much as 18 inches long; *Metrosideros ciliata*, a charming crimson-flowered bush, at present unknown in our gardens; a magnificent new *Grevillea*,* bearing a profusion of racemes 6 inches long, of pure white flowers; the rare and little known *Codia montana* of Labillardière; and an *Anacardium* without flowers, concerning which he has furnished the following memorandum:—

"A native of the island Vanicolla, one of Queen Charlotte's group. The fruit of this plant so closely resembles the Cashew Nut, that it was at first mistaken for it. When gathering the seed, I expressed some of the juice from the nut upon my hand, which, having by some means been communicated to my eyes, caused the eyelids first, then the whole face, to swell to such an extent, that not a feature could be distinguished, and rendered me for two days quite blind. The swelling in the face continued a week. My hands, feet, and legs were then attacked in almost a corresponding degree to that of the face. As soon as the swelling had subsided, the skin came off the parts which had been affected in large flakes. I did not experience the slightest pain at any time. Where the juice touched the hand, the skin became quite black."

XXIV.—*Plan of a new Boiler.*

The following is the plan of a new boiler recently put up in one of the stoves in the Society's Garden at Chiswick, by Messrs. D. and G. Bailey, of 272, Holborn.

It is a cast-iron boiler, with a wrought-iron cover bolted on. Its presumed advantages are, that it is more economical than other boilers in its expenditure of fuel, as it exposes a very large heating surface to the fire; and as it contains but a small quantity of water, it heats quickly.

The pipe on the top, called the combustion pipe, is for the purpose of forming a current for the smoke through the centre of the boiler.

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* G. *exul;* foliis oblongis basi angustatis apice retusis subtus glaucis leviter tomentosis 3-nerviis venosisq., racemis secundis sericeo-tomentosis paniculatis. pistillo glaberrimo, ovario longè stipitato basi gibboso, stigmate medio conico, stylo calyce pluries longiore.—Native of the East Coast of New Caledonia, in exposed situations. Fruit unknown. Related to *Gr. Chrysodendron.*

MESSRS. D. & G. BAILEY'S NEW BOILER.

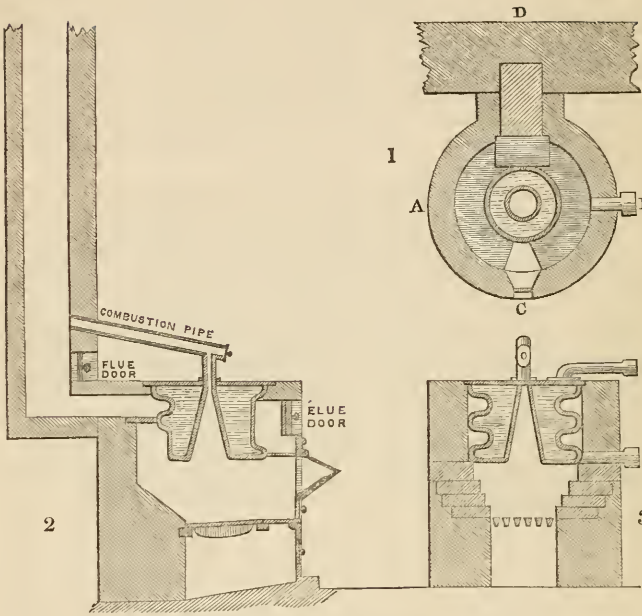


Fig. 1. A plan of the boiler. 2. A perpendicular section through A, B. 3. The same through C, D.

XXV.—*On Bignonia grandiflora, as an Ornamental Pot Plant for the Greenhouse and Conservatory.* By William Wood, Fishergate Nurseries, York.

(Communicated Sept. 10, 1851.)

This noble and somewhat neglected plant is generally known to cultivators as an ornamental greenhouse or conservatory sub-climber, in which capacity its diffuse habit and ornate clusters of bloom, occasionally seen at an elevation of from 12 to 15 feet, render it a striking object in lofty structures. The very few instances, however, in which it is found in any other shape than that just mentioned, favours the supposition that its adaptation for forming an upright standard tree-like shrub is not so generally known as it deserves to be. Being a deciduous plant, and, therefore, with others of a similar character, remaining dormant during the winter season when planted in conservatory or greenhouse borders or pits, it is capable of enduring a comparatively low temperature—in fact, of withstanding any degree of cold; but it only discovers its highest vigour and greatest beauty where its annually re-accumulated growth has been subjected to a genially-stimulating atmosphere during the spring months—a condition always essential to its successful management in pots.

A young plant may be obtained from the nurseries with a good leading shoot. When received, it should be potted in three parts friable turfy loam, and one of heath mould, adding one-sixth of pure river or white sand. It should then be trained as a young vine, supported by a stake proportionate to the mean vigour of the plant, and started into growth in March or April, with the progressive temperature of a warm greenhouse or vinery, water being applied "freely but seldom," about each alternate or third day (but intermediately syringed), until its well-developed leaf buds indicate a healthy circulation of its sap. The lower buds, or small branches on the stem, may be encouraged until a vigorous growth is obtained; after which, increase should be principally restricted to the leading shoot. If a healthy plant is selected, it will reach 4 or 5 feet in height the second season ; and this being attained, the terminal branching head should be formed by pinching or cutting off the extremity of the leading shoot at the required elevation. This operation being performed during the vigorous growth of the plant, will favour, at least, the partial formation of the upper leaf buds into branches during the current year's growth.

The plant should be encouraged to grow vigorously during the second and third year by means of a stronger bodied soil, and an additional sixth part of well-decomposed leaf mould, assisted by a weak solution of manure water, once a week.

If the growth is obtained in a vinery, the plant should be placed under a good exposure to light, until the lateral branches at the extremity have attained 2 feet or more in length, and then it should be removed to a similar situation in the modified temperature of a greenhouse or conservatory, which will assist it in forming flower buds.

After the plant has flowered, it should be permitted to ripen its wood by exposure to a temperature of from 60° to 65°, water being more sparingly applied to the roots than formerly ; and the whole of the expended flower stem at the extremity of each branch cut off, in order to aid the fertility of the remaining growth for the ensuing year.

As the plants evince a tendency to rest, which is known by the partial discoloration of their leaves, they should be gradually exposed to the open air with other deciduous greenhouse shrubs, and ultimately placed in a cool vinery or greenhouse until the following spring. At that period they should be newly potted, and on the first appearance of vegetation pruned closely to within one or two buds at the base of each branch.

The foregoing remarks embody the kind of treatment followed in the case of two plants whose heights were about 4 feet, and the diverging branches 10 and 14 feet in circumference. The ripened extremities of the branches upon each plant produced 11 large racemes of bloom, unfolding in both instances nearly 300 rich bronze-coloured orange funnel-shaped flowers, each $3\frac{1}{2}$ inches in diameter. These plants presented a very beautiful effect by their diffuse flower stems, whilst the elegantly-winged leaves gracefully contrasted with the darker masses of foliage around them. The last, and not least, recommendation of this species is its adaptation, whilst in bloom, for being placed in dark-roofed conservatories, where light is but sparingly admitted, and where plants of softer growth would certainly sustain injury.

XXVI.—*On Flower Pegs.* By A. Forsyth, C.M.H.S., St. Mary's Church, Torquay.

(Communicated Sept. 12th, 1851.)

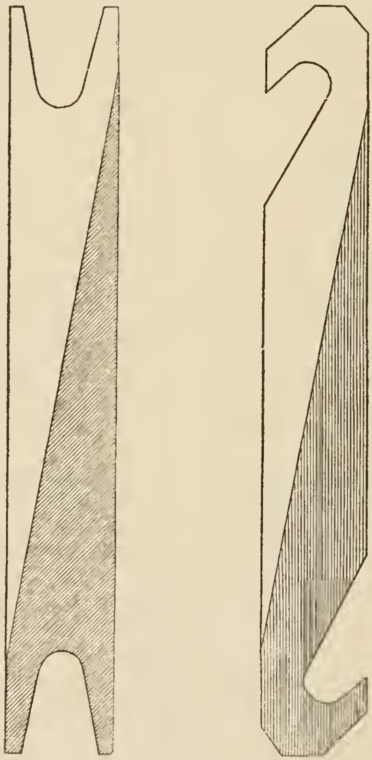
In some branches of horticulture the rudest materials are still used, and appliances of a primitive character resorted to, as if gardening with us were only as yet in its infancy. Surely the finishing stroke to a bed of flowers is the pegging down or tying up of the branches, so as to show off the bed as a whole to the greatest possible advantage.

Passing over the subject of flower sticks, I shall confine myself to pegging and peg making. In the ordinary arrangements of nature we find all flowers more or less elevated; at all events this is the rule, and flowers prostrate either on the earth or on the water are the exceptions to this rule: it is therefore an unnatural practice to bind them to the earth; most plants too have an upward tendency, consequently bending down is apt to break them. For these reasons therefore I find it desirable to employ a prop to hold the flower up from the earth in addition to the hooked stick to keep it down. This appliance will be understood by a glance at the accompanying woodcuts, being neither more nor less than a forked stick, such as is used on a large scale to support the limbs of apple trees when heavily laden. The fork for propping up small plants is made of the same material as that used for the hooked peg of horticulture, namely, the fronds of the common fern (Pteris aquilina); only in the props the shank or stem runs downward, whilst in the hooked peg the shank runs upward in regard to the frond from which they are cut. Although I am anxious to introduce a better and a cheaper article than fern timber for this purpose, I prefer stating the case in this homely way in order that certain old fashioned parties may try the experiment, and likewise that by contrasting the two systems all sorts of readers may comprehend more clearly the drift of my argument, which is that props and pegs manufactured by experienced hands can be rendered less clumsy and less expensive than those formed by the clasp-knife of the labouring man.

It is impossible to make hooked pegs out of the fronds of fern without having the small end tapering to the earth; so that however hard it may be to thrust them in, it is not hard to pull them out, especially if they are put in perpendicularly to the earth's surface as they generally are, whereas if put in slanting the weight of earth would help to keep them firm; but all pegs made of green materials naturally shrink in drying, and consequently get loose. In addition to the fern frond pegs above alluded to, there are wooden ones made from the spray of birch, &c.: indeed, the uses of a birch besom about London may be stated thus,—first it is employed to sweep the lawn, secondly to peg the flower beds, and lastly to light the hothouse fires.

Iron hair pins are used as pegs for plants, and are both neat and cheap, and when made sufficiently large answer for some plants, but still they are liable to corrosion and other faults. The wooden loop of deal or willow, of the same shape as the hair pin and of the strength of a lucifer match, answers very well, but it is subject to very clumsy mishaps in unpractised hands: nevertheless this loop as well as the hair pin has always a leg too many to be neat, since any article that could do its work with one support is preferable to one requiring two, and the very character of these pegs and loops necessarily limits them to the small size of pegs.

When a shoemaker wants pegs to tack heel pieces together, it is quite astonishing to see how cleverly he cuts them out: sections of a beech branch are sawed from half an inch to an inch in thickness and 5 or 6 inches in diameter, these are cleft into pieces of the size and shape of a gentleman's dressing comb, and these combs are again cleft as it were tooth by tooth, and thus the pegs are formed. Now if a labouring man were set to work at 6 o'clock in the morning to make pegs, and were told that every one must be wedge shaped and pointed, and that he had to make 30,000 before night, he would certainly think it a very unreasonable demand, whereas the shoemaker would accomplish the task in the ten hours and have time to spare. Now if the shoemaker's pegs were of larger dimensions, and a saw draught made in the combs, so that the section should be a hooked peg instead of a wedge, and the combs cleft as before with a strong knife, we should have many thousands of neat pegs fit for verbenas and other trailing plants cut in the course of a wet day, and that too with no other tools than the common garden pruning saw and the sheath knife. Although this homely plan is not the best, I could not omit mentioning it, since some may try this cheap and ready method who do not require any great amount of pegs or any of the larger sizes. It is always difficult to get pegs just of the right size required; for the strength or delicacy of the shoot to be secured determines their length and strength, and hence the necessity for a perfect control of the sizes of the pegs and forks. Hundreds of plants would be benefited by being trained near



the earth if proper pegs could be had cheap: witness the gooseberry fanciers training the cherished shoots near the earth, and wide apart from one another, by means of hooks and props, and I have seen this adopted by gardeners to get large fruit, as at Bicton by Mr. Barnes, and surely no kind of trellis could be so cheaply or so readily put down or taken up as a bundle of tent hooks and forked pegs. In putting down these, the hooked peg must always be placed outermost, and the fork between that and the root; for if this order is reversed, the shoot in turning up to the light, which it always will do, leaves the prop loose, whereas the hook being outermost becomes tighter by the upward growth of the plant. Many of our most showy plants are greatly improved in appearance by having their long naked stems hid and their flowers brought forward by means of training; but on the other hand they look broken down if the flowers are pegged to the earth.

The accompanying woodcut will show the way in which one peg is sawn out of another without waste, and another method where the hook hole is punched or rather pinched with pincers such as railway ticket-takers use, and shoe-makers have, and how the remainder of the thin label or veneer is shaped into pegs by a few cuts of the shears. The stronger pegs are made by sawing and boring according to the lines shown on the section.

That pegs will be made by machinery of fair proportions and marvellously cheap there cannot be a doubt, but this is not the place and gardeners are not the people to inquire into the working of steam-engines and circular saws for cutting wood into veneers. I have made the articles here described of various sizes, and that with a few inexpensive tools,—indeed, with little else than a saw.

Pegs thus made of seasoned wood are very superior to those in common use, since they admit of hammering to fasten them, and when they are inserted, the damp earth gets firmer by the swelling of their tissue. In order to arrive at the true character of these pegs, we must take the actual dimensions and see how many can be cut out of a solid foot of timber.

When the smaller sizes are wanted, and the thickness of veneering is sufficiently broad to cut them from, a piece of wood 4 inches long by 1 inch broad, and half an inch thick, will give 10 pegs at each end, or 20 in all out of 2 solid inches of wood, thus furnishing 17,000 and odd out of a solid foot of timber; and these slender pegs would then be quite as strong as the well-known "Menographs," or wooden labels for plants, manufactured by Messrs. Lingham of Birmingham; and even when the pegs are made of large dimensions, 10 inches long, half an inch broad, and a quarter of an inch thick, the enormous number of two thousand and odd can be cut from one cubic foot of timber, the full value of which would be from 6*d*. to 2*s*. 6*d*., according to circumstances, but the average of 1*s*. or 1*s*. 3*d*. would be a fair estimate of the cost per foot for materials. Contrast this with a couple of thousand of hooked sticks 10 inches long, cut from the spray or branches of trees, of sufficient strength to admit of being hammered in driving: instead of packing them into the compass of a cubic foot, I find they would fill the body of a cart—being 46 faggots, 10 inches by 9 inches, or about 27 cubic feet, and nearly 2 cwt.

The training of a wall-tree could not be effected by means of shreds pulling all one way, but it is accomplished readily by pulling the branches right and left, and thus any distance or direction is secured to the bearing wood. Now suppose a plant trained to the face of the earth instead of to the face of a wall, there is wanted the left-hand power to keep the shoot away from the earth, as well as the right-hand power to keep it to the earth; and it is here that the forked prop is required, without which the system of level training, which I am advocating, is impracticable.

By far the most beautiful flower-bed I ever saw was a crescent of moss-roses, pegged down near the earth upon moss, so that the flowers rose upright upon their own footstalks, and the foliage had just room enough to fall without trailing upon the ground.

By means of pegs and props hundreds of rambling plants might be trained or led where we please, that otherwise would get entangled, and would not behave themselves either upon the earth or tied to a stake in the air. Nearly half the summer labour of some flower gardens is the propping and tying of the flowers; and go where you may in the flowery days of summer, you find gardening folks with sticks in their hands, and strands of matting in their teeth to tie the flowers with. The system of propping here detailed will at least support one-half of all the hardy ornamental plants requiring props, and that at a cost of 50 per cent. less than is now required to do them. The foliage of plants, instead of being bundled up in faggots to sticks, should be exposed to sun and air, and this can only be done with an amazing—I had almost said unreasonable—number of ties; it is therefore necessary, in developing this plan, to cheapen the props before using them so extravagantly, for it must come to this at last, that every flower-head shall have a place to itself, and by raising it higher or lower according to circumstances, great beauty and variety will be produced.

Besides bedding plants that are usually pegged, and rambling plants that require tall sticks, there are things that want raising to form a semi-globe, whose natural habits are too flat to show them to advantage in certain positions, and there are few flower borders that have not a particular point of sight to be viewed from, so that sheets of bloom have to be created by pegging or tying the flower-heads forward, where the habit of the plant is to produce only awkward clusters of flower-stalks, half of which would be hid by the other half, and the hint given by the Lancashire gooseberry-growers need not be disregarded in floriculture:—He would rarely succeed in getting a prize fruit who did not train his gooseberry bush. I could enumerate hundreds of highly ornamental plants that cannot be grown in ordinary gardens for want of a trellis to support their vines; here then is a cheap and ready way of training and keeping them trim by sticking them as they advance; and as for tall plants, they seem to be almost discarded from cultivation, for unless they have a stem like a hollyhock, they are rejected on account of the trouble they would cause. It is quite disgraceful to see how few varieties of flowers flower gardening people grow: it is time to alter this, and to give those slender-stemmed and elegant plants a place whose vines are not furnished with tendrils to climb, and whose beautiful heads of flower it would ill become such to make the earth their pillow.

XXVII.—*Notes upon New Fruits and Vegetables proved in the Garden of the Society.* By R. Thompson.

1. Pois Nain Hâtif extra.

Presented to the Society by M. Vilmorin, of Paris.

It is not only very dwarf and early, as its name implies, but also most prolific. Sown April 10; in flower June 16; and fit to gather June 25. Grows about a foot high. Pods straight, nearly round, containing generally six tolerably large peas.

From its dwarf habit, it may be sown in rows 18 inches apart; at this distance it will almost closely cover the whole surface of the ground, thus tending to prevent the latter from becoming too dry. It may be grown between the rows of tall sorts.

It is superior in every respect to the *Pois nain hâtif;* not so large in pod and pea as *Bishop's New Long Pod*, but it is even more prolific and fully a week earlier than that sort. It will therefore prove valuable as an early dwarf pea, and more especially to those who cannot afford space for tall sorts.

2. Hooper's Seedling Strawberry.

An abundant bearer, ripening soon after Keens' Seedling.

Fruit large, oblong-ovate, sometimes compressed, deep red; seeds very small and deeply embedded. Flesh red next the outside, pale near the centre, which consists of a remarkably strong fibrous core. The flavour is acid, not so rich as that of Keens' Seedling. This, and the toughness of its core, render it objectionable for cultivation.

3. Cole's Prolific Strawberry.

This reputed new sort appears to be the same as Keens' Seedling.

4. Royal Pine Strawberry.

This is the same as the Swainstone Seedling, which was raised fifteen years ago in the Isle of Wight.

5. Cuthill's Black Prince Strawberry.

Syn. Malcolm's Aberdeen Seedling.

This was obtained from Mr. Cuthill, of Camberwell, in 1850; and the same variety was received from Mr. Lander, Goshen, near Edinburgh, in 1851, under the name of Malcolm's Aberdeen Seedling.

An abundant bearer, ripening earlier than Keens' Seedling. Fruit middle-sized, roundish or ovate with a neck, shining, very dark red, or blackish when very ripe. Flesh dark red, tolerably rich, but scarcely equal in this respect to the Roseberry, to which it has considerable resemblance in some particulars, though widely different in others. The segments of the calyx are spreading, or somewhat reflexed; scapes long; peduncles very long and slender, in consequence of which the fruit, like that of the Roseberry, lies on the ground, or straggles among the bases of the leaf-stalks. The latter are tall, slender, nearly smooth, and of a reddish colour. Leaflets roundish oval, with serratures moderately deep and almost regular. The flowers of this variety are very remarkable; the petals before fading assume quite a red colour.

Earliness is the principal merit of this strawberry.

6. Myatt's Mammoth Strawberry.

Received from Mr. Myatt.

A moderate bearer, ripening soon after the British Queen. Fruit very large, roundish-oblong, or sometimes cockscomb-shaped, with a smooth, glossy neck, bright red; seeds small, not numerous, shallow, with glossy intervals; calyx reflexed. Flesh reddish, pale towards the core, acid, coarse, nothing like so rich as that of the British Queen. Scapes moderately tall, with soft adpressed hairs.

This sort requires to be kept in single plants, and these free from runners, so that the fruit may be well exposed, otherwise, from its enormous size, it cannot ripen thoroughly.

It is a very inferior sort.

7. Myatt's Eleanor Strawberry.

Received from Mr. Myatt.

An abundant bearer, ripening a few days later than the British Queen Strawberry. Fruit large, oblong, generally a little flattened, deep red; seeds deeply embedded. Flesh reddish, with nearly as much acidity as the Elton. Scapes and leaf-stalks rough with spreading hairs. The habit of the plant bears considerable resemblance to that of the Elton; but it grows taller, and the leaflets are not so round, and the fruit ripens earlier.

The fruit requires to be well exposed, as it contains much acidity. Like the Elton, it would probably answer well for preserving. From its being an abundant bearer and a good colour, it is becoming extensively cultivated for the market.

8. Kitley's Goliath Strawberry.

Fruit very large, but not so large as Myatt's Mammoth; red, with a coarse surface, the seeds being deeply embedded. Flesh pale, with a large core, too acid. This variety cannot be recommended for cultivation.

9. Great Britain Cucumber.

Received from Mr. W. Harris, Clapton.

Fruit very large, cylindrical, deep green; spines black, on very small bases. An early and prolific bearer. The plant is not so rambling as some others of the large sorts, being checked by its early fruiting. It is a valuable sort for early forcing. For late produce a successional sowing is necessary, because it does not continue bearing so long as those that are later in commencing to form their fruit. Owing to the surface of the fruit being quite free from grooves, it can be easily pared.

A first-rate variety, highly deserving of cultivation.

10. Adair Green-fleshed Melon.

About 4¾ lbs. weight, roundish, flattened at the ends, a little ribbed and netted, pale yellow. Rind thick; flesh pale greenish yellow, tough, with little flavour.

Very handsome in appearance, and may prove better in another season.

XXVIII.—*Observations on the Vine Mildew.* By J. H. Léveillé, D.M.* Translated from the French, with Remarks by the Rev. M. J. Berkeley, M.A., F.L.S.

"The gardeners in the neighbourhood of Paris have, unhappily, too much reason for remembering the damage done to their grapes last year by the *Oidium Tuckeri*. Under these painful impressions they are at this very time watching their trellises every instant, and turning up the leaves in search of the baneful mould. Some return from their observations satisfied with the result, but others alarmed, because they have discovered certain spots on the lower surface of the leaves, which they believe to be clearly due to its presence.

It is, I think, useful to destroy this false notion, which is so generally diffused, and which is causing so much anxiety. What is at this moment taken for *Oidium Tuckeri*, the mould which destroys the grapes, is merely the *Erineum* of the vine, which has always existed, and which has never attracted much attention, because it is not, in point of fact, injurious.

To avoid this mistake it will suffice to call to mind that the vine *Erineum* is constantly produced on the lower surface of the leaves, where it forms spots varying in number and extent. It forms a lining to the depressions, which are the counterpart of the blisters which render the upper surface unequal and tuberculated. As soon as it begins to be developed the surface purses up and exhibits a manifest change of colour. It is at first white, rose-coloured, or pale violet; then it assumes a tawny or rusty tint; even with the naked eye it is clearly due to an anomalous development of the hairs, which assume the appearance of threads. To understand their nature perfectly it is necessary to have recourse to the microscope, under which they appear to be elongated, hollow, cylindrical tubes, without any partitions through their whole length, and absolutely empty. The membrane of which they are composed is simple, uniform, without reticulations, and of the same nature with the epidermis, of which it is a continuation. This fact is beyond all doubt, only the true cuticle forms no part of them, because it has been destroyed or perforated by the development of the subjacent cells. This at least seems to be indicated by a little circular line, or a slight irregularity which exists at the base of each of the threads of which the *Erineum* is composed.

The causes of this anomalous growth of the hairs are entirely unknown. It is regarded generally as the result of the puncture

* Recherches sur la Maladie des Vignes, par J. H. Léveillé, D.M. Extrait de la Revue Horticole, No. du 18 Juin, 1851.

of extremely small insects. This explanation, however, notwithstanding the authority of Professor Fée, has never appeared to me completely satisfactory. Every one knows that when an insect deposits one or more eggs under the epidermis, or in the substance of vegetable tissues, a great activity arises in the vegetation, and an unnatural development of the tissues; when, on the contrary, they are deposited on the surface of the leaves, their tissue is not affected, and they experience no change. When an insect, then, has introduced an egg under the epidermis, we ought to find the egg itself, the cavity in which it is contained, and the modification of the tissues which it has caused. But neither eggs nor cavities are ever observed, and the epidermis alone is modified. It is very true that we find amongst the threads of old patches of *Erineum* larvæ and their remains, as also mites and plant-lice. But if we examine the upper surface of the leaf, we find no aperture pierced by the insect in order to escape and live in a state of liberty; the filaments do not present the least solution of continuity in their whole length; their base always rests on the tissue of the leaves, their free extremity is always obtuse and imperforate, and their cavity does not inclose any traces of old skins or excremential substances. Nothing then justifies the notion that *Erinea* are, like galls, bedeguars, &c., the cradles of insects. If indeed we meet by chance with insects or larvæ, the species are not so constantly the same as to justify us in referring to them these accidental forms of vegetation. These observations do not rest merely on the vine *Erineum*, but have been repeated on those of the maple, the sycamore, the lime, and the birch. Whether it resemble a tube or a flask, the accidental production differs simply in form; the organization and mode of development are the same.

Though the vine *Erineum* cannot then be attributed to the puncture of an insect with the view of depositing its eggs, may we conclude that it is due to the puncture of the same insect made in the leaves for the purpose of deriving nourishment from them? Certainly not. Every one knows that amongst insects it is the *Hemipteræ* which have the slenderest mouths. But whether they live on animals or vegetables, they do not derange or tear the tissues in the act of suction by means of the different parts of which their mouth is composed; they employ the most delicate acupuncture which it is possible to conceive; and as soon as the proboscis is introduced the juices ascend simply in obedience to the laws of capillary attraction. May we suppose, however, that at the same time they introduce some irritating fluid? Nothing authorises this supposition; and besides, were it the case, what would be the condition of the foliage of our trees? Not a leaf would preserve its integrity; all would be diseased. Much more must accidental productions bear some proportion to the size of the insects; but this is not the case; and by a kind of eccentricity which is not rare in the human mind, we refer to the most minute causes, the most manifest effects; a locust may pass over without leaving any traces, where those which a plant-louse causes are indelible.

I repeat, then, that the vine *Erineum* does not depend on the puncture of an insect, but is an elongation of the epidermal cells, due to some unknown cause, which exists in the plant itself, as is also proved by the fact that the leaves while still rolled up and plaited exhibit traces of the affection.

I have said enough to enable any one to recognise the *Erineum*, but to prevent its being confounded with *Oidium Tuckeri* I think it right to call to mind the description which I gave of that mould last year, before the Société Philomathique (1850, August 3).

The plants on which the mould is developed present the same appearances as others, except that the shoots of the year, the leaves, bunches, berries, and stamens, in a word all the diseased parts, are covered with a very thin white pulverulent down, which is visible at some distance, and which diffuses a very perceptible mouldy smell. It forms on the leaves white circumscribed spots, which resemble those of *Erysiphe*. This down, when examined under the microscope, is formed of slender branched articulated threads, which creep over the surface of the leaves. From different points of this primitive mycelium spring little erect straight stems, which are transparent, simple, and articulated, and which bear at their extremity three, four, or five, oval or elliptic simple hyaline spores, joined end to end like the beads of a necklace, and filled with extremely fine granules. These granules, when forced out by compression between two plates of glass, are spherical, transparent, and endowed with molecular motion.

These characters do not leave room for any confusion. One of these productions is confined to the under surface of the vine-leaves; it is persistent, and does not disappear when rubbed: the other, on the contrary, attacks every part of the vine except the old branches and roots; it is only temporary, and disappears on the slightest friction.

In questions of the diseases of the Vine, however, the *Erineum* seems to bear a certain part. At least this was the case in 1835, when M. Duby communicated to the Natural History Society of Geneva his observations on *Torula dissiliens*, which occasioned the premature fall of the leaves of the vines in a great part of the valley of the Leman Lake. M. Vallot, of Dijon, thought that he recognised in this plant the *Erineum vitis.* Messieurs Alphonse de Candolle and Duby opposed this view, because they were well acquainted with the *Erineum*, and had made a particular study of *Torula dissiliens.* M. Vallot is, to a certain extent, excusable, because he had seen neither the new *Torula* nor the figure which accompanies the memoir of M. Duby. But the persistence of the *Erineum*, and the ease with which the *Torula* disappears, ought to have raised doubts in his mind. It is sufficient to blow strongly on the lower surface of the leaves to cause it to fly away. So much is this the case that M. Alph. de Candolle remarks, in a note, 'When I wished lately to re-examine the *Torula dissiliens* preserved in my herbarium, I found that the act of drying had caused almost all the joints of this microscopic plant to fall. There remain only the diseased leaves of the vine, marked with traces of the parasite, and some very fine powder.'

The *Oidium Tuckeri* is more easily preserved, and is not dispersed by a mere breath of air; but it is, nevertheless, difficult to recognise its character in dried specimens, beause the spores separate with the greatest ease when it is dry, and nothing but the mycelium is left behind, which resembles that of an *Erysiphe.*

The certainty which has been acquired of the spontaneous development of moulds on some living animals, and especially that of *Botrytis Bassiana*, or silkworms, has made people believe, though wrongly, that many diseases of vegetables and animals were due to a similar cause. Exaggeration has been pushed a little too far. It is well known now, from the researches of M. Decaisne, that the nematoid mycelium, which we find under the epidermis of diseased potatoes, pears, and rotten apples, &c., is consequent on disease in those productions. It is the same with the *Oidium* of the grape. Mr. Berkeley in England, and M. Duchartre in France, think that the mould is the first cause, and the disease its consequence. The researches which I have made do not allow me to participate in the opinion of my honourable friends. M. Decaisne and myself have made vain efforts to discover under the epidermis the least trace of mycelium upon the grapes, the vine-leaves, and on the branches, when beginning to be diseased. We have satisfied ourselves that all the phases of the vegetation of the *Oidium* take place on the surface. The tissues are affected first, and when a white spot begins to appear, however minute it may be, the mould is developed; if the finger is simply passed over it, it disappears; and if we examine the spot with a lens, we see at the point which it occupied and around it, where no malady was suspected, extremely minute black or brown specks upon which the mould is successively developed. The parenchym, which corresponds with these specks, is equally brown and less filled with juice than that which surrounds it; if at this time it were covered with or traversed by mycelium, one ought to find it; but this is not the case. At a later period the epidermis is frayed, the parenchym dries up, and, after having lived some time, the fungus disappears.

When the stalk is diseased through its whole extent, the grapes entirely perish; when the malady attacks the berries in the first stage of development, they dry up or fall; if, on the contrary, they have acquired a certain size, they are able to resist it; some crack, split, and expose their seeds; others are deformed and arrive at maturity, but they never acquire the size which they would have done had they not been diseased. Like fruits which have been punctured by insects, they appear to me to ripen before other grapes; but they are rather fleshy than succulent, and they are almost destitute of flavour.

Another question which preoccupies many minds is that of contagion. I avow beforehand that I have no belief in it. According to my views the fungus does not propagate the malady, but the primitive derangement of the tissues of which I have spoken is endemic. It is the same with the potato disease. It is impossible for us, notwithstanding the numerous researches to which that malady has given rise, to say to what cause it is due. To prove the existence of contagion we ought to be able to produce at our pleasure the disease of the tissues; but we cannot do so. People, to prove contagion, say that they have placed a sound grape by the side of one which was diseased, and that on the morrow or the day after the two grapes were equally bad. This experiment, which I have repeated myself many times, and which has always succeeded, may be interpreted in two ways: first, we may have placed by the side of a diseased grape another in which disease had already commenced, or which was predisposed to contract it; and secondly, the ease with which moulds are developed causes their spores when dispersed to germinate and fructify on almost all kinds of bodies provided their evolution be favoured by moisture and temperature. In this case the remarkable circumstance is, that the points of the fruit or leaves on which the moulds are developed do not present the brown spots. Those who last year attentively followed the progress of the vine disease, have remarked that it had an exacerbation which lasted till the 15th of August. This relapse, though real, had no destructive consequence; it was the result of the torrents of rain which fell on the 6th of August; its violence had cleansed the grapes and the leaves, but in the following days the spores which had been disseminated germinated again. As the disease was over before, the *Oidium* ran through its phases of vegetation and the grapes did not cease to grow. Before the storm of which I speak I had already acquired a certainty of the fact that when the leaves were frequently syringed with common water the fungus grew abundantly and the grapes were not the more diseased. It is to this protracted mode of propagation that we must attribute the small influence of the malady on a great number of the berries which, though almost entirely covered, arrive notwithstanding at perfect maturity.

These spontaneous recoveries deserve more attention than may appear at first sight; they may take place when some particular remedy is applied, and since it seems to have succeeded, all the advantage is attributed to the remedy. I have never seen these recoveries at the beginning of the disease, that is to say, when the berries were forming; but when they have acquired a certain size the *Oidium* is then contagious, and may appear two or three times on the same grape without its being sensibly inconvenienced, because it is superficial, and there has been no primitive disease of the tissues. I am however exaggerating a little—its harmlessness is not always so great; when it covers the grapes with a thick mycelium, it stifles the berries; but then they do not crack, they dry up.

Up to the present time there are but two opinions respecting the disease of vines: the one generally adopted, which attributes it to the development of the *Botrytis*,* and my own, for I am in point of fact the only person who considers the fungus as one of the consequences of the disease. This divergency of opinion induces of necessity another in the treatment of the malady with a view to its cure.

M. Duchartre, Professor of the Agronomic Institute of Versailles, in a report addressed to the Minister of Agriculture and Commerce on the means of combating the effects of the fungus which attacks the vines, said, "I am to-day happy in being able to announce to you that the treatment to which the diseased vines have been submitted has given excellent results, and that henceforth we may flatter ourselves with being able to combat it with success whenever it may appear."

The remedy employed by M. Duchartre consists in dashing over the diseased vines, by help of a garden syringe pierced

* This is probably a slip of the pen for *Oidium;* a true *Botrytis* of the same section with *Botrytis infestans,* but far more beautiful, and highly developed, and, like all the allied species preying on the parenchym, occurs in South Carolina on vine leaves. I have not, however, heard that it is injurious. My specimens, which were gathered by Mr. Ravenel, and have been named *B. viticola,* Berk. and Curt., occurred on *Vitis æstivalis,* and, I believe, on some other species.

with rather large holes, water in which flowers of sulphur are held in suspension.* This simple, inexpensive mean, by common consent, has been most successful. The employment of sulphur in this form had already been recommended by Mr. Kyle, an English agriculturist, who had discovered its properties. These advantages cannot be called in question, and I have no thought of doing so ; I have myself witnessed them, but I have witnessed those also which I have myself obtained in the month of July by syringing with water in which was dissolved a small quantity of common salt, or sulphate of iron. My own treatment has only served to wash off the fungus as fast as it appeared. When the disease was over everywhere, I have compared the results obtained in plants which had been experimented upon with those which I had left to their unhappy lot. I then saw no difference, the bunches were completely dry, or only retained a small number of berries. Amongst these some were small, cracked, and deformed ; others appeared not to have been affected.

The experiments which I made were commenced too late; they would have been more successful at the commencement of the malady, as I have assured myself from late bunches which did not blossom till the end of July. In these the berries presented no trace of disease. I have made but one experiment with sulphur, and my vine, at the time of maturity, did not appear to me in better condition than the others.

I conclude from my researches that the malady which raged amongst vines in 1850, and principally in the Chasselas in the neighbourhood of Paris, and in many other parts of France, is not epidemic but endemic ; that it is due to a primitive, special, unknown corruption of the young branches, leaves, stalks, and berries; and that *Oidium Tuckeri,* instead of being the cause, is only one of its consequences.

That if we wish to prevent, not the ravages, but the development of this fungus, we must not allow ourselves to be taken by surprise, as we did through the summer of last year, but commence from the beginning at the moment of flowering, on the first symptoms of the disease, and not when it is generally dispersed, for then it has produced its effects, and it is difficult to appreciate the advantage of the means which have been employed.

That if, as I believe, the disease does not come from without, but that it is inherent, and belongs to the tissues and juices of the vine, we must seek the cause and means of counteraction in

* As the sulphur is not soluble in water, care must be taken that the powdered mineral is held in suspension. This remark is necessary, as some authorities have recommended the water to be drawn off clear.—M. J. B.

some accidental circumstance or the mode of cultivation. What seems to prove this is, that the disease has been more virulent in white than in black grapes, and that the vineyards have been spared while the trellises have suffered.

I shall terminate these remarks by a final observation on the mode of propagation of *Oidium Tuckeri.* Professor Brongniart told me lately that some persons thought they had remarked that the fungus appeared first in stoves where the vine is cultivated to obtain early grapes, and that by degrees it was communicated to the surrounding trellises. This point of origin, if it were well established, would militate strongly in favour of contagion, but in truth it proves nothing. In fact, if the malady is endemic, if it is connected with a particular condition of the vines, it is very natural that those which are inclosed in stoves should be more diseased than those which are in the open air, since their vegetation is earlier than that of the others. The fungus cannot be developed at the same time on plants which are placed in very different circumstances. I am well aware that it may be objected that the one prepares and preserves the elements of contagion till the others are in a fit condition for being infected, but why then this preference for white grapes, and repugnance for those that are black? In this case the vines whether staked or on trellises should be diseased, and we see the malady rage principally in vines attached to walls, or surrounded by inclosures. There is then something in this question which belongs evidently to aspect and cultivation. If contagion exists, the malady cannot cease to prevail in stoves, and in vineyards it ought to take place as well in the month of September as in the month of June or July, which is exactly the contrary to what really does take place. If, on the contrary, the vine itself is affected in the first instance, we see the *Oidium* prevail as long as the disease lasts. When the points which were diseased are cicatrized or dry, it disappears naturally, and does not invest, as it ought to do, the surrounding surfaces which are sound. The moulds are great gluttons; they are to vegetable what insects are to animal substances. They do not abandon their prey, or rather cease to vegetate except when there is nothing left to feed upon. They could then be propagated in the months of September and October, because at this time atmospheric momenta are certainly as favourable for their development as in the months of June or July. But they are not propagated because the vital conditions of the vines are not the same.

Let us admit for the moment that *Oidium Tuckeri* grows in stoves, and that it spreads from thence into the surrounding districts. By what means ought we to attack it? There is but one. The focus of infection is known, it is necessary in consequence to root up the plant. In doing so the proprietor will not make a great sacrifice, since the grapes which he cultivates are not saleable when diseased, and he will not have to regret being the involuntary cause of greater mischief."

The importance of the foregoing memoir cannot be denied, though written under very strong views with regard to the effects of fungi on living vegetables, and as it seems to me chargeable in parts with what the Germans call inconsequence. The fungal theory of the potato disease, as it is termed, was nowhere more strongly opposed or even ridiculed than in France, insomuch that more than one botanist who commenced with it, was forced to yield to the pressure from without. It is extraordinary, however, that of all the theories that were broached, none has been retained by their several advocates except the fungal theory, which not only is as ardently retained as ever by its first adherents, but is daily gaining ground, and has been eventually adopted by some who were at first the strongest in their opposition. I am not, however, going to discuss again a subject which has been so much canvassed, or which has lost its interest with most readers. My opinions were fully stated in the first number of this Journal, and I have never yet seen reason to alter them.

It is curious that with respect to the vine disease, the majority are in favour of the fungal theory, and my friend Dr. Léveillé is almost alone on the other side. It is not to be denied that his arguments are extremely plausible, and that there is much in his observations that is worth attentive consideration, but I cannot always admit his data. It may be very true that neither he nor M. Decaisne, of whom no botanist will speak without the greatest respect and self distrust, have been able to detect mycelium within any part of the plant; but it is no less true that myself and Mr. G. Hoffman have seen it most distinctly, and that the figure given in the Gardeners' Chronicle in November, 1847, was drawn from specimens lying on the field of the microscope in which the growth through the stomata was as evident as that of *Botrytis infestans*, through the stomata of the potato. The disease, far from disappearing early, as related in Dr. Léveillé's notes, continued, at least in some instances, in this country as long as the leaves were on the trees, specimens having been forwarded to me from Margate quite late in the year from vines which I had studied in July; and in November Mr. Hoffman, than whom there are few more careful observers, and who has an excellent microscope, with very great powers of manipulation, assured me that he then distinctly traced the mycelium in the buds when the leaves had fallen.

The same excellent observer witnessed its propagation from the vine on plants of *Chrysanthemum Indicum* placed purposely beneath, and which were in consequence materially injured. I do not for a moment doubt the correctness of a single observation of Dr. Léveillé, as far as it goes; but the circumstances under which disease of all kinds is propagated are so extremely variable, that it is impossible to come to any conclusions from the simple fact of certain individuals escaping where others are attacked, and it is very easy to conceive that where the attack proceeded from within the tissues, as in this case, if I am correct in my observations, the injury would be greater than where the fungus was propagated secondarily on external surfaces from fallen spores. It is very possible, that while superficial it may do no further harm than clogging up the superficial spores, and hindering the due access of light and air, and that it is only directly destructive where it enters the tissue through the stomata; but this, of course, is mere conjecture. The great point is to attend to facts. The disease was observed in England about two years previously to 1847, and till Mr. Tucker, after whom the mould was named, employed the same remedy, or at least a form of it, which has long been efficacious in the case of peach mildew, the destruction was complete. Mr. John Boys, an eminent solicitor and magistrate at Margate, who has long paid especial attention to the cultivation of the vine, has informed me that one of his own vines, and another which he had an opportunity of examining, were completely killed by it, and that in his case even the pith of the branches was affected. He has told me besides, that thirty plants of the Constantia grape, raised from eyes received directly from the Cape, were all strongly affected, though there was not the slightest reason to believe that the plants from which the eyes were taken were diseased. Though the destruction was at first complete as regarded the crop, and, as stated above, in two instances the disease was fatal to the vines themselves, since he has adopted the system of washing the flues when warm, but not too hot, with black sulphur and quicklime, in the proportion of four ounces of each to sufficient rain-water to make the mixture of the consistence of cream, with frequent syringing with pure water, though the disease has shown itself again and again, his crop has not suffered.* In this case there was no question of

* It is obvious that great caution must be exercised in this kind of fumigation, and that a gentle current of air should be allowed to run from the bottom to the top of the house (not, however, suffering the temperature to get at first below 65°), as soon as the fumes have been allowed sufficient time, which should never exceed an hour, even in the most virulent cases. Indeed, under any mode of treatment, thorough ventilation is a most important element. The mixture of lime and black sulphur was used where the flues were not of iron; in the case of iron flues, it is recommended simply to dredge them with sulphur: the heat, however, must not be such as to ignite the sulphur.

the mildew ceasing after the disease had been established, as mentioned by Dr. Léveillé; but the progress of the malady was completely arrested, which would not probably have been the case had the grapes suffered from some inherent corruption of the tissues themselves.* And the experience of Mr. Boys is borne out by the testimony of the great body of grape growers in the south of England. As the sulphur is the well-ascertained cure of the fungus to which peach mildew is due, it is only natural to conclude that the cause is somewhat similar in grape mildew, where the effect is equally beneficial. Salt was not found efficacious in England, and where sulphur is used, except in the form of vapour, it must be used in substance, as it is insoluble in water. How it acts upon the mould is not known, but doubtless some decomposition takes place, and where used in combination with lime the sulphate of lime may act as a stimulant to the vegetative powers. Possibly, a combination of quick lime and Glauber's salts, as recommended with such great benefit in the case of Bunt, might be an improvement on the methods hitherto practised.

It is curious that the grape mildew has taken a course nearly contrary to that of the potato disease. It appeared in Kent about 1845, and is at this time prevalent on the opposite coast of Essex, and has now extended southward as far as Naples. At Genoa scarce a vine is free, and the black grapes appear to be attacked quite as much as the white varieties, even the *Vitis Labrusca* suffering from its ravages. In the north and midland counties of England I believe the disease is unknown, and I have not heard of its appearance in Germany.

Where the mind can be brought to adopt the notion of spontaneous or equivocal generation, there is little difficulty in these matters, or at least the difficulty is thrown aside; but as all patient investigation, and one which will not submit to jump hastily to conclusions from imperfect data is against such notions, we must be content to treat the propagation of even such minute bodies as *Oidium Tuckeri* as we do those of phenogamous plants.

* It is but fair that I should state that Mr. Boys does not attribute the disease to the *Oidium*, but to some disturbance of the electric currents of the earth—an opinion to which he has been led from constant observation of a thermometer plunged 20 inches below the surface of the soil. The disease, he states, first appeared with him in 1846, in remarkably fine and dry weather, subsequent to a cold and wet spring. The roots of his vines, in consequence of the drought, had been kept wet with liquid manure, the temperature of the earth being comparatively low. In regard to the use of remedies, he recommends cultivators to watch for the very first indications of the white bloom which constitutes the *Oidium*, and then, in four or five days, the cure is certain. A few days' neglect will require greater perseverance in the use of the remedy; but if the young grapes once split and become deformed, it may possibly be too late to do any good.

When a large crop of white clover makes its appearance on lands recovered from the sea, it is an easy solution of the difficulty to say that the plants have been generated spontaneously from the soil. It may not be easy to account for their presence, but yet the lover of truth will not readily solve the difficulty by such an unwarranted conclusion. In the case of the potato disease and of the grape mildew it appears pretty clear that the parasites were not previously known. The conclusion is then, as Morren well remarked respecting the former, that they must have been imported, and there is no more difficulty in this notion, nor indeed so much, as that of the introduction of such a quantity of white clover seed into the tracts recovered from the sea. In every branch of natural history there are difficulties enough, and it would be surprising indeed if there were none where such minute productions are concerned. The reflective mind will often observe with combined wonder and admiration how the Almighty produces effects of great magnitude and importance, which are at the first view altogether incommensurate with the causes from whence they are derived.

XXIX.—*Some Remarks on Heating.* By Robert Glendinning, F.H.S., Chiswick Nursery, Turnham Green.

(Communicated September 22, 1851.)

It appears to me that no system of warming horticultural buildings hitherto devised has been found so effectual as hot water applied by a properly contrived apparatus. Even although so many are interested in the subject, during the last twenty-five years little advance has been made in the methods of heating. If the law which governs the circulation of water in pipes, then and now in use, was not so clearly understood, it was at least as efficiently applied. It is true that a vast number of contrivances has been submitted to the public, all more or less setting physical science at defiance, and therefore proving either inefficient in power, or total failures. The object aimed at in these contrivances has apparently been to involve the simplicity of ordinary hot water systems by complex mechanical appliances; so far indeed has this thirst for complexity been carried, that the expense attending the setting up of these unphilosophical inventions has in many cases been doubled. Now, in the warming of the great proportion of horticultural buildings, the most simple form of apparatus can be readily applied, and almost always to more advantage, and at a considerably reduced outlay. Every deviation from this, whether from caprice or necessity, either *decreases the heating power*, or *increases the price.*

The variety of boilers which from time to time have been submitted to the public, is almost beyond enumeration, each of course purporting to be better than its predecessors. In the contriving of these a great point appears always to have been to hit upon some new shape, the more out-of-the-way the better; but as the public gets bitten, or better versed in the matter, so these contorted kettles vanish in an equal ratio; their construction being as unphilosophical as the whimsicality of their form, necessarily involves an important item in their manufacture, because the more complicated and intricate the boiler, the more likely it is to get out of order; such contrivances being by no means calculated to stand the wear and tear of boilers simply designed. It is astonishing, notwithstanding the opinions adduced by persons competent to give a clear exposition of the laws of physics bearing upon this subject, how much the public has been charmed and cheated by novelty, and overlooking its own interest, has greedily swallowed project after project in perfect disregard of such warnings, and in opposition to the welfare of plants, which, at all times where artificial heat is required, are placed in danger of being much injured if not destroyed by any derangement in the heating power. Instead, therefore, of attending to the intricate schemes of the day, let us examine that form of boiler which has stood the test of time satisfactorily, and that mode of applying pipes to convey water round the building, which experience of long standing has declared to be the best.

One of the earliest boilers in use was of the arch form, and it would have been wise had we endeavoured to improve it—if indeed it is capable of improvement. The arched boiler is at once simple in shape, of efficient power, and easy application. No boiler hitherto contrived so perfectly combines these important points, for while it is possible to get up a boiler with more heating surface, there has invariably arisen some corresponding disadvantage.

But there is an important matter regarding the efficient action of a boiler, independent of its shape. Badly designed boilers when well set often answer beyond expectation, and even to the astonishment of the contriver, whereas boilers constructed upon the best principles, when improperly set, have failed. In the latter case, the heat is not advantageously applied. For instructions in setting the arch boiler in the most efficient manner, I am indebted to its inventor,* who has given me permission to publish them.

* Charles Hood, Esq., F.R.A.S., author of "A Practical Treatise on Warming Buildings by Hot Water, and an Inquiry into the Laws of Radiant and Conducted Heat."

Mr. Hood's method of setting the arch boiler cannot fail to answer when properly carried out, as I have amply proved. It appears to me, however, that for large houses a greater increase of the piers of the arch would be an improvement, as thereby affording more room for fuel. Beyond this, as far as my own experience goes, it seems to be the best source of warming yet devised, combining, as it unquestionably does, both efficiency and economy.

The cause of the motion in hot water, when conducted in pipes through buildings at a lower temperature, has long since been explained. Instead, therefore, of treating this as a theoretical question, I shall deduce from experience a few practical rules for the guidance of those who are less acquainted with the subject than myself.

In setting the boiler it should always be placed so that no dip in the pipes which may be required in passing doorways or other unavoidable obstructions to their level run, shall be lower than its upper surface. Any deviation from this rule will most assuredly affect its proper action, less or more. Nor does it appear that this rule need be deviated from under any circumstance where hot water is applied to hothouses, if proper precautions are taken. It will only be necessary to excavate a little lower, for it is always better to err on the safe side. No obstruction or objection can possibly arise to this unless the water is near the surface, and this objection can only be sustained in old buildings. In all new erections care should in the first instance be taken to keep the building sufficiently above ground to admit of any arrangement for heating. This even may be got over by forming a basin similar to a water tank—*circular*—with the bottom concave to resist pressure. The arrangement in the interior of the building to receive the pipes will of course vary in different structures. This, however, should be so contrived as to admit of a proper distribution of the heat, whether the air only is to be warmed, or the bed for plunging pots.

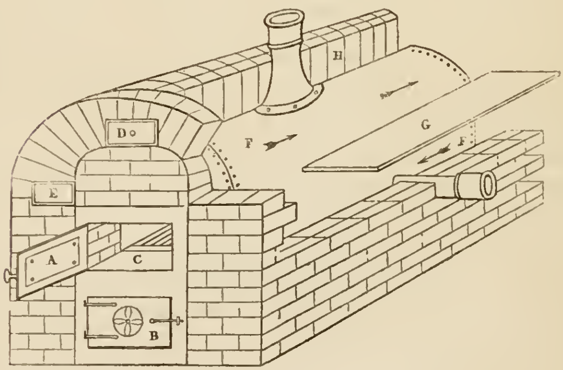
When the pipes rise from the boiler into the house, they should then be conducted *horizontally*. No deviation from this rule has yet been found of the least utility. They may, notwithstanding, be carried upon different levels, the boiler being a close one.

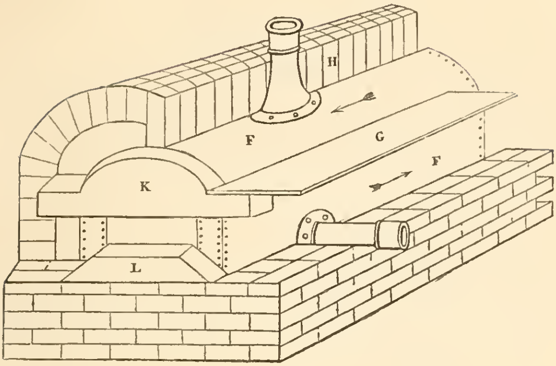
It will be necessary to make provision for the escape of air that may accumulate in the pipes, which would, if no outlet was provided, obstruct the circulation of the water. This is very easily effected by drilling a small hole in one or two of the upper pipes, sufficient to admit ordinary gas tubing, which can be directed up any angle of the building, two or three feet above the highest pipe. In all cases of an ordinary kind this will be found to answer, provided the pipes are accurately laid down, and are not irregular or undulating. A cistern by which the apparatus is to be filled and afterwards supplied must be provided, and may be fixed in any convenient corner of the house or stoking pit. This cistern must be placed higher than any portion of the apparatus, and attended to as occasion may require, in order that the pipes may be constantly kept full and steam prevented from accumulating, or air admitted to interfere with the motion of the water.

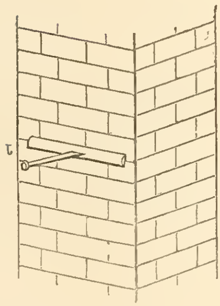
When two or more houses are to be heated by one boiler, stop-cocks will be required to stop the flow of the water. These are often found extremely inefficient, or otherwise very expensive; and unless the building is very circumscribed, one boiler will be found as economical, more efficient, and easier controlled than a combination of mechanical appliances.

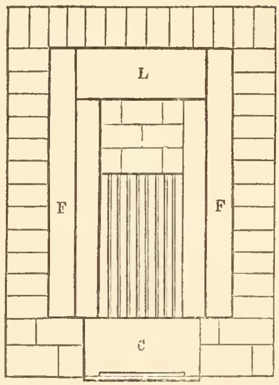
These observations will be readily understood by those to whom a hot water apparatus has hitherto presented a mechanical problem not readily solved. Let us hope that they may prove useful.

The following cuts represent Mr. Hood's mode of setting his arched boilers:—









A. The furnace door.
B. The ash pit door.
C. The dumb plate.
D. and E. Soot doors. Another soot door (on the opposite side to E.) is supposed to be removed.
F. F. The upper and lower flues, which are alike on both sides of the boiler.
G. An iron flue plate to separate the lower from the upper flue, which is built into the brickwork.
H. A brick separation of the flue on the top of the boiler.
J. The damper in the chimney.
K. and L. Two fire clay lumps, placed close to the back of the boiler. The space between these is from 3½ to 4½ inches, according to the size of the boiler and the height of the chimney. This opening is the only passage for the flame and smoke from the furnace into the flues.

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TO THE

FIFTH AND SIXTH VOLUMES OF THE JOURNAL OF THE HORTICULTURAL SOCIETY.

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END OF VOLUME VI.

LONDON: PRINTED BY W. CLOWES AND SONS, STAMFORD STREET.

PROCEEDINGS AT MEETINGS OF THE SOCIETY.

October 1, 1850. (Regent Street.)

Elections. Sir R. Burdett, Bart., Regent's Park, London; John Shaw Leigh, Esq., Luton Park, Beds; and L. B. Foster, Esq., Norwich.

Awards. *Large Silver Medal:* To Mr. Ingram, Gardener to Her Majesty at Frogmore, for a beautiful example of the Prickly Cayenne Pine-apple, weighing 7 lbs. 5 ozs.

Knightian Medal: To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of Orchids, consisting of Oncidium Papilio, Vanda suavis, Lælia Perrinii, Cattleya bicolor (with a highly coloured lip), a Cycnoches from Costa Rica, and one or two other plants.

Banksian Medal: To Messrs. Veitch and Son, for a Flowering Plant of Lapageria rosea. "It was sent to us by Mr. William Lobb, from '*Conception.*' The specimen now produced was bloomed in our conservatory, where we planted it out a very small plant about eighteen months since. Mr. G. Davey, a gentleman who has resided many years in South America, but now of the firm of Anthony Gibbs and Co., of London, has seen it growing in its natural habitat, and believes it will prove perfectly hardy; he found it mixed with Lardizabala triternata, a fine evergreen climber, and which we have proved to be as hardy as the Irish ivy. It is a very free growing plant, and apparently an abundant bloomer." The blossoms individually are extremely handsome, and exactly resemble the published drawings of them both in shape and colour, except that the minute white spots which are represented as being spread over the interior of the crimson bell were nearly wanting, or very indistinctly marked, in the specimen shown. To Mr. Selkirk, Gardener to W. J. Meyers, Esq., Porters, Shenley, for the same. To Mr. Turner, Royal Nursery, Slough, for an exhibition of Dahlias, consisting of large and exquisite blooms of the following varieties:—Duke of Wellington, Thames Bank Hero, Fearless, John Edwards, Magnificent, Earl of Clarendon, Richard Cobden, Mrs. Seldon (Turner), Essex Triumph, Queen of Lilacs (Turner), Mr. Seldon (Turner), Toison d'Or, Snowflake, Scarlet Gem (Turner), Seraph, Mynn, Queen of Primroses, Black Prince, Mr. Palmer, Rosea Alba, Grandis, Model, Miss Hawtrey, and Goliah; the last six being seedlings. The same grower also showed twelve fancy flowers, viz.: Belle de Nogent, Highland Chief, Mrs. Hansard (Edwards), Freund Schmidt, General Cavaignac, Gasparini, Nonsuch (Turner), Dulcinée, Rainbow, Mrs. Labouchere, Striata Perfecta, and Pretty Polly (Turner); the latter a seedling of considerable promise. To Mr. Fleming, Gardener to the Duke of Sutherland at Trentham, for three bunches of Millhill Black Hamburgh Grapes, weighing respectively 1 lb. 10 ozs., 1 lb. 9½ ozs., and 1 lb. 6 ozs. Concerning this large and finely flavoured Grape Mr. Fleming furnished the following memoranda:—"Many persons being doubtful as to the existence of any real difference between the Millhill Hamburgh and the common one, and others confounding the Millhill with the old Dutch Hamburgh, I send some of each, in order that the question may be decided. The Millhill is later in ripening than the common Hamburgh, and its skin being tougher, renders it a good keeping grape. The vine makes strong roots, and, unless means are taken to keep them out of the subsoil, they will soon be revelling in it, and the wood will not ripen well. Our border is shallow and concreted below, and the wood ripens perfectly. This grape is, in my opinion, the best of the late black kinds, and seems to be a cross between the Black Damascus and the Hamburgh, but partaking more of the latter. The grape which I call the old Dutch Hamburgh is large in the berry, of excellent flavour, and very juicy. It does not always become black, but with us is oftener of a flame or red colour, in which state it is much admired. The fewer the number of bunches left upon the vine the nearer to black do the berries approach, although I have never seen them perfectly black. There seems to be much confusion of names among grapes. We have here no fewer than four kinds of Hamburghs, all of which I have tried in one house, and, for early forcing, none excels the variety called the '*Pope*,' a grape for many years grown most successfully at Swinnerton Hall, in this county (Staffordshire); but of which I have not a bunch fit to send to the Meeting." To Mr. Forsyth, Gardener to Viscount Barrington, Beckett, Shrivenham, Berks, for three beautiful bunches of Black Hamburgh Grapes, a little rubbed by travelling, weighing respectively 2 lbs., 1 lb. 10 ozs., and 1 lb. 7 ozs.

Certificate of Merit: To Mr. Rust, Gardener to J. Maclaren, Esq., of Ticehurst, Sussex, for examples of Black Hamburgh Grapes. To Mr. Ferguson, of Stowe, for the same. To

Messrs. Jackson, of Kingston, for six prettily-flowered Plants of Odontoglossum grande. To Mr. Bragg, of Slough, for a Seedling Dahlia named "The Hon. Mrs. Ashley," a beautiful waxy-looking light flower, tipped and shaded with rose. To the same, for twelve spikes of Hollyhocks, consisting of some of the very best varieties.

Miscellaneous Subjects of Exhibition. Six blooms of a beautiful white tipped yellow Fancy Dahlia called "Mrs. Hansard," from J. Edwards, Esq., F.H.S.; and Mr. Turner, of Slough, exhibited the following three Dahlias raised by Mr. Stein:—Nil Desperandum, scarlet; Nepaulese Prince, shaded maroon; and New Standard, a purple and white "Fancy." Mr. Gad, Gardener to J. Lenox, Esq., sent some Petunias. Mr. Ingram furnished cut specimens of a Seedling Heath in the way of Princeps. Mr. Young, of Milford Nursery, Godalming, sent two plants in pots of Cryptomeria japonica about 3 feet high, loaded with young cones. It was stated that the Cryptomeria had ripened seeds at Strathfieldsaye, the seat of the Duke of Wellington, and that young plants had been raised there from them. Mr. Ward, Gardener to W. Stephens, Esq., F.H.S., sent two Envilles and a Globe Pine-apple, whose weights were respectively 5 lbs. 2 ozs., 4 lbs. 4 ozs., and 4 lbs. Mr. Eckford, Gardener to C. Child, Esq., of Bromley Palace, showed a small Queen Pine, which had been ripened out of doors. It was stated to have been planted out on the 14th of May last. Among Grapes was a sample of Black Hamburgh, from the large Vine at Cumberland Lodge, which was stated to have ripened this year a very heavy and fine crop. The bunches exhibited were rather above the average size and well coloured. Mr. Agent, Gardener to W. M. Webster, Esq., sent a large punnet of Black Hamburgh, not large either in bunch or berry, but very black, and beautifully covered with bloom. Cambrian and Late Admirable Peaches were furnished by Mr. Meyers, of Brentford; and Mr. Budd, Gardener to J. Reeves, Esq., sent a ripe fruit of the Egg Gourd (Cucurbita ovifera), which, in a ripe state, has the reputation of being an excellent winter vegetable.

Novelties from the Society's Garden. Microsperma (Eucnide) bartonioides, a handsome yellow flowered Annual.

Books Presented.

Proceedings of the Zoological Society of London. Part 17; and Report of the Council. Read at the Annual Meeting, 29 April, 1850. From the Society.
The Athenæum for September. From the Editor.
Verhandlungen des Gartenbaues Verein. Vol. XX., Part 1. From the Horticultural Society of Berlin.
Transactions of the Royal Society of Edinburgh. Vol. XX., Part 1; and Proceedings of ditto. Vol. II. Nos. XXXV. to XXXIX., inclusive. From the Society.

November 5, 1850. (Regent Street.)

Awards. *Banksian Medal:* To J. Knowles, Esq., Trafford Bank House, near Manchester, for a new Burlingtonia, in a rustic basket, whose sides it covered with numerous pendent dense spikes of beautiful white blossoms. To Mr. Hamp, Gardener to J. Thorne, Esq., South Lambeth, for a nice exhibition of Epiphyllum truncatum and its varieties. To Mr. Ingram, Gardener to Her Majesty at Frogmore, for two finely-swelled fruit of the smooth-leaved Cayenne Pine-apple, weighing respectively 7 lbs. 8 oz. and 7 lbs. 3 oz. To Mr. Bray, Gardener to E. Lousada, Esq., Sidmouth, Devonshire, for a handsome Providence Pine, weighing 11 lbs. To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., Hill House, Windsor Forest, Berks, for three admirable bunches of West's St. Peter's Grape, weighing 1 lb. 14 oz., 1 lb. 8 oz., and 1 lb. 5 oz.

Certificate of Merit: To Mr. Slowe, Gardener to R. W. Baker, Esq., F.H.S., for a magnificent bunch of Red Hamburgh (or possibly Black Hamburgh Grapes, badly coloured), weighing 4 lbs. 4 oz. To Mr. Davis, of Oak Hill, East Barnet, for sixteen finely-ripened bunches of Muscat of Alexandria Grapes, weighing collectively 18 lbs. To the same, for examples of Van Mons Leon le Clerc Pear, a large handsome fruit, said to be equal in flavour to the Marie Louise. It was stated that it would not grow on the Quince stock. To Mr. Watson, Gardener to Mrs. Tredwell, St. John's Lodge, Norwood, for three Queen Pine-apples, weighing 4 lbs. 14 oz., 4 lbs. 4 oz., and 3 lbs. 12 oz. To Messrs. Veitch, of Exeter, for a beautiful specimen of the true Calanthe vestita, for which a worthless variety without the red eye is sometimes sold.

Miscellaneous Subjects of Exhibition. Messrs. Veitch sent a small example of a new Cœlogyne, called Maculata, one of those charming terrestrial Orchids which inhabit the mountains of India. The great headed Pimelea (P. macrocephala), a robust stiff-growing kind, was exhibited in a small state, by Messrs. Henderson, of Pine-apple Place; and a seedling Pentstemon, white streaked with pink, called Salteri, by Mr. Salter, of Hammersmith. Mr. Slowe, Gardener to R. W. Baker, Esq., had a Providence Pine-apple, weighing 9 lbs. Mr. Martin, Gardener to Sir H. Fleetwood, Bart., sent three unripe bunches of Muscat of Alexandria Grape, weighing respectively 1 lb. 15 oz., 1 lb. 7 oz., and 1 lb. 5 oz. Mr. Forsyth, Gardener to Viscount Barrington, exhibited three bunches of the same kind of grape, the peculiarity about which was that they had been ripened in the temperature of a greenhouse. The heaviest bunch weighed 1 lb. 3 oz.: though not so fine as if they had been ripened under more advantageous circumstances, they were, nevertheless, fair eatable Grapes. Mr. Turner, Gardener to W. Blake, Esq., of Danesbury, sent examples of Black Hamburgh Grapes, ripe and sweet, from the open wall. It was stated that they were part of 156 bunches ripened by the same Vine this year. Specimens of Marie Louise Pears were furnished by Mr. Davis, of Oak Hill. French Crab Apples, the produce of 1849, were exhibited, in good condition, by Mr. Milne, Gardener to the Earl of Clare, Mount Shannon, Ireland. A dish of Matchless Marrow Peas, sent as a proof of the power of sulphur in destroying mildew, was shown by Mr. Fry, Gardener to Mrs. Dent, of Manor House, Lee, Kent. Mr. Fry stated, that at one period of their growth they were seriously attacked with mildew; sulphur was then applied, which arrested its progress, and the Peas afterwards grew most luxuriantly, producing a fair crop, considering the badness of the season, and the low temperature to which they had been subjected, 3° of frost having been endured by them. A number of drawings of various flowers and fruits, executed on rice paper, was produced by Mrs. Dickens, of Hereford Square, Old Brompton. These were reported to be satisfactory examples of the style of art to which they belong.

Novelties from the Society's Garden. The handsome and curious hybrid Veronica Andersonii and Green Winter Roman Lettuce (*Laitue Romaine Verte d'Hiver*). This variety of Cos Lettuce was received from M. Vilmorin, of Paris. It is likely to prove valuable on account of its being hardier than any other Cos, excepting perhaps the Brown, which is objectionable on account of its colour.

Along with these came Marie Louise Pears from a wall, and specimens of the fleshy fangs or roots of *Oxalis Deppei*, figured in the Transactions, Second Series, vol. iii. p. 29. In addition to the account there given, it may be mentioned that the French prefer using the leaves as Sorrel, which, they say, have "a mild flavour and are easily cooked. When cut the leaves push again very quickly. A border of it (in France) which had been cut close by the ground was again covered with leaves and flowers in ten days."

Books Presented.

Flora Batava, No. 164. From his Majesty the King of Holland.
The Gardener's Magazine for October. From the Publishers.
The Athenæum for October. From the Editor.
The Quarterly Journal of the Geological Society, Vol. VI., No. 24. From the Society.

December 3, 1850. (Regent Street.)

Elections. H. R. Sandbach, Esq., Hafodunos, Denbigh; J. Smith, Esq., Hanwell, Middlesex; F. Barchard, Esq., Horstead, Sussex; and Mr. Davis, Granchester Nurseries, Cambridge.

Awards. *Large Silver Medal*: To Messrs. Veitch, for Vanda cærulescens, an exceedingly handsome species, with pale lilac blossoms. The accompanying woodcut will give some idea of the size of the individual flowers, of which the spike on the plant exhibited bore thirteen. Fine, however, as this spike certainly was, it was remarked that it was small compared with some that had been received in a dried state from India. The beauty of the plant may therefore be considered as yet but imperfectly developed.

Vanda cærulescens.

Knightian Medal: To J. H. Schröder, Esq., F.H.S., for two charmingly-blossomed plants of Epidendrum Skinneri, Angræcum bilobum, and Sophronitis grandiflora.

Banksian Medal: To F. G. Nash, Esq., Bishop's Stortford, for two basketfuls of famously ripened Muscat of Alexandria and Black Hamburgh Grapes.

Miscellaneous Subjects of Exhibition. Messrs. Henderson, of Pine-apple Place, sent a white Ionopsis from Jamaica, resembling Ionopsis pallida. From Mr. Glendinning, of the Chiswick Nursery, came a large and well-cultivated specimen of Hoya imperialis, which was stated to have been in flower all the summer. Mr. Hibbins, Gardener to the Hon. Mr. Norton, Anningsley Park, Chertsey, furnished Muscat of Alexandria Grapes; but they did not appear to be quite ripe. Mr. Mitchell, of Kemp Town, Brighton, had a small box of Black Hamburgh Grapes, fair-sized bunches, and well coloured, the produce of a second crop from the same Vines this year. The Vines, which were started early in November, ripened off the first crop between the 14th of March and 17th of April, after which they were rested till the 22nd of May, when they were pruned and put in action for the second crop, which is ripe now; and Mr. M. stated that he would take a crop from the Vines again next June. Two crops were obtained in one season from the same Vines three years ago; but Mr. M. is of opinion that double crops should only be ripened by the same Vines once in every four years. Examples of a seedling Grape, which did not appear to be different from West's St. Peter's, were exhibited by Mr. Seymour, of Ashridge Park, Great Berkhampstead, Herts. Two brace of Cucumbers were shown by Mr. Parr, Gardener to J. Jarratt, Esq., Camerton Court, Bath.

Novelties from the Society's Garden. The cinnamon brown and yellow flowered Cymbidium giganteum.

The Garden also furnished the following Pears:—

Napoleon—from a wall.

Vicar of Winkfield—*aliàs* Monsieur le Curé, Poire de Clión, Dumas.

A French Pear, introduced by the Society under the name of Dumas; and by the Rev. Mr. Rham, Vicar of Winkfield, in Berkshire; and from this circumstance it obtained the name it now bears in the Nurserymen's catalogues. It sometimes grows very large, and is a handsome, melting Pear, though not so rich as the Marie Louise and many others. It may be mentioned that it is sometimes exposed for sale as the Marie Louise in Covent Garden Market.

FORELLE or *Trout Pear.*

The origin of this is not exactly known. Dr. Diel says, "Long as I have collected fruits, and searched the gardens in the neighbourhood of the Rhine, furnished with French sorts, I have found no fruit like the '*Forellenbirne.*' We may therefore proudly call this a national variety, which most probably originated in Northern Saxony. It is a valuable addition to our stock of winter pears, which may compete with the very best French sorts, ripening at the same period, and far surpassing them in the length of period of keeping in perfection, and in its beauty." It is rare to find a pear with a brilliant colour and flesh so fine and melting as this is. Those with a bright colour are usually astringent and coarse; this, on the contrary, has a remarkably smooth flesh, and rich pleasant flavour. The tree blossoms at a very early period of the season—so early that in the past spring the young fruit was so far advanced as to resist the 9° of frost which killed most of the other kinds only then in blossom. A good bearer, and a healthy vigorous tree. The specimens exhibited were from an east aspect. From a south wall, or even from a well-exposed standard, the fruit is higher coloured, with more distinctly ocellated spots.

BOOKS PRESENTED.

The Gardener's Magazine of Botany, &c., Part XI. From the Publishers.
Bulletin de la Société Centrale d'Horticulture du Département de la Seine Inférieure, tome IV. Premier Cahier. From the Horticultural Society of Rouen.
The Athenæum for November. From the Editor.

January 14, 1851. (REGENT STREET.)

ELECTIONS. Andrew Lawson, Esq., Aldborough Manor, Boroughbridge; and S. H. Good, Esq., 21, Upper Hamilton Terrace, St. John's Wood.

AWARDS. *Large Silver Medal:* To Mrs. Lawrence, of Ealing Park, F.H.S., for beautiful cut spikes of Amherstia nobilis. This is the second year in which Mrs. Lawrence has succeeded in flowering this fine stove tree, which has also blossomed this season with Mr. Ingram, in the Royal Gardens at Frogmore. Much difficulty has been experienced in keeping the foliage, which is exceedingly graceful, from first decaying at the points, and then dying back; but naturally nothing of the kind happens, and it has only occurred with Mrs. Lawrence in a very trifling degree. The brilliant salmon-coloured and yellow blossoms, numbering from sixteen to twenty on a spike, are exceedingly handsome, and must give a well-flowered tree a very striking appearance. The specimen at Ealing Park is beginning to form seed-pods.

Banksian Medal: To Mr. Loddiges, F.H.S., for Ansellia africana, an Orchid named after Mr. John Ansell, who, when attached to the Niger expedition, discovered it in the island of Fernando Po. In addition to its stately aspect and good quality of keeping long in bloom, it is remarkable as being one of the very few of those Epiphytes which have been found on the stems of Palm trees.

Certificate of Merit: To Mr. Davis, of Oak Hill, East Barnet, for beautiful examples of West's St. Peter's Grapes.

Miscellaneous Subjects of Exhibition. Mr. Dobson, Gardener to Mr. Beck, F.H.S., sent three Oncids and a group of Seedling Cinerarias, which were exhibited to show that by sowing a little seed in May some very gaily blooming plants may be obtained about Christmas. It was stated that at Worton Cottage a constant succession of such plants had been kept up since November. A brace of Cucumbers was furnished by Mr. Parr, Gardener to J. Jarratt, Esq., of Camerton Court, near Bath. Examples of a new kind of Garden Label, called the "Rose Girdle Label," were produced by Captain Armstrong, of Claremont Lodge, Cobham, Surrey. They consisted of a strip or band of zinc, painted where the name was written. They are intended to be bent round the stem of the tree, or whatever else they are to be attached to, the ends being brought together and fastened by means of a screw and nut. Whether they will be found altogether unobjectionable, has not yet been clearly proved, but they are very cheap, and they looked as if they would answer.

Novelties from the Society's Garden. Specimens of Bassano Beet, a turnip-shaped sort, not sufficiently good, it is to be feared, to suit English tastes, but which, according to the 'Bon Jardinier' of 1842, was found by M. Audot in all the markets from Venice to Genoa in June. It was young, tender, very delicate, and preserved its rose-coloured zones after cooking. It is said to be much esteemed in the

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north of Italy. In this country, with good cultivation, its produce may be estimated at from forty to fifty tons per acre; and it may be grown on thinner land than is required for the other kinds of Beet, as it grows mostly above ground, like a turnip.

Books Presented.

Le Bon Jardinier pour 1851. From M. Vilmorin.
The Athenæum for December, 1850. From the Editor.

February 18, 1851. (Regent Street.)

Awards. *Banksian Medal:* To Mrs. Lawrence, F.H.S., for a collection of Orchids, consisting of a nice specimen of the Long-tailed Lady's Slipper (Cypripedium caudatum), Lycaste Skinneri, Cœlogyne cristata, the White-blossomed Odontoglossum pulchellum, Cyrtochilum hastatum, and the Yellow Oncidium Cavendishii. To Mr. Ingram, Gardener to Her Majesty at Frogmore, for an exceedingly handsome specimen of Begonia manicata. It measured about 3 feet high, and as much through, and it was loaded with blossoms, which had, however, suffered considerably from travelling.

Certificate of Merit: To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for an example of the Nerium-leaved Allamanda. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, for two beautiful Seedling Epacrises: one, named Kinghornii, was white; the other, Grandiflora rubra, was red tipped with white. To Mr. Hamp, Gardener to J. Thorn, Esq., of Mawbey House, South Lambeth, for Camellia tricolor, in the shape of a tree some 7 feet high, loaded with blossoms in different stages of development. To Mr. Fleming, Gardener to the Duke of Sutherland at Trentham, for a bunch of White Tokay Grapes, weighing 1 lb. 5½ oz. The berries were plump and good, and appeared as if they would keep sound at least a month longer. Along with it were two bunches of the Muscat of Alexandria Grape, somewhat shrivelled, but excellently flavoured. Mr. Fleming stated that the latter were "from a vine grafted upon the old White Tokay, which, being a very strong grower, and continuing to grow late in the season, seems to improve the fruit of the Muscat; and the berries keep plump and fresh for a month or five weeks later than those on other vines in the same house which are not grafted, but are upon their own roots. There are three grafted vines and eight not grafted in the house; and the superiority of the fruit on the grafted vines has been noticed even since the grapes ripened about the end of August. The bunch of White Tokay has been cut from one of the stocks below the graft." To Mr. Butcher, Gardener to W. Leaf, Esq., of Park Hill, Streatham, for a basketful of Cannon Hall Muscat Grapes, which in this case were not so well flavoured as the Muscats of Alexandria just alluded to.

Miscellaneous Subjects of Exhibition. Messrs. Lee, of Hammersmith, furnished a small example of Rondeletia (Rogiera) thyrsiflora, which promises to be a useful stove-plant. Mr. Gaines, of Battersea, contributed Centradenia floribunda, and the same species of Rogiera. Mr. Hamp, Gardener to J. Thorn, Esq., of Mawbey House, South Lambeth, sent a large plant of the Tankerville Phaius. Blooms of two Rhododendrons, and the Corsican Hellebore, were exhibited by the Hon. Fox Strangways, from Abbotsbury, in Dorsetshire. Mrs. Lawrence produced cut specimens of Heliconia Braziliensis. Three Seedling Cyclamens, in the way of persicum, were furnished by Mr. Ingram, of Frogmore. Two very fine heads of "Penzance Broccoli" were shown by Messrs. Rendle and Co., of Plymouth, who stated that one of the heads weighed 3¾ lbs., and was 2 feet 10 inches in circumference; the other weighed 3½ lbs., and was 2 feet in circumference. These weights and measurements are without the leaves. They mentioned that they have seen some heads with the leaves on, which weighed above 30 lbs. Mr. Tye, of Birmingham, exhibited four topaz and other coloured Hyacinth bottles, which were furnished with convenient wire supports for the flowers. They are beautiful and clever contrivances, with which the ordinary Hyacinth glass will bear no comparison.

Novelties from the Society's Garden. Navet jaune de Finlande. Seeds of this were received from M. Vilmorin, of Paris. It appears to be a variety of the Malta Turnip. Variegated Plumage Kale: this is used for garnishing; but it is also much esteemed by some when it is cooked like a winter green.

Books Presented.

Acta Academiæ Naturæ Curiosorum. Vol. XXII., Part II. From the Academy.
Transactions of the Zoological Society of London. Vol. IV., Part I. From the Society.
The Athenæum for January. From the Editor.

March 4, 1851. (Regent Street.)

Awards. *Banksian Medal:* To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a nice specimen of the Sweet Trichopil (Trichopilia suavis). To Mr. Loddiges, F.H.S., for the beautiful Cymbidium eburneum and the dark variety of Dendrobium nobile. To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for plants of the large-flowered Phalænopsis, Cœlogyne cristata, Epidendrum odoratissimum, and Lycaste Skinneri.

Certificate of Merit: To Mr. Glendinning, F.H.S., for a species of Labichea from Swan River. It somewhat resembled Heimia salicifolia; but the flowers, besides having a dark-brown spot in the centre, are larger and handsomer than those of that plant. It will be found a useful addition to the greenhouse. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a young and very healthy specimen of the pale variety of Rhododendron javanicum. Mr. Cole finds that the best way of managing this fine species is to grow it quickly in the stove until it has assumed the form of a good-sized bush; after which he thinks it will succeed in a greenhouse, treated like an Indian Azalea.

Miscellaneous Subjects of Exhibition. Mr. Wells, Gardener to E. Hussey, Esq., of Scotney Castle, Lamberhurst, sent two examples of new Rhododendrons in flower, said to be from Sikkim-Himalaya. They consisted of a little alpine species, with scurfy leaves and small pale lemon-coloured flowers, which possessed a scent something like that of the buds of the Balsam Poplar. In manner of growth they resembled the ferruginous Rhododendron of our gardens, but were very inferior in beauty to that species. It is probable that these plants were nothing more than the R. lepidotum of the Himalayas.

Novelties from the Society's Garden. Polygala Dalmaisiana, Boronia tetrandra, and Æschynanthus longiflorus. The latter is the handsomest of all the Æschynanths, except perhaps speciosus.

Books Presented.

The Quarterly Journal of the Geological Society, Vol. VII., No. 25. From the Society.
The Athenæum for February. From the Editor.

March 18, 1851. (Regent Street.)

Elections. Henry Bentley, Esq., Richmond, Surrey; Professor Wheatstone, King's College, London; Mrs. Knox, 9, Hyde Park Gate, South; William Fisher Hobbs, Esq., Boxted Lodge, Colchester; George Peabody, Esq., Club Chambers, Regent Street; John Butler, Esq., Woolwich; Mr. Stevens, 38, King Street, Covent Garden; Mr. Ferguson, Nurseryman, Stowe, Bucks; and, as a Corresponding Member, Mr. M'Intosh, Gardener to the Duke of Buccleugh, at Dalkeith Palace.

Awards. *Knightian Medal:* To Mr. Mylam, Gardener to S. Rucker, Esq., F.H.S., for a charming mass of the Cambridge Dendrobe (D. Cambridgeanum), the fragrant Burlingtonia, the Long-tailed Lady's Slipper (Cypripedium caudatum), one of the best sorts of Skinner's Lycaste, together with the ivory-flowered Cymbid (Cymbidium eburneum), a variety of it slightly tinged with pink, and the beautiful Dendrobium anosmum.

Banksian Medal: To Messrs. Veitch, of Exeter, for a plant of the beautiful Rhododendron jasminiflorum, an evergreen greenhouse bush, with long, narrow, waxy, white flowers.

Certificate of Merit: To Mr. Butcher, Gardener to W. Leaf, Esq., of Park Hill, Streatham, for a dish of Muscat of Alexandria Grapes, the produce of 1850. They were a little shrivelled, but were nevertheless still in good condition. They were stated to have been cut on the morning on which they were exhibited. Ripe fruit was gathered from the same vines on the 24th of April last year, and they were reported to have furnished a supply every week since up to the present time, making forty-six weeks out of the fifty-two in which grapes were cut for table. It was mentioned that experience had proved the Muscat to be the best variety for hanging long on the vines, and at the same time preserving its flavour. To Mr. Higgs, Gardener to J. H. Barchard, Esq., F.H.S., for a dish of Keens' Seedling Strawberry. To Mr. Bennett, Gardener to J. Smith, Esq., of Dulwich, for the same.

Miscellaneous Subjects of Exhibition. A Moscow Queen Pine Apple, scarcely ripe, and on that account unrewarded, was produced by Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S. It weighed 3 lbs. 6 oz., a good weight for a Pine at this season of the year. Examples of ornamental rustic baskets, for placing flowering plants in, were furnished by Mr. Howlette, of St. Osyth, Colchester. They were of different shapes, so as to fit them for hanging up against the walls of entrance halls, or in conservatories, and were formed of wood encased in Larch cones, whose tops pointed outwards. The chains by which they were suspended consisted of the same kind of cones, fixed lengthwise in wire, and, being attached to the baskets by hooks, they could be separated from them at pleasure, thus facilitating the introduction of the plants. Various dried vegetables, such as Peas, Haricot Beans, Brussels Sprouts, Carrots, and Turnips, &c., were exhibited from Peyrusset, Möller, and Co., of Paris. These were stated to have been dried by a process peculiar to M. Gannal, the celebrated embalmer of animal substances. This process is understood to consist chiefly in dividing the larger vegetables into pieces, and placing them in an apparatus into which dried air is driven, until they have parted with all their water, and have become perfectly dry. In this condition they may be preserved for any length of time; it is said that their flavour is not at all interfered with, inasmuch as nothing is taken from them except the water they contained, and that, after they are cooked, they are just as good as when fresh gathered. If these facts, therefore, are borne out by experience, the discovery is a very important one, even as regards vegetables, more especially to shipowners, for they can be furnished in large quantities at a very cheap rate; but, in addition to vegetables, fruits—as Apples, Pears, Apricots, &c.—and even flowers, may be dried and preserved by the same process, and, owing to the rapidity with which it is conducted, the latter retain their natural colours almost as brightly as when first obtained from the garden. In confirmation of this, several dried specimens were shown to the meeting; and it was mentioned that others would be exposed to public inspection in the "Crystal Palace" in Hyde Park next summer.

NOVELTIES FROM THE SOCIETY'S GARDEN. A rose-coloured variety of the Guatemala Lycaste candida, Forsythia viridissima, a valuable hardy shrub on account of its producing a considerable amount of gaiety during the spring months, either in or out of doors; and two Chinese Azaleas—one obtusa, the other an unnamed sort. The latter will be found useful on account of its having a disposition to flower earlier than most of its neighbours.

Cuttings of the following Pears were distributed to Fellows:—

GLOUT MORCEAU DE CAMBRON.

This is an excellent variety, very little known. It is quite distinct from the Glout Morceau. The fruit is more allied to the Napoléon, being exceedingly juicy, sugary, and rich. The flesh is of finer texture than that of the Napoléon, and the form of the fruit is different, tapering more regularly from the broad top towards the stalk. A Pear of first-rate excellence, ripe in the end of October.

BEURRÉ D'AMANLIS.

This is also little known; but it deserves to be extensively cultivated. It is a vigorous-growing tree, and likely to be productive. The fruit is large, even from a standard; melting, buttery, and richer than a good Brown Beurré. Ripens in September.

BEURRÉ ST. BERNARD.

Supposed to be good, but it has not yet been proved in the Garden.

FOURCROY, ou MERVEILLE DE LA NATURE.

This is distributed, although only known from the report of foreign authors.

BOOKS PRESENTED.

The Literary Gazette for January and February. From the Publishers.
Notice sur la Culture des Tulipes, par M. Tripet. From the Author.
Mémoires de la Société d'Horticulture du Département de Seine-et-Oise. Tome Huitième. From the Society.
Bulletin de la Société Centrale d'Horticulture du Département de la Seine Inférieure. Last part of the 1st Volume, on Pomology. From the Society.

April 1, 1851. (REGENT STREET.)

AWARDS. *Large Silver Medal:* To Messrs. Veitch, of Exeter, for a specimen of the Darwin Berberry (Berberis Darwinii), a new hardy shrub from Patagonia. Among the many species of Berberry introduced to English gardens within these last few years, this is one of the most beautiful. As an ornamental plant for a clump, or a single bush on the lawn, or for planting against a wall, this fine evergreen deserves a place in every collection. It grows freely in common garden soil, forming a neat bush, 3 or 4 feet in height. It produces blossoms in great abundance; and the leaves being small, the flowers, which are bright orange, are seen to much advantage. It was introduced by Messrs. Veitch through their collector, Mr. Lobb.

Knightian Medal: To Messrs Standish and Noble, of Bagshot, for a new carnation-striped Azalea, named Vittata, from China, which promises to be an acquisition. It is distinct from most of the striped kinds, and very early. To Mrs. Lawrence, F.H.S., for an Epidendrum, bearing a long drooping green flower, which terminated in a broad rich orange-coloured fleshy lip, vieing in brilliancy with the E. vitellinum itself. It was stated that after the plant had gathered strength it might be expected to produce flowers in clusters, which, of course, would add much to its value. To D. T. Curtis, Esq., of Boston, Massachusetts, for examples of Easter Beurré Pears, packed in tin cases, buried in salt. Seven of these cases were opened, in which were found three fruit good, and four spoiled. These Pears, which were very fine, were stated to have been ripened by a method peculiar to Mr. Curtis, the nature of which was not explained. They were melting, sweet, and perfectly ripe, a condition which this Pear attains with difficulty with us in England. The mode in which they were packed is new; and when it is considered that the fruit must have been quite ripe when put into the boxes, it may be pronounced to be successful; but as each tin box contained only one fruit, it will be evident that it is too expensive for adoption on a large scale.

Banksian Medal: To Mrs. Lawrence, F.H.S., for a collection of plants, consisting of a fine specimen of Enkianthus reticulatus, two species of Boronia, Mirbelia floribunda, Phaius Wallichii, Maxillaria Harrisoniæ, and an Oncidium resembling sarcodes. To Mr. E. G. Henderson, Nurseryman, St. John's Wood Road, for a well-grown Dielytra spectabilis. To Messrs. Lane, of Great Berkhampstead, for four boxes of beautiful cut Roses, gathered from a house heated on the Polmaise principle. They consisted of *Hybrid Perpetual:* Baronne Hallez, crimson; Baronne Prévost, blush, large and beautiful; Caroline de Sausal, blush; Châteaubriand, delicate pink; Comte de Montalivet, rosy crimson; Cornet, bright pink; Dr. Arnal, deep crimson; Duchesse de Gallieria, shaded pink; Duchesse de Praslin, blush, with pink centre; Duchess of Sutherland, glossy blush; Edward Jesse, lilac crimson; Gen. Cavaignac, rosy pink; Géant des Batailles, vermilion; General Negrier, rosy blush; George Lecamus, rosy blush; La Belle Amérique, shaded pink; Lady Alice Peel, rosy crimson; Louise Aimée, pink, light edge; Louis Buonaparte, bright rose; Madame Guillot, rosy crimson; Madame Laffay, crimson; Madame Trudeaux, brilliant carmine; Marquise Boccella, pale pink; Miss Pepin, delicate pink; Mrs. Elliot, crimson; Polybe, rosy purple; Princess Beljioso, rose; Queen, brilliant rose; Regulata, pink; Reine des Fleurs, pink; Reine Mathilde, light pink; Robin Hood, lilac rosy pink: Sidonie, bright pink; Standard of Marengo, crimson lake; William Jesse, crimson, tinged with lilac; Comte Robrinsky, beautiful crimson. *Bourbon:* Armosa, rosy blush; Augustine Marget, delicate bright rose; Bernardin de St. Pierre, brilliant carmine; Dupetit Thouars, rich carmine; Emilie Courtier, bright reddish crimson; Le Grenadier, bright lake; Madame Angelina, salmon yellow; Queen, delicate salmon; Speciosa, shaded rose. *China:* Abbé Mioland, fine crimson red; Fabvier, striped crimson; Miellez, lemon white; Mrs. Bosanquet, creamy white. *Tea:* Belle Allemande, cream, shaded blush; Comte de Paris, cream; Devoniensis, creamy white, buff centre; Goubault, salmon-shaded rose; Madame Bravy, creamy white, salmon centre; Niphetos, pale lemon; Smith's Yellow, pale straw; Vicomtesse de Cazes, golden yellow. *Noisette:* A fleur Variable, rosy salmon; Cloth of Gold, yellow; Jeanne d'Arc, lemon white; Mrs. Siddons, fine yellow. To Messrs. Henderson, of Pine Apple Place, Edgeware Road, for a collection of Hyacinths, of which the following are the names of some of the best:—*Light blue:* Orondates, Robinson, Nimrod, Grand Vidette, Grand Lilac, and Passe tout (double). *Dark blue:* Laurens Koster (double), Prince van Sax Weimar, Emicus, Baron van Thuyll, Prince Oscar, and Mignonaude Dryfhout (double). *Violet:* Tubal Cain, William I. and Prince Albert; the latter is very dark. *White:* Helen, Grand Vainqueur, Grand Vidette, La Candeur, and A la mode Epuisée, double white, with a pink centre. *Blush:* Grandeur de Meneilles, Anna Maria (double), Triumph Blandina, ditto, and Tubiflora. *Plum:* L'Unique, a variety much prized for its colour, which is new to hyacinths. *Yellow or buff:* Anna Paulowna, Heroine (double). *Deep rose:* Amphion. *Red:* Herstelde Vreede, Diebitsch Sabalskansky, Appeluis, Le Francq de Berkhey, and Waterloo (double). *Light red:* La Dame du Laack, and Lord Wellington.

Certificate of Merit: To Messrs. Standish and Noble, for Limonia laureola (Skimmia japonica), a sweet-scented shrub, from the mountains of India, and said to be hardy about Kingsbridge, in Devonshire. It was stated that its natural character is to produce fruit of brilliant scarlet in autumn. To Messrs. Hayes, of Lower Edmonton, for two nicely-managed plants of tree Violets. To Messrs. Henderson, Pine Apple Place, for Hebeclinium ianthinum, a promising greenhouse plant, with Ageratum like flowers which are reported to last long in perfection. To Mr. Rust, Gardener to W. Everett, Esq., for a dish of Black Hamburgh Grapes, on account of their being the first exhibited to the

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Society this year. They were stated to have been produced in a house heated on the Polmaise system.

Miscellaneous Subjects of Exhibition. Messrs. Veitch furnished a bloom of the pretty light-coloured striped Camellia, named Countess of Orkney. Messrs. Standish and Noble contributed a flowering plant of Viburnum macrocephalum, raised from a cutting struck last autumn. Messrs. Henderson examples of Narcissi, among which the best were Nannette, yellow, and Radiator, white with a yellow centre. Mr. E. G. Henderson, St. John's Wood, sent an Ixora and two seedling Rhododendrons, a crimson and a light kind. Dielytra spectabilis was exhibited by Mr. Clark, Nurseryman, Brixton Hill; but by far the finest specimen of this hardy Fumewort was produced by Mr. Edmonds, Gardener to His Grace the Duke of Devonshire at Chiswick House. The latter was unfortunately disqualified from receiving any prize, on account of its arriving too late, it being especially required that all subjects of exhibition shall be in the room two clear hours before the time of meeting. The same thing happened in regard to a Java Rhododendron from Messrs. Rollisson, which also came too late to fall under the consideration of the judges. From Messrs. Lane, of Great Berkhampstead, came a single white seedling Camellia and a specimen of the sweet Trichopil (Trichopilia suavis). Messrs. Loddiges sent a handsome pale rose-coloured Rhododendron, raised from Nepaul seeds; and Mr. Myatt, of Deptford, showed two nicely-flowered Cyclamens. Mr. Higgs, Gardener to J. Barchard, Esq., F.H.S., sent Keens' Seedling Strawberries; and a seedling Strawberry very like the Roseberry was produced by Mr. Cooper, of Yeovil, Somerset. A "Fruit Gatherer" was exhibited by Mr. Nevill, of Crutched Friars, and some very nice ornamental Flower Stands by Mr. E. G. Henderson, of the Wellington Road Nursery.

Novelties from the Society's Garden. Boronia tetrandra, and Forsythia viridissima.

Cuttings of the following Pears were distributed to Fellows:—

Powis Castle.

One of those hardy pears, raised by Mr. Knight, which has not fruited in the Garden, and therefore its merits cannot be particularly stated.

Forme de Délices.

This is not generally known; but from what has been seen of its fruit, it is considered well deserving of cultivation. At all events it is certainly worthy of trial. It ripens in October and November. The tree grows vigorously, and may require the operation of root-pruning, in some cases, to bring it into a bearing state.

Broom Park.

This is a hardy pear, raised by Mr. Knight, and possesses peculiar excellence. Instead of becoming mealy or insipid when fully ripe, it still retains its rich sugary quality, and is ultimately like a syrup. It ripens in December and January.

Early Harvest Apple.

This ripens as early as the 1st of August. The fruit is of a good size, roundish, and possesses a brisk flavour, such as is rarely to be found in very early apples.

Books Presented.

Flora Batava, No. 165. From His Majesty the King of Holland.
The Athenæum for March. From the Editor.

April 15, 1851. (Regent Street.)

Elections. Lady C. Wellesley, Apsley House; Mrs. Howard, St. Peter's Square, Hammersmith; T. H. Plasket, Esq., 1, Albert Terrace, Victoria Road, Kensington; Captain Lumley, Clare Villa, Lake, Sandrock, Isle of Wight; Mr. Stephen Brown, Nurseryman, Sudbury, Suffolk; Mrs. Sarah Cuff, Prescot Lodge, Clapham Park; Hamilton Cooke, Esq., Gordon House, Isleworth; R. Sutton, Esq., 79, Hamilton Terrace; Mr. Daniel Nash, 60, Strand.

Awards. *Large Silver Medal:* To Messrs. Veitch for Cantua buxifolia, a free flowering half-hardy shrub, from Peru. Owing to the accounts which had been published of the great beauty of this plant in its native country, much had been expected from it, and it is satisfactory to be able to say that the highest expectations formed of it are likely to be fully realised; for it promises to be not only one of the most charming, but also one of the most useful shrubs that has been introduced to gardens for years. When it is stated that the flowers are more than three times the size, and more brilliantly coloured than those of the two-coloured Cantua, some idea of the beauty of a well-bloomed specimen will be obtained; and then it possesses this value, that it is not only a plant suited for the gardens of the wealthy, but also for those of the cottager, where it will be just as much at home as the Fuchsia, requiring, as it does, about the same kind of treatment. With some slight protection, it is reported to have withstood the two last winters in the open air in Devonshire.

Certificate of Merit: To Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., for two Enville Pine Apples, weighing respectively 4 lbs. 4 oz. and 4 lbs. 14 oz.

Miscellaneous Subjects of Exhibition. Messrs. Veitch again sent a cut branch of the Darwin Berberry, in order to show that the flowers keep long in perfection; and along with it a piece of a reported hardy evergreen shrub from Australia. Mr. E. G. Henderson, of the Wellington-road Nursery, showed seven handsome Gloxinias, and a worthless Besleria, named umbrosa. Messrs. Henderson, of Pine-apple-place, sent two kinds of Grevillea and a Pultenæa, raised from seeds sent by Mr. Drummond from Swan River, and an example of Oncidium hastatum. Mrs. Lawrence again produced beautiful cut spikes of the Amherstia nobilis, which has been in flower at Ealing Park for several months past, and which promises to ripen seeds there. It flowers profusely and continuously, and the blossoms appeared to be brighter coloured than those last exhibited.—Three nice heads of Rhododendrons, raised from Kamoon seeds, were shown from the nursery of Messrs. Jackson, of Kingston. One was white, a second blush, and the third delicate rosy pink.—A dish of Black Hamburgh Grapes were shown from the garden of Sir H. Fleetwood, Bart., of Hill House, Windsor Forest.—Mr. Higgs, Gardener to J. Barchard, Esq., F.H.S., again sent beautiful specimens of Keens' Seedling Strawberry, ripened under rough plate glass.

Novelties from the Society's Garden. Aspasia Epidendroides, green and healthy. This plant has usually a yellow sickly aspect, but in this instance it exhibited a good green colour, caused, it is presumed, by throwing carbonate of ammonia into the atmosphere of the house in which it grows. —Also Ceanothus rigidus, which is hardy about London, provided it is not in a situation where it will be thawed and frozen alternately.

Cuttings of the following Apples and Pears were distributed:—

Apples—

Summer Golden Pippin.—Of a handsome form, like the old Golden Pippin, but larger. Flesh firmer than that of most summer apples, yellowish and rich. The tree is an abundant bearer.

Eldon Pippin.—Middle-sized, roundish, of good quality, and keeps till April. It is but little known.

Pears—

Beurré Van Mons.—A middle-sized, pyramidal, russeted fruit, ripe in November.

Eyewood.—A hardy sort, producing good fruit even in unfavourable seasons. Ripens in November.

Books Presented.

Journal of the Royal Geographical Society, Vol. XX., Part 2. From the Society.
Bombay Magnetical and Meteorological Observations for the years 1846 and 1847. From the Court of Directors of the East India Company.

May 1, 1851. (Regent Street.—Anniversary.)

The following Fellows of the Society were removed, viz.—

Dr. Daniel,
J. E. Denison, Esq., M.P.,
R. S. Holford, Esq.

The following were elected new Members of Council in their room, viz.—

Sir Philip de Malpas Grey Egerton, Bart., M.P.,
Sir C. Lemon, Bart., M.P.,
Dr. Royle.

The following Fellows of the Society were elected officers for the ensuing year, viz.:—

The Duke of Devonshire, President,
J. R. Gowen, Esq., Treasurer,
Dr. Royle, Secretary.

The Annual Report from the Council and Auditors was read and adopted. (See the body of this volume.)

It was proposed by Mr. Charlwood, and seconded by Mr. Glendinning, that the Council take into consideration, at the earliest possible opportunity, the expediency of allowing Fellows to obtain any number of tickets at 3*s.* 6*d.* each, up to some given period antecedent to the yearly exhibitions. It was also proposed by Mr. Glendinning, and seconded by Mr. Matyear, that the Council likewise take into their consideration the expediency of allowing Fellows personal admission, with friends, into the Gardens on Sunday afternoons, subject to such restrictions as might be considered necessary.

May 3, 1851. (Garden Exhibition.)

The weather on this occasion was very unfavourable. The morning, though fine until about noon, settled into a day of gloom and rain, accompanied by a cold wind from the north-east. As regards the exhibition, such a display of good gardening was perhaps never before witnessed. Not only was there an increase in the number of subjects exhibited, but each and all the plants produced were models of perfect cultivation. This was the distinguishing feature of the show. The number of visitors was 1549, exclusive of exhibitors and persons officially employed.

The Award was as follows :—

Large Gold Medal: To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for twenty species of Exotic Orchids.

Gold Knightian Medal: To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S , for a collection of fifteen Stove and Greenhouse Plants. To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for twenty species of Exotic Orchids.

Gold Banksian Medal: To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of fifteen Stove and Greenhouse Plants. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of twenty species of Exotic Orchids. To Messrs. Veitch and Son, of Exeter, for a collection of fifteen species of the same. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of ten species of the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a collection of ten varieties of Cape Heath. To Messrs. Rollisson, of Tooting, for the same. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses, in pots. To Mr. Francis, of Hertford, for the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of twelve varieties of Greenhouse Azalea.

To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of Indian Rhododendrons.

Large Silver-gilt Medal: To Mr. Speed, of Edmonton, for a collection of ten Stove and Greenhouse Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six Stove and Greenhouse Plants. To Messrs. Rollisson, for fifteen species of Exotic Orchids. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six species of the same. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twelve varieties of Greenhouse Azalea. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for six varieties of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Tall Cacti in flower. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of ten varieties of Cape Heath. To Mr. Epps, F.H.S., for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath in 11-inch pots. To Messrs. Rollisson, for the same. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Roses in pots. To Messrs. Paul, of Cheshunt, for the same. To Messrs. Veitch and Son, for Cantua buxifolia.

Certificate of Excellence: To Mr. Croxford, Gardener to H. H. Barnes, Esq., of Stamford Hill, for a collection of ten Stove and Greenhouse Plants. To Mr. Hamp, Gardener to J. Thorne, Esq., F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of Exotic Orchids. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for six varieties of Epacris. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums. To Messrs. Fraser, Lea Bridge Road, Essex, for six varieties of Greenhouse Azalea. To A. Rowland, Esq., F.H.S., for twelve varieties of Roses in pots. To Messrs. Lane, of Great Berkhampstead, for the same. To Messrs. Fairbairn, of Clapham, for a collection of ten varieties of Cape Heath. To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for ten varieties of Cape Heath, in 11-inch pots. To Mr. Epps, F.H.S., for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for the same, in 8-inch pots. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for a collection of Cape Pelargoniums. To Mr. Ayres, of Brooklands, for a collection of Fancy Pelargoniums. To M. Baumann, of Ghent, for Deutzia gracilis. To Messrs. Veitch and Son, for a single specimen of Medinilla magnifica.

Large Silver Medal: To Messrs. Pamplin, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for a collection of six Stove and Greenhouse Plants. To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for six species of Exotic Orchids. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heath, in 11-inch pots. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Cape Heaths in 8-inch pots. To Mr. Ambrose, of Battersea, for a collection of Fancy Pelargoniums. To Mr. Loddiges, F.H.S., for a new species of Aerides. To Messrs. Veitch and Son, for a single specimen of Erica elegans. To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, for a Queen Pine Apple, weighing 3 lbs. 3 oz. To Mr. Davis, Gardener to Lady Bridport, of Cricket St. Thomas, Crewkerne, for two Black Prince Pine Apples in a pot. To Mr. Davis, Gardener to Lord Boston, at Hedsor, Bucks, for a Providence Pine Apple, weighing 8lbs. 4oz. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To Mr. Jackson, Gardener to H. Beaufoy, Esq., of South Lambeth, for Dutch Sweetwater Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To Mr. Bain, Gardener to B. Bernasconi, Esq., of Harrow-Weald, for White Frontignan Grapes.

Silver Knightian Medal: To Mr. Dods, Gardener to Sir J. Cathcart, Bart., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of six species of Exotic Orchids. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for a collection of ten varieties of Cape Heath in 11-inch pots. To Messrs. Rollisson, for the same, in 8-inch pots. To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for a collection of Cinerarias in 6-inch pots. To Mr. Bragg, of Slough, for a collection of Pansies in pots. To Messrs. Henderson, of Pine-Apple Place, for Broughtonia violacea. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for Allamanda neriifolia. To T. B. Graham, Esq., of Lavender Sweep, Clapham Common, for a single specimen of Erica Sindryana. To Messrs. Veitch and Son, for Nepenthes Rafflesiana. To Mr. Barnes, Gardener to Lady Rolle, at Bicton, for a Queen Pine Apple. To the same, for a Prickly Cayenne Pine Apple, weighing 4 lbs. 10 oz. To Mr. Jackson, Gardener to H. Beaufoy, Esq., of South Lambeth, for a Providence Pine Apple, weighing 7 lbs. 9 oz. To Mr. Parsons, Gardener to A. George, Esq., of Ponder's End, for Black Hamburgh Grapes. To Mr. Davis, of Starch Green, Hammersmith, for the same. To Mr. Grant, Gardener to G. H. Simms, Esq., of Borthwick Hill, Bath, for a White Fleshed Melon, named "Victory of Bath."

Silver Banksian Medal: To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a collection of ten Stove and Greenhouse Plants. To Mr. Watson, Gardener to Mrs. Tredwell, of St. John's Lodge, Lower Norwood, for the same. To Mr. Fancourt, Foreman to Mr. Cant, of St. John's Street Nursery, Colchester, for a collection of Cinerarias in 6-inch pots. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Trichopilia coccinea. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Pimelea Nieppergiana. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a single specimen of Indigofera decora. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Ixora Griffithii. To Messrs. Veitch and Son, for Nepenthes sanguinea. To Mr. Hamp, Gardener to J. Thorne, Esq., of South Lambeth, for a collection of Amaryllids. To Mr. Fleming, Gardener to the Duke of Sutherland, at Trentham, for a Black Antigua Pine Apple, weighing 3 lbs. 4 oz. To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, for a Providence Pine Apple, weighing 5 lbs. 1 oz. To Mr. Bain, Gardener to B. Bernasconi, Esq., of Harrow Weald, for Black Hamburgh Grapes. To Mr. Snow, Gardener to Earl de Grey, Wrest Park, Silcoe, for a collection of Apples and Pears. To Mr. Ingram, Gardener to Her

Majesty at Frogmore, for May Duke Cherries. To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for Keens' Seedling Strawberries. To Mr. Smith, of Mogden Lane, Isleworth, for the same. To Mr. Robertson, Gardener to Lady Emily Foley, of Stoke Edith Park, Ledbury, for a Persian Hybrid Melon.

Certificate of Merit: To Mr. Loddiges, F.H.S., for Lycaste sp To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for Epidendrum sp. To Mr. Turner, of Holloway, for a collection of Alpines in pots. To Mr. Wilmer, of Sunbury, for a collection of twenty-four Auriculas. To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for a collection of Lycopods. To G. W. Hoyle, Esq., of Reading, for Epiphyllum speciosum Brookii. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of Apples and Pears. To Mr. Fleming, Gardener to the Duke of Sutherland, at Trentham, for May Duke Cherries. To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, near Acton, for Keens' Seedling Strawberries.

N.B.—Messrs. Lane, of Great Berkhampstead, would have obtained a Certificate of Merit for a collection of Cinerarias if they had complied with the regulations in regard to the size of pot in which they should have been shown.

May 20, 1851. (Regent Street.)

Elections. Manuel de Ysasi, Esq., Club Chambers, 15, Regent Street; William Tatton Egerton, Esq., M.P., Mere Hall, Knutsford, Cheshire; John Archer Houblon, Esq., Hallingbury, Bishop's Stortford; Richard Trevor Clarke, Esq., Wilton Place, Daventry; F. G. Neison, Esq., 25, Pall Mall; Frederick Scrivens, Esq., Clapham Common; Mrs. Mary Tombs, 10, Cavendish Road, St. John's Wood; John Weston, Esq., 57, Gloucester Place, Hyde Park; Richard Taylor, Esq., Wimbledon; John Tremayne, Esq., Heligan, St. Austel; and the Earl of Kilmorey, Orleans House, Twickenham.

Awards. *Banksian Medal*: Mr. Raith, Gardener to Mrs. Smyth, at Ashton Court, Bristol, for half a dozen Royal George Peaches, excellent for the season.

Certificate of Merit: To Mr. Davis, of Oak Hill, East Barnet, for Black Hamburgh Grapes.

Miscellaneous Subjects of Exhibition. J. Luscombe, Esq., F.H.S., sent cut specimens of purple and white hybrid Rhododendrons from the open grounds at Combe Royal, near Kingsbridge, Devonshire; and Mr. Davis, of Oak Hill, contributed a Providence Pine-apple weighing 5 lbs. 8 oz.

Novelties from the Society's Garden. A pale greenish yellow Epidendrum, from New Grenada, and Brownea Ariza, a Mexican stove tree with leaves resembling those of the Amherstia, and bearing a large drooping head of crimson flowers, which develope themselves for several weeks in succession. It was introduced by the Society some time ago through Mr. Hartweg, and is now flowering for the first time.

Books Presented.

The Quarterly Journal of the Geological Society, No. 26, Vol. XXVII. From the Society.
The Athenæum for April. From the Editor.

June 7, 1851. (Garden Exhibition.)

The weather on this occasion was sunless, but dry, and the exhibition an excellent one, being remarkable not only for the great quantity of beautiful specimens, but also for the general absence of bad ones. The number of visitors amounted to 9383, exclusive of exhibitors.

The Award was as follows:—

Large Gold Medal: To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for twenty species of Exotic Orchids.

Gold Knightian Medal: To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants. To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for twenty species of Exotic Orchids.

Gold Banksian Medal: To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of fifteen Stove and Greenhouse Plants. To Mr. Speed, of Edmonton, for a collection of ten Stove and Greenhouse Plants. To Mr.

Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty species of Exotic Orchids. To Messrs. Veitch and Son, of Exeter, for a collection of fifteen species of Exotic Orchids. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of ten species of the same. To Messrs. Veitch and Son for a collection of Pitcher Plants. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., at Syon, for plants of Nutmeg, Vanilla, Cinnamon, and Gamboge, all bearing ripe and unripe fruits, except the Cinnamon, which was in flower. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a collection of ten varieties of Cape Heath. To Messrs. Rollisson, of Tooting, for the same To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses, in pots. To Messrs. Lane, of Great Berkhampstead, for the same. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for a collection of Fruits.

Large Silver-gilt Medal: To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of twenty Stove and Greenhouse Plants. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of fifteen Stove and Greenhouse Plants. To Mr. Croxford, Gardener to H. H. Barnes, Esq., of Stamford Hill, for a collection of ten Stove and Greenhouse Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of twenty species of Exotic Orchids. To Messrs. Rollisson, for fifteen species of Exotic Orchids. To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for ten species of Exotic Orchids. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for six species of the same. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of six varieties of Greenhouse Azalea. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Tall Cacti in flower. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of ten varieties of Cape Heath. To Messrs. Fairbairn, of Clapham, for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath, in 11-inch pots. To Messrs. Rollisson for the same. To Alexander Rowland, Esq., F.H.S., for twelve varieties of Roses in pots. To Mr. Francis, of Hertford, for the same. To Mr. Gaines, of Battersea, for a collection of New Pelargoniums, in

8-inch pots. To Mr. Chapman, of Turnham Green, for a collection of Old Pelargoniums, in 11-inch pots. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a collection of Fruits.

Certificate of Excellence: To Messrs. Pamplin, Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants. To Mr. Watson, Gardener to Mrs. Tredwell, St. John's Lodge, Lower Norwood, for a collection of six Stove and Greenhouse Plants. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of fifteen species of Exotic Orchids. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums. To the same for a collection of six varieties of Greenhouse Azalea. To Mr. Falconer, Gardener to A. Palmer, Esq., of Cheam, for Tall Cacti in flower. To Messrs. Fraser, for a collection of ten varieties of Cape Heath. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Cape Heaths, in 11-inch pots. To Messrs. Fairbairn, for the same. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Cape Heaths in 8-inch pots. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Roses in pots. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of Cape Pelargoniums. To Mr. Bragg, of Slough, for a collection of New Pelargoniums in 8-inch pots. To Mr. Gaines, for a collection of Old Pelargoniums in 11-inch pots. To Mr. Ambrose, of Battersea, for a collection of six Fancy Pelargoniums in 8-inch pots. To Mr. Edmonds, Gardener to the Duke of Devonshire, F.H.S., at Chiswick, for a single specimen of Rhododendron aureum superbum.

Large Silver Medal: To Mr. Hamp, Gardener to J. Thorne, Esq., F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of Exotic Orchids. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of Helichrysums. To the same, for a collection of Cape Heaths in 11-inch pots. To Messrs. Rollisson for a collection of Cape Heaths in 8-inch pots. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, for a collection of twenty-five varieties of cut Roses. To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for a collection of Cape Pelargoniums. To Mr. Gaines, for a collection of six Fancy Pelargoniums in 8-inch pots. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of twelve Calceolarias in 11-inch pots. To Mr. Chapman, of Turnham Green, for the same. To Messrs. Veitch and Son for a single specimen of Erica metulæflora. To the same, for a shrubby species of Calceolaria from Peru. To Mr. Floud, Gardener to C. Bailey, Esq., Aberaman House, near Aberdare, Glamorganshire, for a Queen Pine Apple, weighing 5 lbs. 14 oz. To Mr. Davis, of Oak Hill, East Barnet, for a Providence Pine Apple, weighing 6 lbs. 11 oz. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To Mr. Smith, Gardener to S. Ricardo, Esq., Titness Park, Sunning Hill, for Sweetwater Grapes. To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for Muscat Grapes. To Mr. Harrison, Oatlands Palace Gardens, Weybridge, for the same. To Mr. Bain, Gardener to B. Bernasconi, Esq., of Harrow-Weald, for White Frontignan Grapes.

Silver Knightian Medal: To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for a collection of six Stove and Greenhouse Plants. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a single specimen of Exotic Orchid (Dendrobium Calceolaria). To Mr. Watson, Gardener to Mrs. Tredwell, Lower Norwood, for a collection of Helichrysums. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for six varieties of Cape Heath, in 8-inch pots. To Mr. Willmer, of Sunbury, for a collection of Pinks. To Mr. E. G. Henderson, of Wellington Road Nursery, St. John's Wood, for six varieties of Fancy Pelargonium, in 8-inch pots. To Mr. Francis, of Hertford, for a collection of Pansies in pots. To Mr. Wood, of Norwood, for a collection of Alpine Plants. To the same, for a collection of Variegated Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a single specimen of Erica Cavendishii. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for the same. To Messrs. Veitch and Son, for Dendrobium Veitcheanum. To Mr. Braid, Gardener to H. Perkins, Esq., of Hanworth Park, near Hounslow, for fruit of Musa Cavendishii. To Mr. Hoare, Gardener to J. Bailey, Esq., Glanusk Park, Brecknock, for a Queen Pine Apple, weighing 4 lbs. 12 oz. To Mr. Slowe, Gardener to R. W. Baker, Esq., F.H.S., for a Providence Pine Apple. To Mr. Ingram, Gardener to Her Majesty at Frogmore, for Black Hamburgh Grapes. To the same, for

Muscat Grapes. To Mr. Mitchell, of Brighton, for Black Hamburgh Grapes. To Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S., for Muscadine Grapes. To Mr. Cox, Gardener to J. Tredwell, Esq., Leigham Court, Brixton Hill, for White Frontignan Grapes. To Mr. Collinson, Gardener to the Marquis of Westminster, Eaton Hall, Cheshire, for Royal George Peaches. To Mr. Davis, of Oak Hill, for Noblesse Peaches. To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, Acton, for a collection of Strawberries in pots. To Mr. Ewing, Gardener to O. F. Meyrick, Esq., F.H.S., for a Green-fleshed Melon.

Silver Banksian Medal: To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Taylor, Gardener to J. Coster, Esq., for a collection of Helichrysums. To Mr. Francis, of Hertford, for a collection of Yellow Roses. To Mr. Bragg, of Slough, for a collection of Pansies, in pots. To Mr. Turner, of Barnes Common, for a collection of Alpine plants. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a single specimen of Leschenaultia biloba major. To Mr. Speed, of Edmonton, for a single specimen of Clerodendron fallax. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a single specimen of Pimelea Hendersoni. To Mr. Coster, of Benson, for a collection of Ranunculuses. To Mr. Speed, of Edmonton, for Clerodendron Bethuneanum. To Mr. Frost, Gardener to E. L. Betts, Esq., of Preston Hall, near Maidstone, for a Queen Pine Apple, weighing 3 lbs. 4 oz. To Mr. Harrison, of Oatlands Palace Gardens, for a Queen Pine Apple. To Mr. Drummond, Gardener to C. H. Leigh, Esq., of Ponty-pool Park, for a Providence Pine Apple. To Mr. Boyd, Gardener to Viscount Dillon, of Dytchley, Eustone, for Black Hamburgh Grapes. To Mr. Harrison, of Oatlands Palace Gardens, for the same. To Mr. Challis, Gardener to Mrs. Irvine, of Luddington House, Egham, for Muscadine Grapes. To Mr. Cox, Gardener to J. Tredwell, Esq., of Leigham Court, for Muscat Grapes. To Mr. Smith, Gardener to G. Elliott, Esq., Binfield, for White Frontignan Grapes. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for Peaches. To Mr. Ingram, Gardener to Her Majesty at Frogmore, for British Queen Strawberries. To Mr. Mann, of Isleworth, for the same. To Mr. Turnbull, Gardener to the Duke of Marlborough, for Keens' Seedling Strawberries. To Mr. Mann, of Isleworth, for the same. To Mr. Robertson, Gardener to Lady Emily Foley, Stoke Edith Park, Ledbury, for a Persian Hybrid Melon.

Certificate of Merit: To Mr. Bragg, of Slough, for a collection of six Fancy Pelargoniums, in 8-inch pots. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a single specimen of Leschenaultia formosa. To Mr. Salter, of Hammersmith, for a collection of Daisies. To Messrs. Veitch and Son, for Eurybia sp., from New Zealand. To Messrs. Henderson, of Pine Apple Place, for Gastrolobium cuneatum. To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, Acton, for British Queen Strawberries. To Mr. Harrison, of Oatlands Palace Gardens, for Keens' Seedling Strawberries. To Mr. Smith, Gardener to S. Ricardo, Esq., of Titness Park, for a Bromham Hall Melon.

June 17, 1851. (Regent Street.)

Elections. Lord Gardner, 46, Dover Street; H. St. John Mildmay, Esq., 46, Berkeley Square; J. Rashleigh, Esq., 33, Cumberland Terrace; T. Lawford, jun., Tirydail, Llandillo; and Mr. Francis, Nurseryman, Hertford.

Awards. *Knightian Medal:* To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for beautifully ripened Grosse Mignonne Peaches and Scarlet Nectarines.

Banksian Medal: To Mr. Tillyard, Gardener to Lord Southampton, at Whittlebury, for two dozen finely swelled and highly coloured Elruge Nectarines.

Certificate of Merit: To Mr. Cuthill, of Camberwell, for very fine fruit, from the open ground, of his Black Prince Strawberry, a valuable sort, now becoming pretty well known. It is certainly the earliest and most prolific of Strawberries, yielding as it does a constant and plentiful supply of good fruit from the first of the season up to the very latest period at which Strawberries can be gathered out of doors. A singular circumstance connected with this variety is, that blossoms have been detected on some of the plants exhibiting a beautiful crimson colour.

Miscellaneous Subjects of Exhibition. Mr. May, Gardener to E. Goodhart, Esq., Langley Park, Beckenham, Kent, sent a beautiful purple and white striped variety of Phlox Drummondi, called Mayii variegata. Mr. Mackintosh, Nurseryman, Maida Vale, Edgeware Road, furnished a small example of a White Chrysanthemum in blossom, in order to prove that this favourite autumnal flower may be made to bloom in the middle of summer. It was raised from a cutting put in in December, and had been grown on a greenhouse shelf near the glass. Melons came from Mr. Chapman and Mr. Eckford, Gardener to C. Child, Esq. The former sent two oblong fruit of the Sweet Melon of Cashmere, a white-fleshed sort of which little is at present known. It is, however, evidently related to the Persian kinds. Mr. Eckford had two fruit of the Bromham Hall, one not externally different from it, named Brown's Green Fleshed, and two of the Trentham Hybrid.

Novelties from the Society's Garden. Brassavola Digbyana, with its broad fringed lip, and the Chinese Indigo Plant (Isatis indigotica), a Crucifer resembling a young Spring Cabbage.

Books Presented.

Proceedings of the American Philosophical Society, Vol. V., No. 45, from the Society.

Transactions of the Linnean Society, Vol. XX., Part III., and Proceedings of ditto, from Nos. 41 to 44, from the Society.

July 19, 1851. (Garden Exhibition.)

The number of visitors at this meeting, exclusive of exhibitors, amounted to 9345. The weather was unfavourable, but the exhibition excellent. In some respects it was perhaps the finest show of the season in which it was held. The fruit, as usual, formed the most remarkable feature.

The Award was as follows:—

Large Gold Medal: To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of twenty Stove and Greenhouse Plants. To Mr. Mylam, Gardener to S. Rucker, Esq., F.H.S., for twenty species of Exotic Orchids.

Gold Knightian Medal: To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of twenty Stove and Greenhouse Plants. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids.

Gold Banksian Medal: To Messrs. Fraser, of Lea Bridge Road, Essex, for a collection of twenty Stove and Greenhouse Plants. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of fifteen Stove and Greenhouse Plants. To Mr. Speed, of Edmonton, for a collec-

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tion of ten Stove and Greenhouse Plants. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids. To Messrs. Veitch and Son, of Exeter, for fifteen species of the same. To Mr. Blake, Gardener to J. H. Schröder, Esq., F.H.S., for ten species of the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a collection of ten varieties of Cape Heaths. To Messrs. Rollisson, of Tooting, for the same.

Large Silver-gilt Medal: To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of twenty Stove and Greenhouse Plants. To Mr. Croxford, Gardener to H. H. Barnes, Esq., of Stamford Hill, for a collection of ten Stove and Greenhouse Plants. To Messrs. Pamplin, Lea Bridge Road, Essex, for a collection of six Stove and Greenhouse Plants. To Messrs. Rollisson, of Tooting, for fifteen species of Exotic Orchids. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of Exotic Orchids. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of six species of the same. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heaths. To Messrs. Fairbairn, of Clapham, for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a collection of Cape Heaths, in 11-inch pots. To Messrs. Rollisson, for the same. To Mr. Gaines, of Battersea, for a collection of New Pelargoniums, in 8-inch pots. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a very fine set of miscellaneous Plants. To Mr. Spencer, Gardener to the Marquis of Lansdowne, F.H.S., for a collection of Fruits.

Certificate of Excellence: To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for a collection of six Stove and Greenhouse Plants. To the same, for six species of Exotic Orchids. To Mr. Godfrey, Gardener to R. Dawson, Esq., of Tottenham, for a collection of Achimenes. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of Helichrysums. To the same, for a collection of Cape Heaths, in 11-inch pots. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of ten varieties of Cape Heaths. To Messrs. Fraser, of Lea Bridge Road, for the same. To Messrs. Fairbairn, of Clapham, for a collection of Cape Heaths, in 11-inch pots. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a collection of the same, in 8-inch pots. To Messrs. Lane and Son, of Great Berkhampstead, for fifty varieties of cut Roses. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for six species of Cape Pelargoniums. To Mr. Gaines, of Battersea, for a collection of Fancy Pelargoniums, in 8-inch pots. To Mr. Lochner, of Paddington, for twelve varieties of Carnations, in 11-inch pots. To the same, for twelve varieties of Picotees, in 11-inch pots. To Mr. Norman, of Woolwich, for twelve varieties of Carnations, in 11-inch pots. To the same, for twelve varieties of Picotees, in 11-inch pots. To Mr. Salter, Gardener to T. Yeels, Esq., Bath, for a single specimen of Erica Shannoni. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., at Trentham, for a collection of Fruits. To Mr. Smith, Gardener to S. Ricardo, Esq., of Titness Park, for three specimens of Black Hamburgh Grapes, in pots.

Large Silver Medal: To Mr. Bunn, Gardener to —— Richards, Esq., of Edmonton, for a collection of six Stove and Greenhouse Plants. To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for six species of Exotic Orchids. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of Calosanths. To Mr. Munro, Gardener to the Earl of Clarendon, The Grove, Watford, for a collection of Achimenes. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of Cape Heaths in 11-inch pots. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of the same, in 8-inch pots. To Messrs. Paul, of Cheshunt, for fifty varieties of cut Roses. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twenty-five varieties of cut Roses. To Mr. Parker, Gardener to J. M. Strachan, Esq., F.H.S., for a collection of Cape Pelargoniums. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of Fuchsias. To Mr. Newhall, of Woolwich, for twelve varieties of Carnations, in 11-inch pots. To the same, for twelve varieties of Picotees, in 11-inch pots. To Mr. Bragg, of Slough, for twelve varieties of Carnations, in 11-inch pots. To the same, for twelve varieties of Picotees, in 11-inch pots. To Messrs. Henderson, of Pine-Apple Place, for Hemiandra pungens. To Messrs. Veitch, of Exeter, for a single specimen of Erica metulæflora bicolor. To Messrs. Lee, of Hammersmith, for a collection of variegated Stove Plants. To Messrs. Standish and Noble, of Bagshot, for a collection of New Hardy Shrubs and

Trees. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for Hothouse Ferns. To Mr. Munro, Gardener to Mrs. Oddie, of Colney House, St. Albans, for a collection of Fruits. To Mr. Jones, Gardener to Sir John Guest, Bart., F.H.S., for a Queen Pine Apple, weighing 5 lbs. 12 oz. To the same, for an Enville Pine Apple, weighing 8 lbs. 9 oz. To Mr. Briddon, Gardener to W. O. Gore, Esq., of Porkington, Salop, for a Providenee Pine Apple, weighing 9 lbs. To Mr. Stent, Gardener to W. Herbert, Esq., of Clapham, for Black Hamburgh Grapes. To Mr. Harrison, of Oatlands Palace Gardens, Weybridge, for the same. To Mr. Elphinstone, Gardener to the Speaker, at Heckfield, for three bunches of Black Hamburgh Grapes, cut from vines grown in pots. To Mr. Macqualter, Gardener to Col. Challoner, F.H.S., for Black Prince Grapes. To Mr. Rust, Gardener to J. Maclaren, Esq., F.H S., for Muscadine Grapes. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for Muscat Grapes. To Mr. Mitchell, of Brighton, for the same. To Mr. Leonard, Gardener to J. Cox, Esq., of Weybridge, for Chasselas Musqué Grapes.

Silver Knightian Medal: To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for six Stove and Greenhouse Plants. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for a single specimen of Aërides odoratum. To the same, for Epidendrum replicatum, from New Grenada. To Mr. Watson, Gardener to Mrs. Tredwell, of Lower Norwood, for a collection of Helichrysums. To Mr. Godfrey, Gardener to J. Lester, Esq., of Tottenham, for a collection of Achimenes. To Messrs. Rollisson for a collection of Cape Heaths in 8-inch pots. To Mr. Francis, of Hertford, for fifty varieties of cut Roses. To A. Rowland, Esq., F.H.S., for twenty-five varieties of cut Roses. To Mr. Salter, F.H.S., for a collection of Fuchsias. To Mr. Willmer, of Sunbury, for twelve varieties of Carnations, in 11-inch pots. To the same, for twelve varieties of Picotees in 11-inch pots. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for a single specimen of Erica retorta major. To Mr. Constantine, Gardener to C. Mills, Esq., of Hillingdon, for a single specimen of Lisianthus Russellianus. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a single specimen of Dipladenia splendens. To Messrs. Henderson, of Pine Apple Place, for a collection of variegated Plants. To Mr. Woolley, Gardener to H. B. Ker, Esq., of Cheshunt, for Hothouse Ferns. To Mr. Turner, of Holloway, for twelve Alpine Plants. To Mr.

Watson, Gardener to Mrs. Tredwell, of Lower Norwood, for six Statices. To Mr. Frost, Gardener to E. Betts, Esq., of Preston Hall, Kent, for a Queen Pine Apple weighing 5 lbs. 5 oz. To Mr. Bray, Gardener to E. Lousada, Esq., of Peak House, Sidmouth, Devon, for a smooth Cayenne Pine Apple, weighing 6 lbs. 9 oz. To Mr. Jones, Gardener to Sir John Guest, Bart., F.H.S., for a Providence Pine Apple weighing 10 lbs. To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., for Black Hamburgh Grapes. To Mr. Spary, of Brighton, for the same. To Mr. Turnbull, Gardener to the Duke of Marlborough, F.H.S., at Blenheim, for West's St. Peter's Grapes. To Mr. Wood, Gardener to Scott Murray, Esq., F.H.S., for Muscadine Grapes. To Mr. Campbell, of Darlington, for Muscat Grapes. To Mr. Carpenter, Gardener to Sir E. Scott, of Great Barr Hall, Staffordshire, for Grizzly Frontignan Grapes. To Mr. Snow, Gardener to the Earl de Grey, F.H.S., for Peaches. To Mr. Wilson, of Warwick, for the same. To the same, for Nectarines. To Mr. Tillyard, Gardener to Lord Southampton, F.H.S., for Nectarines. To Mr. Brown, Gardener to H. Minton, Esq., of Stoke-upon-Trent, for a Trentham Hybrid Melon.

Silver Banksian Medal: To Mr. Watson, Gardener to Mrs. Tredwell, of Lower Norwood, for six Stove and Greenhouse Plants. To Mr. Falconer, Gardener to A. Palmer, Esq., of Cheam, for a single specimen of Renanthera coccinea. To Mr. Carter, Gardener to H. Hughes, Esq., of Hoddesdon, for twenty-five varieties of cut Roses. To Messrs. Fraser, for a collection of Fuchsias. To the same, for a single specimen of Calosanthes miniata. To Messrs. Rollisson, of Tooting, for Cattleya granulata, var. Leopoldii. To Messrs. Henderson, of Pine Apple Place, for Gordonia Javanica. To Mr. Turner, of Barnet, for Alpine Plants. To Mr. Over, Gardener to W. M'Mullen, Esq., of Clapham, for a single specimen of Hoya bella. To Mr. Henchman, of Edmonton, for a collection of New Holland Proteaceous Plants. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for three variegated Stove Orchids. To the same, for Muscadine Grapes. To Mr. Salter, F.H.S., for a collection of Petunias. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for Hothouse Ferns. To Mr. Higgs, Gardener to J. Barchard, Esq., F.H.S., for a Queen Pine Apple weighing 4 lbs. 4 oz. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a Black

Jamaica Pine Apple weighing 3 lbs. 12 oz. To Mr. Moffat, Gardener to the Duke of Newcastle, at Clumber, for a Providence Pine Apple weighing 7 lbs. 12 oz. To Mr. Umpleby, Gardener to Mrs. Benyon, of Roundhay, near Leeds, for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To Mr. Hill, Gardener to R. Sneyde, Esq., of Keele Hall, Staffordshire, for Black Prince Grapes. To Mr. Davy, Gardener to Mrs. Smith, of Colney Hatch, for Muscat Grapes. To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., for Grizzly Frontignan Grapes. To Mr. Turnbull, Gardener to the Duke of Marlborough, F.H.S., at Blenheim, for Peaches. To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., of Hill House, Windsor Forest, for Nectarines. To Mr. Marcham, Gardener to J. Smith, Esq., F.H.S., for Black Circassian Cherries. To Mr. Myers, of Brentford, for the same. To the same, for White Bigarreau Cherries. To Mr. Snow, Gardener to Earl de Grey, F.H.S., for Elton Cherries. To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, Acton, for British Queen Strawberries. To Mr. Beach, of Isleworth, for the same. To Mr. Parsons, Gardener to A. George, Esq., of Ponder's End, for Myatt's Eleanor Strawberries. To Mr. Lydiard, of Bath, for the same. To Mr. Munro, Gardener to the Earl of Clarendon, The Grove, Watford, for a Persian Green-fleshed Melon.

Certificate of Merit: To Mr. Hamp, Gardener to J. Thorne, Esq., F.H.S., for a single specimen of Oncidium pictum. To Mr. Parsons, Gardener to A. George, Esq., for twenty-five varieties of cut Roses. To Messrs. Veitch, of Exeter, for Hoya, sp. Manilla. To the same, for a Yellow Capsicum from Peru. To Messrs. Henderson, of Pine Apple Place, for a collection of Petunias. To Mr. Masters, of Canterbury, for Hothouse Ferns. To Mr. Munro, Gardener to the Earl of Clarendon, The Grove, Watford, for Peaches. To Mr. Turnbull, Gardener to the Duke of Marlborough, F.H.S., at Blenheim, for Nectarines. To Mr. Busby, Gardener to S. Crawley, Esq., F.H.S., for Black Circassian Cherries. To Mr. Gainford, of Brentford, for the same. To Mr. Elliott, Gardener to Mrs. Boothby, of Twyford Abbey, Acton, for White Bigarreau Cherries. To Mr. Eckford, Gardener to C. Child, Esq., F.H.S., for British Queen Strawberries. To Mr. Lydiard, of Bath, for the same. To Mr. Wood, Gardener to Scott Murray, Esq., F.H.S., for Downton Strawberries. To Mr.

Wilson, of Warwick, for Eleanor Strawberries. To Mr. Grant, Gardener to G. H. Simons, Esq., of Bath, for a Bromham Hall Melon.

N.B.—Mr. Steers, of Teddington, having sent only three bunches of Sweetwater Grapes, instead of six, was on that account disqualified from receiving a prize.

August 5, 1851. (Regent Street.)

Awards. *Knightian Medal:* To Mrs. Lawrence, F.H.S., for an interesting collection of Orchids, in which were three species of Cattleya, two Oncids, Vanda Roxburghii, the tailed Angrec, Epidendrum phœniceum, the beautiful rich crimson variety of Dendrobium secundum, introduced by the Society a few years ago; Stanhopea insignis, and a new Cycnoches, bearing a pendent chain at least 15 inches long, of very singularly-formed blossoms. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for six excellently-grown Cape Heaths, consisting of two varieties of tricolor, Ewerana superba, Irbyana, the larger variety of retorta, and infundibuliformis. To Mr. Markham, Gardener to the Hon. R. Clive, M.P., of Hewell, for a beautifully ripened Moscow Queen Pine-apple, weighing 4 lbs. 2 oz., and for a Providence, 9 lbs. 10 oz.

Banksian Medal: To the same for a dish of Black Hamburgh Grapes, large both in bunch and berry, and finely coloured. To Mr. Price, Gardener to W. Thompson, Esq., M.P., for a very fine Queen Pine Apple, weighing 5 lbs. 8 oz. To Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., for the same kind of fruit, weighing 6 lbs. To Mr. Rivers, of Sawbridgeworth, for Cherries, Plums, Pears, and Peaches, in the shape of small trees in pots, bearing (except the two latter) ripe fruit. Although many of the Cherries and Plums had dropped in travelling from Sawbridgeworth to London, still enough remained to show that very small plants of these kinds of trees in pots will bear heavy crops of fine fruit. They were stated to have been produced in what Mr. Rivers terms an "Orchard House;" *i. e.*, under a glass roof, with a Beech hedge for a back wall, and a Yew hedge for the front. The pots had been standing on a raised border, and were open at the bottom, in order to allow the roots to pass into the bed below. Two or three were covered with Haythorn's muslin net, to show how late Cherries may be preserved in the autumn; for, being under glass, autumnal rains do not injure them. Late Plums may also be preserved in the same manner; they shrivel, and become very delicious. Some of the pots were painted round with chopped horse-hair, tar, and salt, which has been found to be a capital bar to the snail tribe. To Mr. E. G. Henderson, of the Wellington Road Nursery, St. John's Wood, for Bromelia longifolia, bearing a nice head of pink flowers.

Certificate of Merit: To Mr. Martin, Gardener to Sir H. Fleetwood, Bart., Hill House, Windsor Forest, for dishes of Black and Red Hamburgh Grapes. Some are of opinion that Red Hamburghs are only badly coloured Black Hamburghs, but Mr. Martin's exhibition went to prove that this is not the case, for one Vine in the centre of his Vinery bore the large Grapes exhibited, which had the colour of an Orleans Plum, though they were quite sweet and ripe, while those growing on either side of it produced jet black fruit, which was otherwise different from the red kind. To the same for very fine Morello Cherries.

Miscellaneous Subjects of Exhibition. A flower of a seedling Fancy Pelargonium, called Negro Boy; a small punnet of Black Prince Strawberry, to show that it is not only very early, but also very late; and a dish of Lapstone Kidney Potatoes, from Mr. Cuthill, of Camberwell. The latter were produced to prove that Potatoes wintered on Cuthill's plan are free from disease, while those not so treated, and growing in his immediate neighbourhood, were stated to be more or less affected by the prevailing epidemic. It was mentioned, that although his plan of wintering might possibly not ensure sound Potatoes under all circumstances, yet that the produce of seed so treated would be more likely to escape disease than that from mismanaged sets. Mr. Martin produced the Windsor Prize Melon, a small, netted, green-fleshed kind, excellently flavoured; and Mr. Markham sent a Cabul Melon, weighing 13 lbs. 15 oz. It was stated that four of such Melons weighed collectively 35 lbs. They had been grown in a rudely-constructed temporary pit, merely by way of experiment.

Novelties from the Society's Garden:—

Seymour's Golden Perfection Melon.—About 4 lbs. weight, roundish or somewhat cylindrical, flattened at the ends, of a beautiful golden yellow, and finely netted. In a former season this was found very good, but the quality of Melons is exceedingly variable: for example, the Bromham Hall obtained the first prize in almost every instance last season, whilst this year the judges for the Exhibition at the Garden remarked, that out of a number of Bromham Halls exhibited they only found one good.

White Paris Cos Lettuce.—Seeds of this have frequently been distributed to the Fellows of the Society, as the very best summer Cos Lettuce. The specimen exhibited was grown on the top of the ridge, between rows of Celery. The entire plant weighed 4 lbs.; but some in perfection a week ago weighed 4 lbs. 5 oz. The leaves hood over each other at the top, so that tying up for blanching is scarcely necessary. It is a fortnight or three weeks longer than any other Cos in running to seed.

Early White Scolloped Gourd.—This is the name under which the seeds were received from America. It is sometimes called the *Crown Gourd*, and is the *Patisson*, or *Bonnet d'Electeur*, of the French. The plant forms a round bush, not *running* like most of the tribe; and the fruit is produced very close to the stem.

Egg or Apple Squash, or Orange Gourd.—So named from its shape, colour, and size, resembling that of an Orange. In size it forms a very wide contrast with the Mammoth Gourd.

Chou-rave blanc Hâtif de Vienne, and Chou-rave Violet de Vienne.—These are said to be finer fleshed than the common Kohl-rabi, which is used for cattle.

Pois sans Parchemin, or Sugar Pea.—The sort the pods of which are cooked like those of French Beans. It is much used on the Continent.

Books Presented.

Verhandlungen der k. k. Landwirthschafts Gesellschaft in Wien, &c. Vol. VII. 1st and 2nd Parts. From the Agricultural Society of Vienna.
Journal de la Société d'Horticulture Pratique de l'Ain. No. 1. From the Society.
The Quarterly Journal of the Geological Society, Vol. VII., No. 27. From the Society.
The Transactions of the Microscopical Society, Vol. III., Parts 1 and 2. From the Society.
The Athenæum, for May, June, and July. From the Editor.
The Gardener's Magazine of Botany, for July and August. From the Publishers.
Vergangenheit und Zukunft der Kaiserlichen Leopoldinisch-Carolinischen Akademie der Naturforscher, von Dr. C. G. Nees von Esenbeck. From the Author.

Sept. 2, 1851. (Regent Street.)

Awards. *Knightian Medal:* To Mr. Fleming, Gardener to the Duke of Sutherland, at Trentham, for an old Queen Pine Apple, weighing 7 lbs. It was an exceedingly handsome fruit, but hardly sufficiently ripe.

Certificate of Merit: To Mr. Turnbull, Blenheim, for Noblesse Peaches, one of which weighed very nearly 11 oz.

MISCELLANEOUS SUBJECTS OF EXHIBITION. Messrs. Lane, of Great Berkhampstead, produced two small Stanhopeas, and Warczewicz's Achimenes Margarettæ, a new kind, whose blossoms are pure white, and approach in size those of longiflora. Mr. E. G. Henderson, of the Wellington Road Nursery, sent young plants of Æchmea fulgens, and the new sort called Æ. miniata discolor; Gesnera zebrina, and an improved variety of it named splendens; Vriesia splendens, with a gay spike of scarlet bracts at least a foot in length; Clitoria braziliensis; and the scarlet Isotoma triflora. Mr. Summersby had Azalea fulgens scarcely an inch high, with three large flowers on it; also Goliath Plum, and a netted Cantaloup Melon. Mr. Martin, Gardener to Sir H. Fleetwood, Bart., sent dishes of Muscat and Black Hamburgh Grapes; and some Victoria Raspberries were furnished by Messrs. Lane. The fruit shown was gathered from canes which were reported to have been in bearing from the beginning of the season until the present time.

NOVELTIES FROM THE SOCIETY'S GARDEN:—

Impératrice Nectarine.—A melting sort which will hang till it begins to shrivel, and then it is very rich.

Pucelle de Malines Peach.—A new sort, presented to the Society by Messrs. Knight and Perry, in 1848. The fruit has the appearance of a Royal George; but from this it is perfectly distinct, for the Royal George has serrated glandless leaves and *small* flowers: the Pucelle de Malines has serrated glandless leaves and *large* flowers.

Malta Peach.—An excellent variety; but both in France and this country the tree is found to be a shy grower.

Reeves's Muscadine Grape.—Presented to the Society by J. Reeves, Esq., F.H.S., by whom it was obtained from the Cape. It is a great and constant bearer.

Denyer's Victoria Plum.—This is the same as the Alderton Plum, so named from a place in Sussex, where old trees of it are growing. It is an extraordinary bearer, and excellent for kitchen use. It is now becoming extensively cultivated in the neighbourhood of London.

Egg-shaped Gourd.—Seeds of this variety were presented to the Society by Mr. Reeves. Its pulp is excellent cooked, when the fruit has attained a mature state, and proved much superior to the other varieties that are used in that way.