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ORIGINAL COMMUNICATIONS.

I.—*A Short Account of the more Ornamental Evergreen Berberries cultivated in the Gardens of Great Britain.* By Professor Lindley.

So little is the public aware that there exists in England a large class of most beautiful hardy Evergreen shrubs belonging to the genus Berberis, that it has become an object of some importance to bring them into notice. It is not too much to say that among them are shrubs in no degree inferior for ornamental purposes to Laurels and other similar exotic bushes.

Some are from the West, some from the East. America has contributed a large number, and has an abundance of others in store to reward the enterprising collector. Nor does the warmer part of Asia yield the palm in this respect. Already a crowd of handsome strangers has reached us through the assistance of the East India Company, and there are probably as many to follow from the temperate mountains of that vast continent.

In the following brief account I have sought to collect what is most worth knowing about them; but extended details have not been introduced, because to have done so would have made this paper more botanical than is desirable in a Horticultural Journal. Let me hope that it will be the means of bringing to light other as yet unknown species, not less deserving of cultivation than the best of those here spoken of.

The Evergreen Berberries should be divided into three principal groups, viz.—I. Those in which the leaves are simple and the flowers solitary or fascicled in the axils of the leaves. II. Those in which the leaves are simple and the flowers in lengthened racemes or panicles. III. Those in which the leaves are pinnated. In this order they are treated of here.

I. *Leaves simple. Flowers solitary, or, if in clusters, one only on a stalk; the stalks all springing from the axils of leaves.*

1. The CROWBERRY-LEAVED Berberry.

Berberis empetrifolia, *Lamarck*, *Illustr.*, t. 253, f. 4. *Bot. Reg.*, 1840, t. 27. *Sweet*, *British Flower Garden*, ser. 2, t. 350.

From the country lying between the Straits of Magellan and the Cordillera near Valparaiso.

A little trailing bush, with stiff, 3-parted spines, and linear, pungent leaves, not unlike those of Genista anglica; bright green, clustered, and about an inch long. From their axils appear, in the month of May, a few bright yellow flowers, growing singly or in pairs, on stalks shorter than the leaves.

This is a well-known plant, suited for rock-work in a mild climate, but among the less valuable of the genus. According to Dr. Hooker, it is confined to the Cordillera, and characteristic of a dry climate.

Very nearly related to this is a plant called, in Mr. Low's nursery, *B. cuneata.* It has much more slender spines, and fine subulate leaves. At present its flowers are unknown to me, and it necessarily remains for future description. The name is a very bad one, and must at all events be altered.

2. The STAR-SPINED Berberry.

Berberis actinacantha, *Martius, in Römer and Schultes,* vol. vii. p. 12. *Botanical Register*, 1845, t. 55.

Found all over Chile, in the mountainous districts.

In gardens a stiff bush, about 3 feet high, conspicuous for its great palmate spines, and small, sessile, dark green, spiny, fascicled leaves. The flowers are abundant, but small and clustered, not racemose.

It is among the least interesting of the genus, and is scarcely more worth cultivating than B. heterophylla, or the so-called Mahonia Knightii. It is quite hardy, but subject to lose a great part of its leaves in severe winters.

3. The BOX-LEAVED Berberry.

Berberis buxifolia, *Lamarck*, *Illustr.*, t. 253, fig. 3. *J. Hooker*, *Fl. Antarctica*, ii. p. 231 t. 87—*aliàs* B. dulcis, *Sweet*, *British Flower Garden*, ser. 1, ii. t. 100. *Paxton's Magazine*, x. t. 171. *The Botanist*, i. t. 42—*aliàs* B. rotundifolia *of the Nurseries*—*aliàs* B. microphylla, *Forst. Comment. Gött.*, 9, p. 29—*aliàs* B. inermis, *Persoon*, *Synops.*, i. 387.

A very common plant all over the southern regions of South America, throughout Patagonia, Chiloe, Tierra del Fuego, and the Straits of Magellan.

In gardens it forms a straggling bush, with small ovate, or oblong, spiny-pointed, toothless leaves, of a dull dark-green above, and somewhat glaucous with indistinct veins beneath. When the bush is old, it produces an abundance of strong 3-

parted spines, which are longer than the leaves, some of which are toothed, and obovate instead of ovate. The flowers grow singly or in clusters, are very deep yellow, and rather larger than usual in the genus. It is almost universally known in gardens by the erroneous name of *B. dulcis;* but I have it from Messrs. Veitch under its correct designation, they having raised it direct from seeds collected by Mr. T. Lobb. In its early state the leaves are much rounder than in the more advanced stage.

Dr. Joseph Hooker, in his *Flora Antarctica*, gives the following interesting account of the wild plant:—

"This is a variable species, especially in the foliage, exhibiting a different aspect at different seasons of the year. In spring, when the flowering commences, fascicles of new leaves are produced, which are pale green, membranous, and entire. At this period the leaves of the former season begin falling, while those of the present year gradually become larger, stiffer, coriaceous, and generally mucronate or pungent at the apex. They are not fully developed till autumn, when they are generally quite entire, attenuated at the base, and shortly petiolate, about half an inch long, rigid and coriaceous, reticulated on the upper surface: during the following spring these in their turn fall away. In seedling plants the leaves are larger than at any future time, on long petioles, broader, and here and there furnished with spinous teeth. The flowers are generally in threes, but sometimes solitary, pale yellow. The berries, about the size of a small pea, were much used for tarts by the officers of the 'Beagle,' and found excellent. The *B. dulcis* of Sweet agrees with the common form of this plant, except that the flowers are larger in that author's figure, and the pubescence of the pedicels not visible in the wild specimens. The *B. inermis* seems a variety, some of the specimens being quite unarmed: indeed, the spines of this genus afford but an inconstant character."

For the purposes of cultivators it may be desirable to distinguish the true *B. buxifolia* from the Straits of Magellan, from the *B. dulcis* from Valdivia. The latter has larger and more spathulate leaves, larger fruit, and is more deciduous. The former is also a dwarfer plant. They are not, however, specifically distinct.

4. The YELLOW Berberry.

Berberis lutea, *Flora Peruviana*, iii. p. 51, t. 280.

A native of the mountains near Veto in Peru, at the height of 12,000 feet above the sea, where it was found by Mr. T. Lobb, and sent to Messrs. Veitch, of Exeter. Ruiz and Pavon say that it grows in coldish places (*locis frigidiusculis*).

In its wild stations this is said to be an evergreen bush as much as 18 feet high; it has, however, all the appearance of being much smaller. The branches are downy, and thickly covered with small leaves, the size and colour of *B. Darwinii;* oblong, with three or more spiny teeth when young, perfectly undivided, narrower, and mucronate in old plants. The spines are small and slightly 3-parted. The flowers grow in fascicles from among the leaves, on slightly downy footstalks.

It has stood out during two winters with Messrs. Veitch. It is a very pretty little species, and, if hardy, will almost rank with B. Darwinii, from which it differs in its flowers not being in racemes.

With the same habit as this, Messrs. Veitch have two other alpine Peruvian Berberries — their Nos. 264 and 340; but whether they are varieties of *B. lutea* or of *B. virgata*, or new species, it is impossible to determine until they acquire greater age.

5. WALLICH'S BERBERRY.

Berberis Wallichiana, *Decand.*, *Prodr.*, i. 107. *Wallich*, *Pl. As. Rarior.*, iii. p. 23, t. 243—*aliàs* B. macrophylla *of the Gardens—aliàs* B. atrovirens, *Don's Dictionary of Gardening*, i. 117.

A native of the mountains of Java, where it was obtained for Messrs. Veitch by Mr. Thomas Lobb, at the elevation of 9000 feet above the sea. Also found on the mountain Sheopur, in Nepal, by Dr. Wallich's collectors.

An evergreen of most beautiful aspect, with brown branches, a very dark green, dense foliage, and long, slender, 3-parted spines. The leaves grow in clusters, are about 3 or 4 inches long, with a sharp, prickly point, and numerous fine serratures, ending in a straight point on each side: on the upper side they are a rich bright green, turning to a claret colour in the autumn, and remarkably netted; on the under side they are pale green and shining.

I learn from Messrs. Veitch that it has stood with them through three winters without shelter, and is now 4 or 5 feet high. Naturally it is said to grow 10 feet high. In the Garden of the Society, to which it was presented by Messrs. Veitch, it has been kept in a cold frame.

The flowers have not been borne by the cultivated plants. Dr. Wallich describes them as growing on footstalks, clustered in a round dense fascicle, and pale yellow.

As it is a Java plant, it may be the *B. xanthoxylon* mentioned, but not described, in Hasskarl's 'Hortus Bogoriensis.' If so, that name must give way to Dr. Wallich's.

The species is in foliage extremely like an undescribed Bolivian plant, found by Bridges, and preserved in my Herbarium; but its flowers are totally different.*

6. The RAGGED Berberry.

Berberis heterophylla, *Jussieu. Hooker*, *Exot. Fl.*, t. 14 —*aliàs* B. ilicifolia *of many Gardens.*

Said to be a native of the Straits of Magellan, on the authority of the French botanist Commerson; I have, however, seen no wild specimens of it.

It is a straggling, inelegant, hardy, evergreen bush, sparingly covered by holly-like, narrow leaves, and long, stout, 3-parted spines. The flowers grow singly from among the leaves.

It is a species of no beauty, and undeserving cultivation. The common garden name of it belongs to another and very fine species.

II. *Leaves simple. Flowers in racemes or panicles.*

7. The ILEX-LEAVED Berberry.

Berberis ilicifolia. *Forst.*, *Comment.* 9, 28. *J. Hooker*, *Fl. Antarct.* ii. 230, t. 86. *Bot. Mag.* t. 4308—*aliàs* B. lagenaria, *Poiret.*

Wild in Tierra del Fuego and the Straits of Magellan.

This very rare shrub is described by Dr. Joseph Hooker as being a straggling bush about 8 feet high, and the handsomest species of the genus. I only know it from the figures published in the works above quoted, from which we learn that it has bright glossy holly-leaved foliage, large clusters of fine orange-coloured flowers, and berries of a deep steel blue tint. The leaves are described by Sir W. Hooker as being "obovate, petiolate, acute, coriaceous, dark shining green, especially above, pale beneath; the margin coarsely and distantly serrated, and each serrature armed with a distinct spur."

The plant which flowered at Kew is unfortunately dead, and

* As this plant probably exists in some English garden, Mr. Bridges' seeds having been much dispersed, it seems desirable to give it a name; and therefore I would thus define it:—

B. *ciliaris;* sempervirens, inermis (?), foliis fasciculatis oblongo-lanceolatis altê reticulatis ciliato-spinosis utrinque concoloribus, racemis subcorymbosis compactis erectis foliorum longitudine, bracteis pungentibus, sepalis petalisque elongatis. *Bolivia;* Bridges.

the species requires to be reintroduced. There is not a more ornamental hardy shrub in any of our foreign possessions.

8. DARWIN'S BERBERRY.

Berberis Darwinii, *Hooker's Icones Plantarum*, t. 672.

Chiloe and Patagonia furnished this to Mr. T. Lobb, whose seeds have enabled Messrs. Veitch and Co. to raise it. Mr. Darwin also found it in Chiloe; Bridges in Valdivia and Osorno.

It forms an evergreen shrub 3 to 5 feet high, of extraordinary beauty, and conspicuous for its ferruginous shoots, by which it is at once recognised. The leaves are of the deepest green, shining as if polished, not more than ¾ inch long, pale green, with the principal veins conspicuous on the under side, with three large spiny teeth at the end, and about one (or two) more on each side near the middle. Although small, the leaves are placed so near together that the branches themselves are concealed. The flowers, which have not been yet formed in England, are in erect racemes, and of the same deep orange yellow as in the Box-leaved species.

Mr. Veitch informs me that this plant appears to be decidedly hardy: as is probable, considering that it grows naturally near the summer limits of snow upon its native mountains. It is now 3 feet high, and Mr. Lobb says it is, when a large plant, the finest he ever saw of the genus, in which I have no doubt that he is right.

9. THE SMALL-FLOWERED BERBERRY.

Berberis parviflora, *Lindley, in Journal of the Horticultural Society*, vol ii. p. 243, with a figure—*aliàs* B. virgata *of the Gardens.*

Presented to the Garden of the Horticultural Society by Messrs. Lee of Hammersmith; supposed to be a native of South America.

It is a pale-wooded evergreen bush, with slender branches, small, rather fine spines, and bright-green leaves, without a trace of glaucousness. The leaves are about 1½ inch long by ½ an inch wide, and have pretty exactly the form of a lengthened wedge whose upper end is almost always divided into three nearly equal coarse spiny teeth: other teeth, however, occasionally appear at the sides. The flowers are unusually small, and grow five or six together in nodding clusters, whose stalks are nearly as long as the leaves.

Among all the evergreen species this is known at first sight by the form of its leaves. Perhaps its nearest relation is

B. Lycium. It differs from B. virgata, whose name it sometimes bears, in the form of its leaves, and especially in the flowers being racemose, not solitary.

It is a true evergreen, perfectly hardy, and rather handsome.

10. THE LOXA BERBERRY.

Berberis loxensis, *Bentham, Pl. Hartweg*, No. 709.

Obtained by Messrs. Veitch, through Mr. T. Lobb, from the Peruvian Highlands, near Loxa, where it was also found by Hartweg.

If it were not for its smaller size and much more diminutive flowers, this would be regarded as a variety of *B. Jamiesoni.* It has small palmated spines, and very shining, blunt, obovate, bright-green leaves, of nearly the same colour on both sides; they seem to have in all cases a spiny point, and very often several teeth at the sides. The flowers are unusually small, and stand erect in panicled racemes on a long peduncle quite clear of the leaves.

Its hardiness is uncertain; but its beautiful foliage makes it worth some protection if necessary. It stood with Messrs. Veitch unsheltered through last winter.

11. THE WAVY BERBERRY.

Berberis undulata.*

From the mountains of Peru, where Mr. T. Lobb collected it for Messrs. Veitch, near the village of Andagles, at the elevation of 12,000 feet.

In a young state, as now with Messrs. Veitch, this has slender branches, and weak palmated spines. The leaves are dull green, scarcely glaucous, oblong, tapering to the base, remarkably wavy, and furnished with a few spiny distant teeth, without any distinct trace of netted veins. The flowers have not yet appeared.

In a wild state, as in Mr. Lobb's specimens, now before me, it is a stout stiff bush, with three-parted or five-parted spines, sometimes as much as $1\frac{1}{4}$ inch long. The leaves are thick, narrower than in the cultivated plant, but still preserve their undulated appearance. The flowers appear in small roundish, nearly sessile racemes, which are scarcely so long as the leaves. In this state it is not unlike the figure of *B. flexuosa* in the

* B. *undulata;* sempervirens, rigida, spinis 3-5-partitis, foliis fasciculatis coriaceis undulatis opacis mucronatis nunc spinoso-dentatis oblongo-lanceolatis vix reticulatis, racemis erectis subsessilibus folio brevioribus.

Flora Peruviana, but the spines are not corky at the base, the racemes are much shorter, the flowers smaller, and the leaves thicker.

Messrs. Veitch describe this as being undoubtedly hardy, it having stood out two winters. It is an evergreen shrub, from 4 to 6 feet high.

12. The ORANGE-FLOWERED Berberry.

Berberis Aurahuacensis, *Lemaire, in Van Houtte's Flore des Serres*, iii. t. 334.

Said, in the work above quoted, to have been found by M. Linden in Rio Hacha, a province of New Granada, near the village of Aurahuaco-Taquina, in the Sierra Nevada, or Snowy Mountains, at about 9000 feet above the sea, near the snow-line.

It is described as an elegant shrub, with straight erect branches, and to be distinguished by bearing leaves of two sorts: the lower cordate, slightly enlarged, and angular in the sinus where they are jointed with the petiole, which is very long; the upper obovate, elliptical, tapering to the base, coriaceous, wavy, with a few marginal spiny teeth near the end, very glaucous beneath. The flowers are in compact racemes, drooping, and very deep yellow.

The Belgians express a hope that it may be hardy, but they have no experience upon the subject. With us it is likely only to prove sub-evergreen at the most, and rather tender.

13. JAMIESON'S Berberry.

Berberis Jamiesoni, *Veitch—aliàs* B. glauca, *Benth.*, *Pl. Hartweg*, No. 710.

Found in Peru by Dr. Jamieson of Quito, who sent its seeds to Messrs. Veitch; I have also seen it in the nursery of Mr. Glendinning, who obtained his plants from seeds collected near Santa Martha by Purdie.

This very beautiful bush has leaves of the deepest green and most lucid surface; they appear in fascicles, and are nearly 3 inches long when full grown; in form they are oblong, a little narrowed at the base, with a spiny point, and a few spiny toothings on each side, or with scarcely any; beneath they are pale-green, without a trace of glaucousness. The flowers have not been produced in this country, but in my wild specimens, gathered near Loxa by Hartweg,* they are in close somewhat

* This is named *B. glauca* in Mr. Bentham's list of Hartweg's plants, but I take that plant to be quite a different species, of which I have a specimen from Mathews, gathered in Peru, in the province of Chachapoyas.

erect panicled racemes, about 3 inches long. This must certainly be a plant of great value in gardens.

Messrs. Veitch inform me that it has stood several winters with them at Exeter, but in very severe weather the shoots and young wood have been injured. They regard it as being decidedly less hardy than their Wallich's Berberry.

In the garden of the Horticultural Society it has been kept in a cold frame, the plant being small.

14. The WHITENED Berberry.

Berberis dealbata, *Lindley, in Bot. Reg.*, t. 1750.

Raised by the Horticultural Society from imported seeds about the year 1830. Its exact origin is unknown. The gardener in charge of it asserted that it was Mexican, but Mr. Hartweg stated that he had never seen it wild in Mexico, although he met with it frequently on the mountains of New Granada. This collector produced, however, no evidence of the fact. It is probable, nevertheless, that it really inhabits the same country as *B. glauca* and *B. tomentosa.*

A good-looking shrub, with stout brown branches, scarcely spiny, and undulated leaves of a bluish green on the upper side, and almost white beneath. The latter are generally truncate, with three spiny teeth at the end, and two or three more at the sides, sometimes 2 inches long and $1\frac{3}{4}$ wide. In the Botanical Register they are not well represented, being much too small, and not distinctly enough truncate. The flowers appear in April, in short, oblong, very compact drooping yellow racemes.

The plant in the garden of the Horticultural Society is about 4 feet high, and has stood unprotected in the open border for several years; in severe winters it loses the greater part of its leaves, but in ordinary winters it is quite evergreen.

15. The WHITE-BACKED Berberry.

Berberis hypoleuca, *Lindley, in Journal of Horticultural Society*, vol. ii. p. 246, with a figure.

Raised in the garden of the Horticultural Society from Nepal seed, presented by Dr. Royle.

One of the stoutest of the genus, with strong very pale erect branches. The spines are unusually small for the size of the shrub. The leaves are larger than in any other simple-leaved species, sometimes measuring 4 inches in length by 2 in breadth; they are leathery, strongly netted, dull dark green, and very white underneath; at the edge they are furnished with coarse rather spiny teeth. The flowers are about the size of those of B. vulgaris, and appear sparingly in long-stalked corymbs.

It is a remarkably fine species, likely to rival the Kushmul in stature. It is truly evergreen, but is sometimes slightly injured in the foliage by a severe winter.

16. THE KUSHMUL BERBERRY.

Berberis asiatica. *Roxburgh*, *Fl. Indica*, ii. 182. *Delessert's Icones*, ii. 1—*aliàs* B. ilicifolia. *Asiatic Researches*, vi. 357, according to Roxburgh.

Found in all the mountainous country north of Hindostan, where it appears to be called *Kushmul.* It is correctly distinguished from the *Chitra*, or *B. aristata*, by Dr. Royle.

This is the largest of the species in cultivation, growing quickly to the height of 8 or 10 feet, with pale erect branches, rather small spines, and a beautiful lucid bright green glaucous foliage. The leaves are oblong, tapering to the base, and a good deal netted when old; as in all the Indian species, they are toothed in various degrees, according to age or other circumstances; when toothed they invariably are scolloped as it were, and not serrated as in the Chitra. The flowers grow in very short, roundish, sessile racemes, scarcely projecting beyond the leaves; and are succeeded by clusters of dark purple, roundish berries, covered with a rich bloom like a plum. In India these are dried and sold as raisins, which they much resemble, except in size. It is the best known of all the Indian Berberries, having been longest in cultivation, and in the south-west of England has become extremely common. Thousands of plants have been distributed by the Horticultural Society. Nowhere, however, has it been cultivated with so much success, or on so large a scale, as at Killerton, the seat of Sir Thomas Dyke Acland, Bart., from whose gardener, Mr. Craggs, I have received the following account:—

"About eighteen years ago I received a packet of seed of Berberis asiatica, from which I raised about one hundred plants. After keeping them two or three years in the nursery, I planted them out singly in different situations both at Killerton and Holmcote. The plants grew vigorously, were allowed to take their natural growth, and in a few years, at the latter place, began to seed. Being near the sea, the late spring frosts did not kill the blossoms; and from those plants we have now for several years obtained many pounds of seed, the plant being upwards of 14 feet high, and as many in diameter.

"From the commencement of their ripening with us the seeds have been sown annually in drills or broadcast in beds in the open ground about the first week in March, in a light soil, letting them remain in the above situation until the spring after. I then plant them out in the nursery in rows, about 15 inches from row to row, and about 6 inches from plant to plant. In two years they make fine strong bushes for permanent situations.

"Finding the plants to be free growers, nearly evergreen, and very strong, and raising many thousands per year, I began, by the desire of my employer, to plant them out for hedges, and they succeed particularly well either planted on banks or on the bare surface. The latter I can highly recommend for dividing allotments in cottage gardens, this berberry being free from mildew; and it can be kept clipped with shears or shorn with a reap-hook to any width required.

"When planted on a bank, it makes a beautiful hedge by cutting out with a knife the very luxuriant shoots about twice a year to within an inch or two from where they grow, allowing the side and weak growth to form the hedge. I have a hedge at Killerton so treated, which has been planted upwards of twelve years, and at this time is not more than 4 feet high and about the same width; and with the same treatment it can be kept to the same size.

"I should recommend in planting hedges to keep the plants a foot apart, and, if the hedges are to be kept shorn, in a single row; but if to be kept in the more natural growth, plant two rows, not more than one foot apart, and the plants the same, but put in alternately.

"When strong, this Berberry is proof against any cattle. Last spring I planted a stout bush in the deer park without protection. They have battled it with their horns, but they have not killed it. It can be planted nearer a fence where cattle have access than any shrub I know."

It is indeed a most valuable plant, and hardy enough to defy the rigour of any frosts south of the Humber.

Many varieties are to be found in gardens, but they are not different in important characters.

17. The CHITRA Berberry.

Berberis aristata. *De Cand. Systema*, ii. 8. *Hooker's Exot. Bot.* t. 98?—*aliàs* B. Chitria *Buchanan. Ker, in Botanical Register*, t. 729—*aliàs* B. floribunda, *Don's Miller's Dict.*, i. 115—*aliàs* B. affinis, *Don, l. c.*

Long known as a Nepal plant, and more particularly described by Dr. Royle as inhabiting the Himalayas at from 5000 to 8000 feet of elevation, from Jurreepanee to Mussooree and on the Choor Mountain; its hill name is *Chitra*. It is also found on

Nuera Ellia, in Ceylon, and probably grows along the whole of the Neilgherry range.

By no means uncommon in gardens, where it forms a stout evergreen bush, with dark brownish-red spreading branches, and shining rich green leaves, usually fringed with bristle-pointed, fine, close serratures, whence its specific name. The flowers are large, bright, not dark, yellow, in loose panicled, long-stalked racemes hanging down beyond the leaves. They are succeeded by an abundance of red, bloomless, oblong, acid berries, which hang on the branches till Christmas.

The fine, close, bristle-pointed serratures of the leaves, the rich reddish-brown branches, and the long, loose, panicled racemes of flowers are quite peculiar to this plant, and separate it clearly from every other. Dr. Royle tells us that its fruit forms a part of the hill raisins of Nepal; in England they acquire no bloom, and would not readily dry.

Like *B. asiatica*, this produces several varieties, one of which I propose to call the *entire-leaved Chitra* (*B. aristata integrifolia*). It is distinguished by the edges of the leaves being almost wholly destitute of bristles, and is known in some gardens under the false name of *B. Wallichiana*, to which it bears no resemblance.

The plant figured in Sir W. Hooker's 'Exotic Flora' has the leaves of *B. petiolaris* of Wallich, a species which I have not myself seen alive; at least their toothed, not serrated, margin would lead to such a conjecture; at the same time the flowers are exactly those of *B. aristata.*

18. The UMBELLED Berberry.

> Berberis umbellata. *Wallich, in Don's Miller's Dictionary*, i. 116. *Botanical Register*, 1844, t. 44—*aliàs* B. angulosa. *Wallich, Catalogue*, No. 1475—*aliàs* B. gracilis *of German gardens.*

Dr. Wallich's collectors appear to have first discovered this plant in Kamaon and Gossain Than. For its introduction to our gardens we are indebted to the East India Company.

It is a hardy bush, about 4 feet high, with a spreading manner of growth, pale brown, angular branches, slender 3-parted spines, and very narrow, bluish-green leaves, strikingly glaucous beneath; on an average they are $1\frac{3}{4}$ inch long by $\frac{3}{8}$ wide; sometimes they are perfectly entire, in which state they are represented in the 'Botanical Register;' but they are more commonly furnished with a strong, marginal, spiny tooth or two, and sometimes with many. (Can this state be the *B. ceratophylla* of G. Don?) The flowers are pale yellow, in drooping, narrow racemes, and are succeeded by an abundance of oblong, purplish fruits.

The species is very pretty, in consequence of its graceful manner of growth. It is best suited for growing among rough places, such as heaps of rock-work, where its spreading way of branching can best be seen. It is not, however, a good evergreen, the leaves being too thin and pallid.

19. The DYER'S Berberry.

Berberis tinctoria. *Leschenault de la Tour*, *in Mémoires du Muséum*, ix. 306. *Delessert*, *Icones*, ii. t. 2? *Wight's Illustrations of Indian Botany*, t. 8.

Found wild in the Neilgherry Mountains, whence it has been lately introduced by the Honourable Court of Directors of the East India Company.

The plants in gardens are slender, brown-wooded shrubs, with small slender spines, usually 3-parted. The leaves are thin, not shining, dull green above, glaucous beneath, oblong, blunt, with a spiny point, but scarcely spiny-toothed, except on the seedling plant. The flowers have not hitherto appeared. They are represented by Dr. Wight as standing erect in loose racemes scarcely longer than the leaves, and succeeded by an abundance of dull red fruit. In the absence of such evidence there would be some doubt as to this; for botanists have evidently misunderstood the distinctions of some of the Indian Berberries. M. Delessert, for instance, figures a *B. tinctoria*, declaring at the same time that it is nothing but *B. asiatica;* yet *B. asiatica* has no resemblance to the plant now described, whose leaves are glaucous, not bright green, thin, not coriaceous, almost veinless, not strongly netted. Dr. Wallich, on the other hand, distributed under the name of *B. tinctoria* specimens which in part at least belong to *B. aristata*. But the specimen from Leschenault in Wallich's Herbarium, deposited with the Linnean Society, is extremely glaucous beneath, and appears to agree with the garden plant, as it does with Dr. Wight's figure.

At present little is known of its quality; it appears to be only a sub-evergreen, and to be tolerably hardy.

Its name has been given it in consequence of its furnishing, like other species, a fine yellow dye. Vauquelin states that it is inferior to few woods for that purpose.

20. The OPHTHALMIC Berberry.

Berberis Lycium, *Royle's Illustrations of the Botany of the Himalayan Mountains*, p. 64.

According to Dr. Royle, this occurs in the Himalayahs from Rajpore to Mussooree, at from 3000 to 7000 feet of elevation; also from Nahn to Choor.

This bush derives its name from having been discovered by Dr. Royle to be the real Lycium indicum of the Greek physicians. To this day its extract is used against ophthalmia with great success, as in the time of Dioscorides. Its branches are erect, pale brown, and angular, armed with 3-parted spines of unusual length for the size of the leaves. The latter, when young, are glaucous on the under side; but in winter they are nearly green, and become a dull, unpleasant, brownish red. In form they are oblong-lanceolate, spiny-pointed, with several lateral spiny teeth; sometimes, however, they are toothless. The flowers grow in long, erect, somewhat panicled racemes, much longer than the leaves.

This is a bad evergreen, but a pretty summer bush. It is perfectly hardy.

III.—*Leaves pinnated, or trifoliolate.* Ash-leaved Berberries, or Mahonias.

21. The THREE-LEAVED Berberry.

Berberis trifoliata, *Bot. Register*, 1841, *Misc.* 149, 1845, t. 10.

In the north of Mexico, among stunted Mimosas and Cacti, this plant is found occupying large tracts of country. Introduced by the Horticultural Society.

It is a charming evergreen bush, with prickly, deeply scalloped leaves, having bluish-green variegated leaflets in threes sessile at the end of a stalk either longer or shorter than themselves. On the under side they are quite glaucous. The wood is hard, reddish brown, and somewhat streaky. The flowers are pale, clear yellow, growing from three to five together, in small, nearly sessile racemes, in the axils of the leaves. The fruit has not been yet formed in this country: it is said to be eaten by the children that inhabit its native wildernesses.

None of the genus are more worth cultivating than this in a country that suits it. It grows 3 or 4 feet high, and has hitherto proved hardy near London.

22. The THIN-LEAVED Berberry.

Berberis tenuifolia, *Lindley, in Bot. Reg.*, 1838, *misc. No.* 121. 1844, t. 26—*aliàs* B. fraxinifolia, *Hooker's Icones*, iv. tt. 329, 330.

A Mexican shrub, from the foot of Orizaba. Introduced by the Horticultural Society.

No probability exists of this graceful plant being hardy, it being destroyed by only a few degrees of frost. It is easily distinguished by the leaflets of its long, pinnated leaves being ovate-lanceolate, pale bright green, and perfectly free from all trace of toothing. Its flowers appear in abundance in long, simple, erect, loose, open racemes, opening, in the month of December, in a greenhouse. It is said to grow ten feet high in its native places, and is a good conservatory plant.

23. EHRENBERG'S Berberry.

Berberis Ehrenbergii, *Kunze, in Linnæa*, xx. 45.

From the temperate parts of Mexico.

According to Professor Kunze, this has flowered in the Botanic Garden of Halle. In England it is unknown. The author states it to be nearly allied to the Thin-leaved Berberry (B. tenuifolia), but to have longer and narrower leaflets; the flowers are longer than their stalks, and therefore nearly sessile; the sepals *white;* the petals small and yellow.

I have no private information about it; and the language of the describer leaves some doubts concerning its true character. For example, it is difficult to reconcile the nearly sessile flowers ascribed to it with compound *lax* racemes.

24. The PALLID Berberry.

Berberis pallida, *Bentham, Plantæ Hartwegianæ*, p. 34. *Bot. Reg.*, 1844, t. 16.

An evergreen shrub, from five to six feet high, from the mountains of Mexico. Introduced by the Horticultural Society.

A handsome species, with pinnated, slightly prickly leaves, and long, panicled racemes of pale yellow flowers, succeeded by globular, dark purple, glaucous fruit, the taste of which is not only unpleasant, but particularly acrid.

It is a very rare and very fine greenhouse shrub, but too tender for the neighbourhood of London, and therefore not deserving of more particular description.

25. The PRICKLY Berberry.

Berberis fascicularis, *Sims, in Bot. Mag.*, t. 2396—*aliàs* Mahonia fascicularis, *De Cand.*, *Syst. Veg.*, ii. 19—*aliàs* B. pinnata, *Lagasca. Bot. Reg.*, t. 702—*aliàs* Mahonia diversifolia, *Sweet*, *British Flower Garden*, ser. 1, t. 94.

A species confined, apparently, to the lowlands of California and the north of Mexico. The statement made by Sweet that this is also from Monte Video is, no doubt, some mistake.

With much the appearance of the Holly-leaved Berberry, in the Herbarium, this is, I apprehend, a distinct species, when alive distinguishable by its much more prickly leaves, and their want of lucidity, especially on the under side, which is as unpolished as in the Creeping Berberry. It is also more arborescent; its inflorescence is much more compact, and it is far more impatient of cold, not living in the open air near London, except under the shelter of a roofed wall.

A hybrid, between it and B. aquifolium, exists in cultivation, said to have been raised by Mr. Rivers. It is of a larger growth than the prickly Berberry, and has its compact inflorescence and dull, hard leaves, but all the habit of the Holly-leaved. This *Berberis hybrida* is a good-looking evergreen, and perfectly hardy.

26. The HOLLY-LEAVED Berberry.

Berberis Aquifolium, *Pursh*, *Fl. Am. Sept.*, i. 219, t. 4; *Bot. Reg.*, t. 1425—*aliàs* Mahonia Aquifolium, *De Cand.*, *Prodr.*, i. 108.

All over the North-Western parts of N. America, both in the Hudson Bay Company's territory and in Oregon, this plant is found in woods. It does not appear to inhabit California.

Than this we have no finer evergreen in cultivation. Hardy enough to bear all winters, putting forth its half-transparent rosy foliage in the spring, hardening it into a gloss and texture not inferior to those of the common Holly, and bearing in the autumn enormous quantities of large globular deep purple berries, covered with a bloom that rivals that of the finest raisins, this shrub is certainly one of the most valuable of the numerous species for the introduction of which Europe is indebted to the Horticultural Society. It thrives in sandy or clayey land, in wet places, or on precipices, overshadowed by trees, or exposed unsheltered to the sun. In the latter situation it bears fruit most abundantly, and therefore may be ranked as the first among bushes suitable for rock-work.

This character applies however, strictly, only to the true Holly-leaved Berberry, the leaves of which are a bright clear green, very shining, even on the under side, and a rich vinous red along the leafstalks. In the nurseries are numerous varieties of inferior merit, with broader leaves, not shining on either side, of a duller green, and apparently hybrid varieties between this and the Creeping Berberry (*B. repens*). They too are fine evergreens, but not so handsome as the genuine original kind. It is desirable that they should be separated by the nurserymen who deal in them.

The original plant, still growing in peat in the garden of the Horticultural Society, is now 9 feet 3 inches high, having been planted about the year 1828. Peat is not, however, so well suited to the plant as loamy or clayey land, in which it fruits in very great abundance.

27. The CREEPING Berberry.

Berberis repens, *Lindley*, *in Botanical Register*, t. 1176.

A native of North-West America, according to United States nurserymen, by whom it was first sent to Europe. I suspect, however, that it is confined to the Rocky Mountains, for it is not among Douglas's plants, and it has lately been met with on the mountains of New Mexico by Mr. Fendler, by whom it has been distributed under the name of B. Aquifolium.

It is the opinion of many botanists both in Europe and the United States that this is a mere variety of the Holly-leaved Berberry. I cannot agree with them, unless they use the word species in the same sense as those who identify the dog with the wolf and jackal. The Creeping Berberry owes its name to its great tendency to form what are called creeping roots, for which it is much more remarkable than the Holly-leaved. It is a dwarf bush of no great beauty, scarcely exceeding a foot in height; its leaflets are not shining, are not sharp-pointed, are little prickly, but are roundish, of a dull glaucous green, and few in number. Moreover, it has few of the good qualities which distinguish the other. It is, however, to be observed that it breeds freely with the Holly-leaved, and from this mixed parentage has probably arisen the spurious form of the Holly-leaved to which I have alluded in mentioning that species.

It can scarcely be said to be worth cultivating except in botanical gardens.

28. The CHAFFY-STEMMED Berberry.

Berberis glumacea, *Spreng.*, *Syst.*, ii. 120. *Lindl.*, *in the Botanical Register*, t. 1426—*aliàs* Mahonia glumacea, *De Cand.*, *Syst.*, ii. 18—*aliàs* Berberis nervosa, *Bot. Mag.*, t. 3949.

Found in shady pine-woods at the mouth of the Columbia, in N.W. America, where it is common.

This well-known plant is scarcely larger now, in the Garden of the Horticultural Society, than it was twenty years ago. It forms a close bush, about a foot high, and produces every year an abundance of upright racemes of pale yellow flowers, succeeded by globular purple berries, covered by a fine bloom. Their taste is austere and acid. The species derives its name from its stem being covered by the long persistent lanceolate scales of the leaf-buds, which continue to clothe the stem like coarse chaff for many years. (Something of the same kind occurs in Fortune's Chinese Berberry.)

The leaves are nearly 18 inches long, and bear about 6 pairs of sessile leaflets, quite similar in form to those of *B. nepalensis*, pale green on both sides, lucid on the under, with a reddish petiole.

In many books this is called *Berberis nervosa*, its leaves having been joined with the flowers of B. aquifolium to make a monster, upon which Pursh conferred that name. As there is no such plant as a Berberry with the leaves of one species and the flowers of another, it is clear that the name was given to a nonentity, and must be cancelled. I cannot understand the reasoning by which the name of *B. nervosa* is sought to be retained.

In the 'Botanical Register' it is remarked that, although perfectly hardy, this little plant cannot bear that the extremity of its shoots should be removed. It seems to have little power of developing new axillary buds if the terminal one is destroyed; so that, if injured, it either dies outright or remains in a stunted state.

29. The NEPAL ASH-LEAVED Berberry.

Berberis nepalensis, *Wallich*, *Catalogue*, No. 1480—*aliàs* Mahonia nepalensis, *De Cand.*, *Systema*, ii. 21—*aliàs* Berberis pinnata, *Roxb.*, *Fl. Ind.*, ii. 184.

A native of the mountains of Northern India, extending as far to the eastward as the Munipoor country, according to Roxburgh.

Little is yet known of the habits of this fine plant. It exists at Kew and in the Garden of the Horticultural Society, but the plants are very young. The dried specimens before me, from Dr. Wallich's collections, have pinnated leaves a foot and more in length, with 5 or 6 pairs of sessile, ovate, oblong, obliquely cordate, coarsely spiny-toothed leaflets, the largest of which are 3 inches long and 1 inch broad. From among them rise erect, simple racemes of large flowers, sometimes as much as 6 inches long. The fruit is oblong and dark purple. The leaves of the seedlings are glaucous on the under side. It was raised at Chiswick from seeds supplied by the East India Company. There is no trace of glaucousness on the dried specimens.

If hardy, this must be a very fine thing. An unprotected seedling, on rock-work, has borne 14° of frost (18° Fahr.) without suffering in appearance.

30. ACANTHUS-LEAVED Berberry.

Berberis Leschenaultii, *Wallich's Catalogue*, No. 1479. *Wight's Neilgherry Plants*, p. 7, t. 8—*aliàs* B. acanthifolia, *Wallich*.

Dr. Wight says that this is found in almost every clump of jungle about Ootacamund, in the Neilgherries, flowering during the S.W. monsoon and at other seasons; the fruit, which is bluish purple, ripening in the dry season. What is said to be it has been raised in the Royal Botanic Garden at Kew.

As far as we know anything of this, it must be a still nobler plant than *B. nepalensis*, its leaves being almost 18 inches long, with 11 or 12 pairs of leaflets, which seem to be harder and shorter, and much more closely set upon the petiole, than in *B. nepalensis;* the fruit, too, is globular, not oblong. The plant figured in Delessert's *Icones*, under the name of Mahonia nepalensis, appears to belong here.

Nothing is yet known of its capability of bearing cold; nor is it certain that we yet possess more than the name.

31. FORTUNE'S CHINESE Berberry.

Berberis Fortuni, *Lindl., in Journal of Hort. Soc.*, vol. i. pp. 231 and 300, with a figure.

From the gardens of China, introduced by the Horticultural Society.

As this has been already described in the present work, it is not necessary to refer to it more particularly, especially as it has not realized the expectations entertained of it. It is a plant with poor foliage, not much worth cultivation even in a greenhouse and out of doors inferior to all the other Ash-leaved species although quite hardy. It grows 4 to 6 feet high.

32. The JAPANESE Berberry.

Berberis ————, *R. Brown*, *in the Appendix to the Congo Expedition*, p. 22—*aliàs* Ilex Japonica, *Thunberg*, *Fl. Jap.*, 79—*aliàs* Mahonia Japonica, *De Candolle*, *Systema*, ii. 22—*aliàs* Berberis Beallii, *Fortune*.

The earliest account of this is to be found in Thunberg's Flora Japonica, where it is mentioned under the name of Ilex Japonica, that traveller having mistaken a leaf for a branch, and the leaflets for true leaves. He found it cultivated, under the name of Sasa Nanting, in Nipon, where he observed it while on his journey to the Court of Japan. Dr. Robert Brown afterwards, in 1818, pointed out this strange blunder, which indeed was sufficiently evident from a figure of the so-called Ilex published by Thunberg himself in the year 1802. A live plant has now been received by Messrs. Standish and Noble of Bagshot from Mr. Fortune, who informs them that it grows from 100 to 150 miles N. of Shanghae, and that it is the most gigantic of the Berberries.

A leaf, which has been sent me by Mr. Standish, is nearly 15 inches long, and of a stout leathery texture; it originally had four pairs of leaflets, and the usual terminal one; the lower pair has dropped off: the other lateral leaflets are sessile, slightly cordate, about 3½ inches long, with from 3 to 4 strong spiny teeth on each side, and a very stiff triangular point; the terminal leaflet is 5 inches long, and very deeply cordate, with 5 coarse, spiny teeth on each side.

This is certainly the finest of the genus, and if hardy it will be the noblest evergreen bush in Europe. There is, however, but one plant of it at present in cultivation, so that its habits are unascertained.

Besides these, our gardens contain various other Exotic Berberries, concerning which further information is desirable. Several Indian forms, which approach *B. asiatica* and *B. aristata*, require to be studied; and of the S. American forms, two or three at least remain for inquiry.

Among them the most remarkable is that called *Mahonia Knightii*, concerning whose history I can obtain no information. Messrs. Knight and Perry can only state that they have had it many years in their nursery under this name. Rumour, however, says that it was introduced by Mr. Anderson, the collector attached to Captain King's expedition, from the Straits of Magellan. It is a little tufted, erect, unattractive shrub, scarcely more than a foot high, with slender downy shoots and orbicular, somewhat cordate flat leaves, fringed with slender spines, and seated upon downy stalks, more than twice as long as themselves; they are pale-green, and only a little darker on the upper than on the under side. The flowers are unknown to me. The spines are not very hard or conspicuous, but are broad and deeply divided in a palmate manner. This little plant is perfectly hardy.

B. *coriaria*, Royle, in the Botanical Register for 1841, t. 66, is as deciduous as the Common Berberry.

B. *brachybotrys*, a Himalayan bush, described by Mr. Edgeworth as growing from 2 to 3 feet high, has been raised by Mr. Glendinning; but at present the plants are mere seedlings, and nothing can be said about them.

II.—*A Micrographic Study of the Disease of Saffron known under the name of Tacon.* Read before the Society of Biology at Paris, Dec. 2, 1848, by C. Montagne, D.M.

The Saffron Crocus (Crocus sativus, L.) is a plant known at a very early period, and admitted from the beauty of its flowers as an ornament of our gardens; its economical uses however and its medical qualities render it still more important, and altogether worthy of fixing our attention. The interest attached to its successful culture has made it a matter of duty to study carefully the diseases to which it is subject, either with a view to their prevention, while there is still an opportunity, or to limit, as much as is in our power, the terrible ravages which they commit.

Amongst these, there are two especially which have long excited the attention of cultivators. The first, which is not properly speaking a pathological affection, though frequently productive of death, is due to the presence of a parasitic fungus, living at the expense of the plant which it attacks. This fungus was classed amongst truffles by Duhamel, who gave the first good description of it in the Memoirs of the Academy for 1728, and has since been figured by Bulliard under the name of *Tuber parasiticum*, which Persoon afterwards changed into *Sclerotium crocorum*. Decandolle finally raised it to the dignity of a genus, and called it *Rhizoctonia*. Whatever name we may retain, whether with Decandolle and Fries we adopt the genus Rhizoctonia, or with Desvaux and Léveillé we consider its species as *Sclerotia*, this singular parasite consists of sclerotioid almond-shaped tubercles, united by byssoid filaments going from one to the other, forming a sort of subterraneous net. It is by means of these filaments, which are attached to the rootlets of the plant, or which creep over the surface of the bulbs after having pierced their integuments, that the parasite appropriates their nutritious juices after the manner of *Cuscutas*, and induces, if not direct death, at least a weakly development.

The second disease has received from cultivators of saffron the vulgar name of *Tacon*,* an old French word borrowed probably from the Italian *Taccone*, which signifies in either language a piece of leather patched on a shoe-sole. Our first knowledge of this pathological affection is due, as far as I know, to Fougeroux de Bondaroy, who has described it as follows in the Memoirs of the Academy of Sciences at Paris for the year 1782:—

"Brown spots are first observed in the tissue of the bulb which injure its substance, and though the coat seems sound, the spots beneath enlarge in proportion as the malady increases, the texture is destroyed, the ulcer (for so this disease may be termed) gains ground, consumes the flesh until it is changed into a black dust; the coats themselves finally change colour, becoming red; the bulb rots, or rather is reduced to a substance resembling vegetable mould.

"The malady increases rapidly; the Tacon is communicated to neighbouring bulbs, but for this end they must either be in contact, or the dust settling on them must communicate the disease, and this communication is effected slowly. . . . . This dust is different from that which results from decay. It has rather appeared to me to be of the nature of bunt in wheat."

The author then compares bunt with the Tacon in respect of propagation:—

"In wheat it is the starchbearing part which is corrupted; in the bulb also it is the starch which is first destroyed, and the bulb equally with the wheat turns into a black fœtid powder."

From all which it may be inferred that the disease which attacks the bulbs of saffron, for the communication of which I am indebted to M. Rayer, is not due to the presence of a *Rhizoctonia*, but is clearly the result of that sort of decay which is called Tacon. The present state of science requiring our investigations not to stop at the surface of things, but that they should be pursued as far as our powers of observation permit us to penetrate, it will not be thought superfluous if I add the following details to the description of Fougeroux. They will enable us to appreciate correctly the mode of change of the tissues examined under the compound microscope, and will complete the very imperfect information at present in existence on the nature of this affection.

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* The word Tacon is still used in Spain to signify the heelpiece of a shoe. Our provincial word "tacked," for bletted or decayed in spots, has possibly a Norman origin. Richardson derives it from "tache," a spot, of which the Italian "taccia" is the equivalent.—*Tr.*

At the beginning of the malady we perceive on the surface of the bulb, if we separate slightly the fibres of the coat, little orbicular brown spots of the size of a lentil. I believe that the point of origin is generally that of the rootlets of the plant; the tissue is a little swollen at the circumference of the spots, so as to form a sort of raised ring which is less strongly coloured. Gradually these spots enlarge, and assume a darker tinge which passes at last into black. They increase insensibly, and from the confluence of many individuals lose their original orbicular form. The malady, however, does not extend merely in width; the disease of the tissue penetrates into the substance of the bulb, destroying the walls of the cells and the fecula which they contain. At this period those deep excavations commence which do not cease to be formed till the whole bulb is destroyed. The cavity hollowed out in the substance of the bulb is not at first visible, in consequence of the persistence of the coat of the bulb, which forms a sort of tympanum round the cavity, and does not burst till a very late period. This happens at last from the always increasing extension of the decay which constitutes this formidable disease. When arrived at the last stage, all the base and even the centre of the bulb is destroyed, and the whole presents to the eye nothing more than a black dust formed by the remains of the parenchymatous cells of the peridia of a fungus of which I shall speak presently; of the coats, or according to M. Payen, of the tegumentary strata of the grains of fecula; and finally, which is not the least remarkable, of an insect which lives in the centre of these débris, but this insect is exactly the same as that which has been pointed out by M. Rayer to M. Guerin Menneville as inhabiting the diseased potatoes, and which the latter has named *Tyroglyphus Feculæ.*

Now if we make a vertical section passing through the axis of the bulb, and examine under a lens the relation of the parts, we perceive that beneath this pulverulent black stratum, composed of the productions I have just enumerated, the parenchym is of a reddish yellow tinge, and softened to the depth of from $\frac{1}{2}$ to $\frac{2}{3}$ of a millimètre; beyond this second layer the substance of the bulb has at present remained sound. We want now to ascertain what a microscopic examination of the parts will teach further. In order to ascertain this, we must take with a razor an extremely thin vertical slice, comprising at once, for the purpose of comparison, both the sound and diseased portions of the bulb; if the slice be then placed on a slip of glass in a drop of water, a magnifying power of 50 diameters will show the whole at one view. The same slice should then be transferred to the plate of Schiek's Compressor, and after compression examined with a power of 380 linear. The cells which are infested and form the base of the excavation will be found to have lost their transparency; their once delicate tissue is thickened and granular; their crystal-white has become dark-brown; and finally the fecula has vanished, or only a few scattered injured grains remain; meanwhile their polyhedric form continues unaltered: this, however, is not the case with another stratum lying beneath the first, and which separates it from the sound parenchym. This is formed of cells perfectly hyaline it is true, but whose grains of fecula have entirely disappeared. It is about the eighth or tenth of a millimètre in thickness. The absence of the fecula is not the only phenomenon which makes it remarkable. The primitive dodecahedric cells, pressing against each other, form prisms of five or six faces and of the length which I have assigned to the whole stratum. These prisms thus disposed exhibit a number of transverse lines which are formed by the lines of junction of the faces of the cells. I cannot give a better notion of it than by comparing it with the structure of the axis of Chorda Filum, which I was the first to demonstrate, with this difference however, that in the Alga the meshes of the net are, or appear to be, quadrilateral, and besides less pressed against each other. Finally, beyond the layer just mentioned, we find the parenchym of the bulb in its normal condition, and the hyaline cells, of which it is formed, filled with numerous perfectly healthy grains of fecula.

The details into which I have just entered respecting the ravages caused by the Tacon present the closest analogy between that disease and the potato-murrain. Read in fact the descriptions which have been given of it, which, from its frequent occurrence, are unhappily too numerous; remark especially the identity of the injury to the tissues, the more or less complete evanescence of the fecula (an observation already made by Fougeroux), the brown colour, and the granular thickening of the cells of the parenchym—all, even to the presence of Tyroglyphus Feculæ, confirms the analogy between the two diseases.* And if we look to the causes, and make a parallel between the conditions of development, we shall be the more convinced of the justice of the comparison. There would indeed be some essential difference between them, were we agreed on the indispensability of the presence of Botrytis infestans on the leaves, &c. of the potato before the attack of the tubercles; but botanists are still at variance on this much contested point.

* I should however observe, that I find no trace of the filaments which run between or within the cells of the parenchym, regarded by M. Payen as mycelium, but as simple plaits in the cellular membrane by M. Decaisne. [Both these positions are true,—sometimes in the same, sometimes in different cells.—*Tr.*]

I have shown above that Fougeroux compared the Tacon to bunt in wheat, but in this particular he is clearly wrong. The tissues affected belong to very different organs, and have nothing in common except inclosing in their cells amylaceous matter. The labours of the Messrs. Tulasne have shown that the morphosis of bunt (Tilletia Caries) is different from that of smut (Ustilago), though at maturity it is scarcely possible to distinguish generically the species of these two genera. The progress of the malady and its consequences are therefore quite different in the two plants.

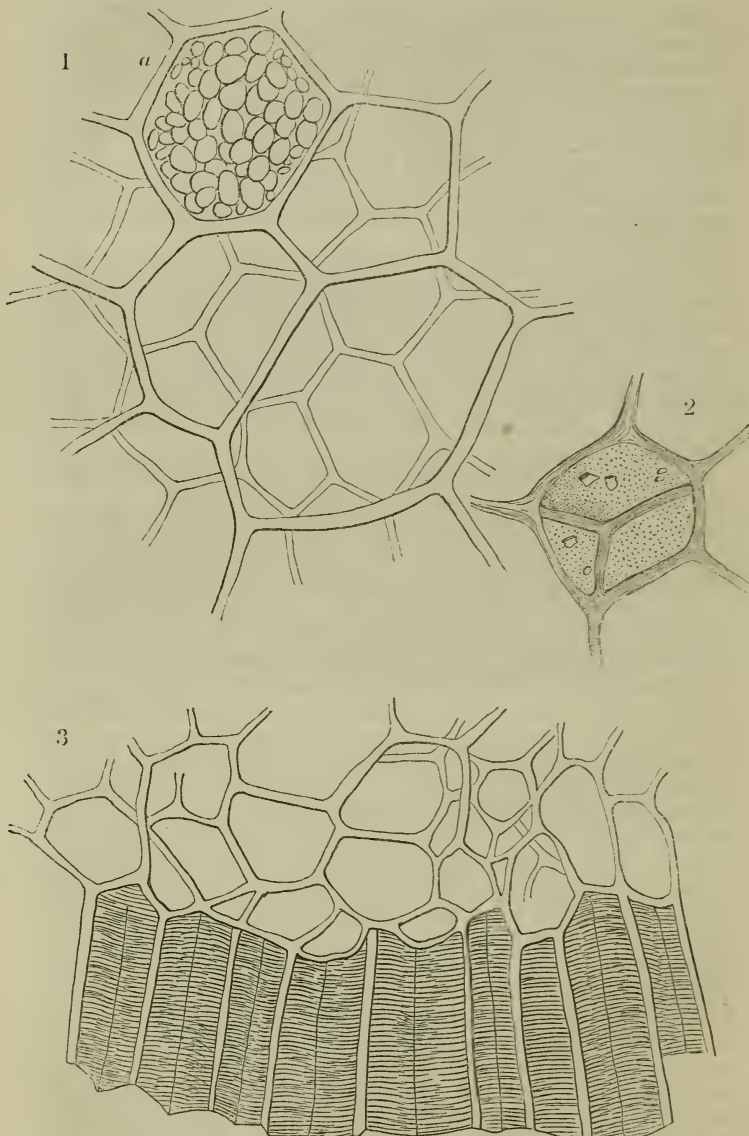
As to the means of arresting the propagation of the Tacon, or to prevent its reproduction the following year, in the absence of any observations of my own, I must again have recourse to the Memoir of M. Fougeroux. He informs us that the most approved remedy is immersing the bulbs in an alkaline solution, as in thick lime-water, &c., in which they are to be steeped for two hours. He proposes also leaving them some days in wine-lees.

Fougeroux informs us, moreover, that the *Rhizoctonia* may exist at the same time on the saffron bulb as the Tacon.

I have said above that the coat of the bulb, blackened by the progress of the disease, retains for a long time its original form. On this a species of Perisporium is frequently developed which I have called *P. crocophilum*, Mont. It is characterised: "Peridiis minimis ovoideo-globosis atro-nitentibus apice poro pertusis è basi fibras irradiantes emittentibus; nucleo primitus celluloso, cellulis subconcatenatis, sporis globosis minimis."

M. J. B.

I take the opportunity of adding to this memoir a few words on some bulbs of Tulips which were attacked by *Sclerotium Cepæ*, Lib., and *Sporotrichum polysporum*, Link. I have laid before the Society of Biology an account of a disease very prevalent in tulip-roots sent me by M. Rayer. I have clearly established the fact that it is due to parasitic fungi. In some between the scales of the bulb I found a large number of globular grains, black and shining when fresh, and of the size of a grain of hemp. These parasitical bodies, already observed by Madame Libert in Belgium, and in England by Mr. Berkeley, upon bulbs, whose further development they had prevented, have been referred to *Sclerotium* by these two cryptogamists. Other bulbs presented as the cause of evil a very different parasite from the first. The roots and the base of the scales were deformed by bundles of white threads, which, examined under the microscope, belonged certainly either to *Sporotrichum polysporum*, Lk., or to some very nearly allied species.



Dissections of Saffron Disease, from a drawing by M. Montagne. The figures magnified 300 diameters. 1, healthy cells, of which *a* is filled with starch; 2, a diseased cell; 3, stratum of compressed cells.

III.—*Account of an Experiment in packing ripe fruit of the Boston Nectarine, in boxes surrounded with ice, and transmitting it from Boston to London.* By Robert Thompson.

The following is a copy of a letter from Stephen H. Perkins, Esq., Brookline, near Boston, Massachusetts.

"In the year 1821 my father, Samuel G. Perkins, who was then a corresponding member of the Horticultural Society, sent to the Secretary two plants, and a drawing, of a new variety of Nectarine, which was named in London the Boston Nectarine. One of the plants was sent to the garden of Mr. Knight, and one to the garden of the Society, but, as I understand, neither has ever borne fruit. The garden in which this fruit is raised, on one tree spreading about 35 feet on the wall, and the only tree bearing fruit of the kind in this country, as far as I know, came into my possession two years since by inheritance. Last year I packed some of the fruit in ice, and kept it in perfect order for six weeks, and I am induced by the success of this experiment to attempt sending some this season to England, thinking that the rarity and great beauty of the fruit may make them acceptable. I shall therefore send by the Europa, Captain Lott, to sail next week, about two dozen nectarines, packed in ice, some of which I trust will arrive in good order. I have put up the nectarines which ripened latest, without selecting the handsomest specimens which the tree bore. This year the tree bore 210 nectarines, several of which measured over 9½ inches. It is under glass, but no fire was used in ripening the fruit. I shall direct Captain Lott to send the package to Regent Street by express, and it should be attended to at once, in order to save the fruit.

"Stephen H. Perkins.

"*Brookline, near Boston, Sept.* 18, 1849."

In a second letter, dated Sept. 25, Mr. Perkins advised that he had that day packed the nectarines. "Captain Lott," he adds, "to whom I have intrusted them, has promised to do his best to hasten them to their destination as soon as they leave the ice-house of his ship." They were landed from the steam-ship Europa Oct. 8, and forwarded from Liverpool by railroad to London. They were received at the office in Regent Street on the 10th.

The nectarines were each wrapped in cotton, then in varnished silk, and thus enveloped they were packed among cotton in cylindrical wooden boxes or drums, 8 inches in diameter, and 3½ inches deep. The lids of these boxes fitted tightly, and they were also tied down. There were five of them, all packed in a stout wooden box enclosed in a cask of ice. Some of the nectarines were as sound as if they had been just pulled; others were a little bruised and in consequence beginning to decay. They ought to have been more firmly packed with cotton in the boxes, and so as to render it impossible for them to move against each other. Any one unaccustomed to see peaches or nectarines well packed, would think them roughly handled in the process. It must be done as tightly as the fruit can possibly bear.

The nectarines were large and very beautiful, roundish; of a fine bright red on the one side, shading off to yellow on the other. Flesh yellow, melting, parting from the stone, *but no flavour remained.* Some of the fruits were 9 inches in circumference. The weights of twelve of them, taken promiscuously, were as follows:—Ounces, $4\frac{3}{4}$, $5\frac{1}{4}$, $5\frac{1}{8}$, $4\frac{1}{4}$, $4\frac{1}{4}$. $5\frac{1}{2}$, $5\frac{3}{4}$, $5\frac{1}{2}$, $4\frac{1}{4}$, $5\frac{1}{4}$, $4\frac{1}{2}$, 6.

The Boston Nectarine was raised at Boston, in the United States, by Mr. Lewis, from a *stone of a peach.* The original tree was destroyed by boys, when full of fruit; but the sort was preserved by Samuel G. Perkins, Esq., a Corresponding Member of the Horticultural Society; and in 1821 that gentleman sent two trees, as above stated, accompanied with a drawing of the fruit grown by him. It appears that Mr. Stephen H. Perkins, the present proprietor, had supposed the variety has never been fruited in this country. It is, however, recorded in the Transactions of the Society, First Series, vol. vi. p. 394, that it was fruited by Mr. Knight, at Downton Castle, in 1823; and it has frequently borne against the peach-wall in the Society's garden.

The Boston Nectarine stands unique in the classification of peaches and nectarines. It is the only known variety of nectarine with *globose* glands and *small* flowers. The Pitmaston Orange agrees with it in having leaves with globose glands, fruit with melting, orange flesh; but it differs in having *large* flowers; and, though not more beautiful, yet it is richer than the Boston Nectarine.

This experiment proves that although fruit as delicate as a melting nectarine may be sent across the Atlantic, and then exhibit as fresh an appearance as if but newly pulled from the tree; yet the flavour, that which constitutes the chief merit of the fruit, is lost. The thanks of the Society are nevertheless due to Mr. Perkins for the great care he has bestowed on the experiment; and also to Captain Lott, of the Europa, for the promptitude with which he forwarded the consignment on his arrival at Liverpool.

IV.—*Memorandum concerning a Remarkable Case of Vegetable Transformation.* By Professor Lindley.

At a time when much attention has been drawn to supposed, or possible, cases of transmutation in the Vegetable Kingdom, any striking fact which bears upon so abstruse a question appears to be highly deserving of record; if it were only for the purpose of showing within what limits the changes in question are really confined. For that reason I make no apology for laying before the Fellows of the Horticultural Society the following strange occurrence, for a knowledge of which I was in the first instance indebted to Sir Philip Egerton, and afterwards to Lady Rolle, in whose park at Bicton, near Sidmouth, it occurred.

The following letter from Mr. James Barnes, C.M.H.S., Lady Rolle's intelligent gardener, explains the origin of what is about to be described:—

"I beg to forward a small branch of a Colletia, observed by Sir Philip Egerton growing in her Ladyship's arboretum; at the moment Sir Philip was making inquiries of me respecting it, I had quite forgotten its origin; since that time I have a perfect recollection, through being reminded of it by the foreman of the arboretum, who states that three years last spring, on our looking over the pleasure-ground in search of plants that would be an acquisition to the already extensive collection of plants in her Ladyship's arboretum, I gave him this plant, stating at the same time, that it was a seedling I had raised from Colletia horrida, and that it seemed to be something different from it, and would possibly prove a variety. Of this circumstance I have a perfect recollection. I also perfectly recollect my turning the young plant out of a pot into the place it was growing on the pleasure-ground the year previous, at a time when I turned out a number of other old greenhouse and New Holland plant-seedlings, &c. It was then about two years old; it is now grown to be a nice, healthy, curious looking plant, at this time well covered with bloom, about four feet high and from three to four feet in diameter. It is perfectly hardy; at least it has never had the least protection with us, since it was first turned out."—*Nov.* 27, 1849.

Colletia horrida, the plant here alluded to as being the parent of the singular production about to be described, was so called by Willdenow, but is better known under its more correct name of *C. spinosa;* it is also sometimes called *C. spinosissima*, and *C. polyacantha.* It forms a leafless spiny shrub, growing 3 or 4 feet high, and producing little, bell-shaped, greenish-white flowers in some abundance at the base of its spines. Being a Chilian plant, and therefore somewhat tender, except in the warmer parts of England, and not having much beauty, it is so little known in gardens that a figure to represent its usual appearance is necessary, in order to make these remarks intelligible. Conceive then a dull green plant, with the aspect of a furze bush, whose branches are slender, tapering, very sharp-pointed spines, and whose leaves, such as they are, exist only in the form

[Colletia spinosa.]

of inconspicuous scales at the base of the spines. Imagine moreover those spines to be slightly flattened near the base, and to be placed on the branches crosswise (decussating) and in tolerably uniform opposite pairs. This, and an examination of the woodcut, will show what *C. spinosa* is.

The extraordinary transformation which resulted from sowing its seeds, and which I propose to call *C. Bictonensis*, is here represented, for the sake of contrast. It is leafless,

[Colletia Bictonensis.]

spiny, and dull green like its parent; but its branches, instead of being long and taper, are produced in the form of nearly equilateral triangles, with an indistinct rib along the middle, and the base parallel with the branch on which they are seated. As in the original these stand crosswise and have each a minute scale at the base, from within which the flowers spring. Some of these triangular spines are flattened vertically near the end, and then bear small scales and rudiments of other spines. Upon examining the nature of the connection between the triangular spines and the main stem, it is found that they are true expansions of the wood, and that their appearance is not due to any leafy expansion of the surface of the branches.

I believe that this case is at present without a parallel; unless indeed some of the supposed species of Cacti and similar leafless plants should have been accidentally thus produced in wild places; of which we have as yet no proof. It must, however, teach us to distrust mere peculiarities of external form, unattended by corresponding differences in the fructification; and must throw the greatest doubt upon the original distinction of numerous plants now admitted into books as species.

To gardeners it has this further interest, that it demonstrates the possibility of obtaining the most unexpected and novel varieties by a patient perseverance in the task of sowing seeds; and not improbably points out how some of the most striking varieties of cultivated plants may have been formerly obtained. The knobs of Knol Kohl, the turnip of Celeriac, and even the succulent heads of the cauliflower, may very possibly have originated thus and been perpetuated by art.

V.—*Memoranda concerning some new Plants recently introduced into gardens otherwise than through the Horticultural Society.* No. 2. By John Lindley, Ph. D., F.R.S., Vice-Secretary.

15. Blandfordia flammea.

B. *flammea;* foliis linearibus obtusè carinatis margine vix scabris caule brevioribus, racemo brevi 6-7-floro, bracteis ovato-lanceolatis rigidis pedunculis multò brevioribus, perianthio inversè conico gibbis sex longè infra medium, staminibus ad gibbos ideòque prope basim insertis.

Native country, *Australia.*

This, which is perhaps the finest of the Blandfordias, was received by Messrs. Low and Co., of Clapton, from a correspondent at Sydney, who had received it from Hunter's River. I have specimens from a small swamp of sand and peat at Port Stephens, where it was collected by Mr. Alexander Burnett. In a vigorous state it is full 4 feet high, and bears 5 or 6 flowers at the end of its graceful stem. The plant, which flowered with Messrs. Low, was a little, unhealthy off-set, scarcely more than 6 inches high. The leaves are narrow and stiff; the flowers about 2½ inches long, 1½ inch across the mouth, of the most vivid orange scarlet, with a broad edge of clear yellow. It is even handsomer than *B. intermedia* and *marginata*.

16. PHARBITIS limbata.

P. *limbata;* annua; caule retrorsum piloso, foliis cordatis integris angulatis trilobisque pilosis lobis basi dilatatis acuminatis, pedunculis solitariis unifloris petiolis duplò brevioribus, sepalis basi hispidis apice pilosis linearibus acutis longissimis.

Native country, *Java;* imported by Messrs. Rollissons.

Specimens of this very handsome plant received a certificate of merit at the meeting of the Society, October 2, 1849. It appears to be an annual, seeding freely, and has much the appearance of Pharbitis Nil, from which it principally differs in the great length of its sepals, their excessive hispidity, and the shortness of the flower-stalk. The flowers, equal in size to the old Convolvulus major, but less spreading at the mouth, are of an intense violet, edged with pure white, and have a beautiful appearance. A Brazilian Pharbitis, referred to *P. Nil* by Mr. Gardner (No. 79 of his Herbarium), is very near this, but has the long flower-stalks of that species.

17. DENDROBIUM Palpebræ.

D. *Palpebræ* (Dendrocoryne); caulibus erectis clavatis tetragonis apice tantum foliosis, foliis coriaceis oblongo-lanceolatis acutis planis 5–7-nerviis, racemis multifloris laxis lateralibus, bracteis angustis membranaceis deciduis, sepalis patentissimis oblongis acutis, petalis conformibus obtusis denticulatis, labello ovato obtuso cucullato pubescente versus basim palpebris longis ciliato.

Native of *Moulmein;* imported by Messrs. Veitch and Son.

A charming species, in the way of *D. densiflorum*, with the perfume of distant hawthorn. Its stems are more slender than those of the species just named; the flowers in loose racemes and white, with a deep yellow stain at the base of the lip, which is not only covered with soft down, but is fringed near the base with long hairs like eyelashes. These elevated lines pass along the middle, and terminate near the base in a 3-lobed tubercle, for the purpose of receiving which the base of the column is hollowed out into an oblong cavity. It was received from Messrs. Veitch in Nov. 1849.

18. Spathoglottis aurea.

S. *aurea;* foliis lato-lanceolatis 9–11–nerviis scapo æqualibus, racemo contracto, bracteis herbaceis obtusissimis concavis, labelli lobis lateralibus linearibus erectis columnæ subæqualibus intermedio subconformi apice ovato lateralibus parvis acutis intus villosis, cristæ lobis 2 carnosis erectis obliquè rotundatis divergentibus.

Native country, *Malacca;* imported by Messrs. Veitch and Co.

A rather handsome terrestrial Orchid, with narrow leaves like those of a Phaius, and a scape 2 feet high, bearing at the very end about half a dozen large golden-yellow flowers, with a few dull sanguine spots on the lip. Mr. T. Lobb found it growing on Mount Ophir, near the beautiful Nepenthes sanguinea. According to a memorandum by the late Mr. Griffith, now before me, it inhabits rocks on Mount Ophir, at places called Goonong, Toondook, and Laydang.

19. Trichoglottis pallens.

T. *pallens;* floribus lateralibus subsolitariis, labello trilobo: laciniis lateralibus subacinaciformibus erectis medio callosis margine tenuibus intermedio obovato utrinque cis apicem denticulato supra carinâ villosâ aucto callis duobus bidentatis uno ante alterum sacco nullo, columnâ glabrâ muticâ basi in labellum decurrente.

A native of *Manilla;* received from his Grace the Duke of Devonshire's collection at Chatsworth.

I observed this curious species in flower at Chatsworth in November last. It was then a dwarf erect plant, with oblong distichous leaves, and a lateral flower or two, not quite 2 inches in diameter, pale yellowish green, with delicate brownish spots and a white lip. The latter organ was oblong, with a white, shaggy crest on the upper side, and a pair of short, yellowish scimitar-shaped segments standing erect near the base; within these were a pair of forked callosities, one placed before the other in the centre, but no sac or pouch was found between them. In this respect it resembles *Tr. philippinensis*, and differs from the definition given by Dr. Blume. The pollen masses are two, waxy, pierced by a loophole, and sessile, upon an obovate caudicle. It would seem to be allied to *Tr. rigida* of Blume, as far as can be judged from that author's slight account.

The plant is of little beauty, but of considerable botanical interest.

·—20. ODONTOGLOSSUM rubescens.

O. *rubescens* (Leucoglossum); pseudobulbis uncialibus oblongis compressis monophyllis, racemo 2-6-floro folii longitudine, sepalis lineari-lanceolatis acutissimis rectis, petalis tenuibus oblongis undulatis, labello cordato obtuso crispo cristâ carnosâ antice obtusâ bidentatâ medio cochleatâ, columnâ angustâ.

Imported from *Nicaragua* by G. U. Skinner, Esq.; flowered at Biddulph Grange with James Bateman, Esq., Nov. 1849.

A charming species, belonging to the beautiful white-lipped section of the genus, and remarkable among them for its flowers being suffused with a tender blush colour. The sepals are very straight and sharp-pointed, richly spotted with crimson. The petals have similar spots near their base; the lip is spotless, crisp, and cordate, but not ciliated. It seems near Odontoglossum cærulescens of Galeotti, but the lip has a different outline.

21. LIBOCEDRUS chilensis. *Endlicher*, *Synopsis Coniferarum*, p. 44.

(Thuja chilensis, *Don*. *Hooker*, *London Journal of Botany*, ii. 199, t. 4.—Thuia andina, *Pöppig*, *Nova Genera et Sp. pl.* iii. 17, t. 220.)

It is probable that this plant will become common, a quantity of its seed having been received from Chile by Mr. Low of Clapton, Messrs. Standish and Noble of Bagshot, and, I believe, others. It is to Messrs. Standish that I am indebted for dried specimens of the branches and empty cones.

The resemblance of this species to an Arbor Vitæ is so great, that it was always considered one until the late Professor Endlicher separated it and some others, under the name of Libocedrus, mainly on account of the scales of its cones being pressed face to face, instead of overlapping at the edge; he also relied upon some differences in the seeds, which appear to be of less importance, and which are not exactly as that lamented botanist understood them.

The young branches of this tree, when they are visible, are compressed, obovate between the nodes, and bright green, with glaucous furrows; they are, however, for the most part, hidden by the leaves. The latter, which are compressed, blunt, and keeled, are glaucous at the sides, but bright green at the back and edges; they stand in two pairs crosswise, the lower pair being much larger than the upper pair, which resembles two tubercles. These leaves evidently represent the type of the cones, which are drooping, short-stalked, about half an inch long, and consist of four woody scales, also standing crosswise, in two very unequal pairs. These scales are applied face to face, and have a sharp tubercle on the outside below the point. The two larger scales have each two seeds at their base; the two smaller are seedless. The four seeds stand erect in the cones, with unequal-sided wings, as is well represented by Sir William Hooker in the work above quoted.

There is no doubt that this is a fine evergreen tree. Mr. Bridges, who sent home the seeds, writes that it is from 65 to 80 feet high. Sir W. Hooker (*Journal of Botany*, ii. 199) says it is a tree from 30 to 40 feet high, of great beauty, and well worthy of being introduced into our gardens. Pöppig (*Nov. Gen.* iii. 17) relates that it resembles the American Arbor Vitæ, but is less robust, sometimes branching from the base, and gaining the habit of a Cypress, but in other cases forming a conical head. "The trunk," he adds, "of this last variety is simple as high as the middle, straight, taper, clothed with a rough cracked bark of a brownish ash-colour, knotty, scarcely more than a foot thick, with a yellowish, resinous, hard, strong-scented (*olente*) wood."

Whether it will bear the climate of Great Britain without protection is at present uncertain. A plant has existed for some years at Elvaston Castle, the seat of the Earl of Harrington, in Derbyshire; but I learn from Mr. Barron, his Lordship's gardener, that it has hitherto been sheltered in winter. Sir William Hooker has expressed a favourable opinion of it as to this important quality. "There can be little doubt," he observes, "from its native regions, whether the Andes of Chile or the southern provinces of Antuco and Valdivia, that it would thrive well in the open ground." If it be one of the trees called "Alerse," inhabiting the same elevations on the mountains as the Araucaria and Libocedrus tetragonus, this is highly probable, but we are at present without sufficiently precise information on this point. All that I can find on positive record is the statement of Dr. Gillies and Mr. Lobb, that it inhabits the *valleys* of the Andes of Chile; and of Pöppig, that it is found "in the *colder valleys* of the southern Andes of Chile, near Castillo de

Tvun Leuvu, and on the volcano of Antuco," a mountain about 3 degrees north of Valdivia.

22. PHOLIDOTA clypeata.

P. *clypeata;* spicâ brevi leviter flexuosâ pedunculo filiformi bracteis imis tantum persistentibus, columnâ maximâ petaloideâ subtrilobâ in mediam faciem antheriferâ, labello concavo apice hastato bilobo membranis duabus ascendentibus e basi hastæ appendiculato.

Received December 12, 1849, from Mr. A. Kenrick, who bought it of Messrs. Low and Co., in 1847, as a *Borneo* plant.

I have only seen the flowers, which resemble those of P. imbricata, but stand in a spike not more than 3 inches long. The column is very like a 3-lobed petal, bordered with brown, and gives the flower the appearance of having two opposite lips. Mr. Kenrick states that the pseudo-bulbs are "about 2 inches long, with a dark green leaf."

23. STANHOPEA cirrhata.

S. *cirrhata;* pedunculis unifloris bracteis spathaceis imbricatis tectis ovario longioribus, petalis ovatis acutis reflexis sepalis obtusis multò brevioribus, hypochilio intus tricostato extus rotundato medio depresso ore aperto cornubus brevibus carnosis, epichilio ovato indiviso multò longiore supra basim foveato, columnâ apterâ cirrhatâ.

A native of *Nicaragua;* introduced by G. U. Skinner, Esq.

A few pseudo-bulbs of this remarkable plant were sold at one of Mr. Skinner's sales, having been collected in Nicaragua by Mr. Warczevitz. A couple of specimens in spirits enable me to define it. Among Stanhopeas it is unique, the flowers being absolutely solitary, not in spathaceous spikes, and the column being wingless, and extended into a pair of feelers like some Odontoglossums. The lateral horns of the lip, too, are extremely short and fleshy. Its colours are unknown, but it does not promise to be a showy species of much horticultural interest.

VI.—*Experimental Investigation into the Amount of Water given off by Plants during their Growth; especially in relation to the Fixation and Source of their various Constituents.* By J. B. Lawes, of Rothamstead.

(Communicated December 4, 1849.)

Of the several natural orders of plants which yield food to man, or to the animals destined for his consumption, or other use, perhaps the most important, both as to the extent of their distribution and the amount of the products they supply, are the *Graminaceæ* and the *Leguminosæ*. There are others, however, to which we are indebted for the roots and tubers, the extended cultivation of which, in alternation with corn, so prominently characterises at least the national agriculture of the present day. The corn-plants of most extended utility in the Leguminous family are the *Bean* and the *Pea;* but we owe to it also some of the most important of our fodder-plants, such as *Clover*, *Trefoil*, *Vetches*, and others. The Graminaceous family, on the other hand, supplies us with *Wheat*, *Barley*, *Rye*, *Oats*, *Rice*, *Maize*, the *Sugar Cane*, and others, besides the natural grasses of our meadows and pastures.

Between these two great natural orders of plants there are, however, many striking and obvious points of contrast as to habits, structure, and products, whilst the vastly different positions allotted by experience to the individuals which they respectively comprise in a system of alternate cropping are such as clearly to indicate that the resources of their growth are also widely different; and it has been maintained that an explanation of them is mainly to be found in the various mineral composition of the crops. The scattered observations, however, of many experimenters, and some of not very recent date, would seem to favour an opposite view of the question, and the vastly accumulating published results of the last few years lend an ample confirmation in the same direction.

For our own part, an extensive and systematic series of experiments, conducted both in the field and in the laboratory, leaves not a doubt in our mind that in the ordinary practice of agriculture in Great Britain the *exhaustion* which is suffered is prominently connected with a deficiency of "*organic*" or primarily *atmospheric*, rather than the "*mineral*" or, more properly, *soil*-constituents; and especially that the supply of NITROGEN, *relatively to other constituents*, is defective. We have already, in the Journal of the Royal Agricultural Society, indicated some striking facts bearing upon this point, in the discussion of the results of some of our experiments upon the growth and composition of Wheat and of Turnips. Beans, Peas, and Clover, as the types of the agricultural plants of the Leguminous family, have also been the subjects of experiment for several years past, and we hope before long to complete the results for publication.

Besides the experiments of a more purely agricultural scale and character, however, it was thought that the explanation of the alternation of crops would materially be aided by any additional information as to the characteristic qualitative and quantitative functional actions of some of the plants which ordinarily find a place in rotation. With this view it was sought to ascertain, as in some degree a measure of the activity of the processes of the plants, the amount of water passed through those belonging to different natural orders, and holding different positions in rotation, both as compared one with another, and in reference to the quantitative fixation in the plants, of several of their more important constituents, having regard also, as far as was practicable, to the source of these constituents—that is to say, as to whether they were derived from the soil or from the atmosphere.

The experiments, as thus far proceeded with, however, can be considered as little more than initiative, especially so far as the demonstration of those important *agricultural* problems, for the elucidation of which they have mainly been designed, is concerned: were it otherwise, indeed, the pages of this Journal would not be deemed the fittest medium for the publication of results of more purely agricultural interest. The facts already obtained, however, are not without interest to the botanist and the vegetable physiologist; and it is as a contribution to the scanty information already at command on the subject of the amount of water given off during the growth of plants, that these results are arranged and presented to the reader. It will nevertheless be seen, that they provide some important and interesting indications in reference to the more special object of our investigation, and at the same time afford some useful suggestions for its future conduct.

In deciding upon the method of procedure, the choice seemed to be between such experiments as would yield somewhat rapid, and in some points, perhaps, more direct information, though at the cost of the health and perhaps matured growth of the plant, on the one hand, and a closer imitation of the usual circumstances of growth on the other—by which, however, *inferences* rather than *demonstration* might be elicited. The latter course was chosen, more especially as there are well-conducted experiments of the former kind on record, which it was thought might serve to check or confirm some conclusions which our own results, taken alone, might be held not fully to justify.

It was considered important to provide such conditions for the plants as should enable them to live and mature their seed, if such were the product for which they were usually cultivated—an end not very easily accomplished in the case of plants growing through a period of several months, and requiring an accurate registry of the water passing through them. This was not, indeed, in every case satisfactorily attained, as will be explained further on. But if from this cause any otherwise general indications should seem to be opposed by figures, at first sight, discrepant, a little further consideration may perhaps show that if these are coincident with irregularities of growth and maturation, they may be taken rather as confirmations than as contradictions of any conclusions to which the results of the more naturally developed plants might lead us. We shall, however, submit to the reader a sufficient description both of the methods of experimenting, and of the results as they were actually obtained, whether numerically or by observation merely—leaving him, therefore, in a position to judge of the value of any suggestions we may offer, whilst the experience thus far attained will, it is expected, enable us to avoid in future some of the irregularities complained of, and the results then supplied will serve amply to confirm or correct any inferences at present hazarded.

The plants selected for experiment were *Wheat* and *Barley* of the natural order Graminaceæ; with *Beans* and *Peas* as Corn-plants, and *Clover* as a Fodder-plant, from the Leguminosæ—these several plants, moreover, occupying somewhat important and characteristic positions in a course of rotation. A *Root-crop* would also have been taken, but for the great and manifest difficulties of arranging the experiment. These we hope to overcome, however, in the coming season.

The main desiderata in the arrangement of the experiments were—

To provide the plants with soils of some known history and composition or resources, and in quantities sufficient to allow of a natural development of the roots.

To prevent any serious amount of evaporation from the soil other than through the plants themselves.

To have the means of supplying weighed quantities of water to the soils as it was needed.

To determine by the balance the amount of water given off by the plant within any desired period of observation.

To determine the total amount of water passed through the plant during the entire period of its growth; and in relation to this, the amounts of dry produce, and several of its constituents fixed in the plant.

To determine the source of these fixed constituents, whether soil, manure, or atmosphere.

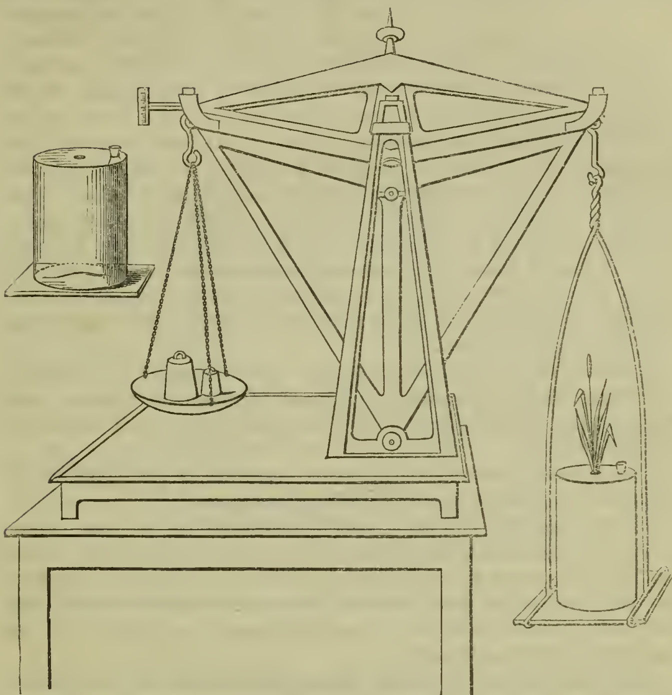
We are prepared for the objections which may be raised against the means adopted for attaining the end and indications desired, and against the competency of the results, when obtained, to afford *demonstration* on some important points of the inquiry. Yet it is not unadvisedly that some of them, at least, have been risked, and especially in reference to the question of the exact composition and resources of the soils employed, do we not scruple to declare, though in opposition to the known opinions of several esteemed chemical friends, that we are more disposed, for the present at least, to rely upon the comparative indications which a natural and unanalysed but exhausted soil may yield alone, and in admixture with manures of known composition, than upon one of an artificial kind, such as pure sand, for example—or upon the results of analysis at the *commencement* of the experiments. Indeed, in proof of the dangers and uncertainty to which we are exposed in judging of the exact capabilities of a soil by its analysis, and especially of an exhausted one, wherein all the more important constituents are so small in quantity, we need only call attention to the very elaborate examination of this subject in the hands of Professor Magnus, as detailed in his account, 'Uber Versuche betreffend die Erschöpfung des Bodens.'

The knowledge we obtain by synthesis in the method adopted and described further on, with the comparisons which will in time be provided, is, we believe, our safer guide. Specimens of the soil, as originally taken for the experiments, are, however, preserved for analysis at some future time, when the whole subject of the composition and properties of soils can be entered into —and when, also, by the continuous growth of the different plants as proposed, the *balance* of the constituents in the cases of the several experiments will be so far affected as to yield sufficiently wide variations, and therefore trustworthy points of comparison.

As already stated, the plants selected for experiment were—Wheat, Barley, Beans, Peas, and Clover. Seeds of the first four of these were sown in a box of mould, where they were allowed to reach the height of about 3 inches before being transferred to the experimental pots; but the Clover plant was brought direct from the field. One or more of each description of plant was grown in each of three different conditions of soil, and each set of the five plants with the same description of soil constituted a *Series*. An inspection of the following plan will aid a conception of the arrangement of the experiments as to condition of soil and description of plant:—

Series 1 .	Soil – from a plot of land from which ten successive corn-crops had been taken without manure (the larger stones being sifted out and the weeds picked)	Wheat, Barley, Beans, Peas, Clover, No plant.
Series 2 .	Soil—as in Series 1, with mineral manure, containing Sulphate of Potash, Sulphate of Magnesia, Chloride of Sodium, and Superphosphate of Lime	Wheat, Barley, Beans, Peas, Clover.
Series 3 .	Soil—as in Series 1, with the mineral manure of Series 2, and Muriate of Ammonia added	Wheat, Barley, Beans, Peas, Clover.

Glass jars, 14 inches in depth and 9 inches in diameter, and which were capable of holding about 42 lbs. of soil, were the vessels employed. Six of these were filled with the soil as described for *Series* 1; five with that of *Series* 2; and five with that of *Series* 3: there being in all, therefore, sixteen separate experimental jars. Into these, excepting the sixth jar of *Series* 1, the plants raised, as described above, were transferred; those from three seeds each of the Wheat and of the Barley being taken, and one plant only of the Beans, Peas, and Clover. A glass plate having a hole in the centre about three-quarters of an inch in diameter for the plants to grow through, and another, nearer the side, by which to supply water as it was needed, and which was at other times closed by a cork, was then firmly cemented upon the top of each of the sixteen jars. The sixth jar of *Series* 1, however, though provided with soil and closed with a lid as the rest, was left without a plant, as indicated in the tabulated plan above, in order to determine the amount of evaporation from the centre orifice. Each jar was placed upon a varnished board, for the convenience of attachment to the arm of the balance, and as thus fitted and mounted weighed little short of half a hundred-weight. The jars on their stands constituting a Series, were placed upon a truck, by means of which they were sometimes drawn into a green-house for the night, and under the balance when it was desired to weigh them, and on to a grass-plot during the day for free exposure to sun and air; a canvas awning being provided, however, to protect them in case of rain. These arrangements will be clearly understood on inspection of the annexed drawing, in which is represented a *Series* of the jars with their plants fixed upon their scale boards, and placed upon their truck.



The balance employed for weighing the plants was constructed for the purposes of these experiments by Mr. Oertling of London, and is calculated to turn with the third of a grain when loaded with from half a hundredweight to a hundredweight in each pan. A drawing of them is also given with a jar and plant as in process of being weighed. The knife-edge of the balance was relieved in the usual way by a support to the beam when not in actual use; this being removed or applied at pleasure by means of a lever, the arrangement for which is not, however, indicated in the drawing. The whole was, moreover, covered by a frame of glass, provided with a door by which to gain access to the weight-pan, and another for the attachment of the loose arm by which the jar and plant are suspended. A standard counterpoise, consisting of two leaden weights, was kept in the weight-pan, the deviations only above and below this amount being determined by weights—a set of which, from ten thousand grains down to one-tenth of a grain, was provided for this purpose. As will shortly be seen, however, the amounts of water given off by the plants were very large; and after a time it was not deemed necessary in practice to determine the weight within one grain, or frequently even two.

Between the time of planting and the full growth of the plants more than twenty weighings of most of them were taken; and weighed quantities of water were supplied whenever it seemed to be required.

The collected results of the water supplied or given off by the plants are exhibited in the following tables:—

In the opposite Table (No. 1), as well as in those which follow it, the results are arranged in two sections; the upper one bringing more prominently to view the comparisons between the different plants with one and the same condition of soil, and the lower one those of the same description of plant with the varying conditions of soil.

The summary of the total water given off during the growth of the plants, as shown in the third column of this Table, is, of course, chiefly of interest in connection with the coincident accumulation of vegetable substance, and it will therefore be repeated, and further considered, when we come to treat of that part of the subject. Attention may here be called, however, to the evidence afforded by a glance at the figures of this column—whether in the upper or the lower section—at the much greater regularity in Series 1 without manure, and in Series 2 with mineral manure only, than in Series 3 with both mineral and ammoniacal manures. Indeed, from the beginning, the plants of Series 3 were unhealthy, and, as indicated in the tables, only the wheat and the barley survived to the end of the experiment, and these even gave a produce far inferior to the same description of plants under the other conditions, though the ammonia provided by the manure amounted in this case to only about 0.1 per cent. upon the weight of the soil.

It is seen that, in the cases of the healthy plants, there has

TABLE I.—Showing the Total Amounts of Water supplied, derived from the Soil, and given off, during the entire period of the growth of the Plants.

Entire Period of 172 days, from March 19 to Sept. 7.

		Total Water supplied.	Total Water obtained from Soil.	Total Water given off.
Unmanured	Wheat	79,800	33,727	113,527
	Barley	88,800	31,225	120,025
	Beans	87,800	24,431	112,231
	Peas	81,800	27,282	109,082
	Clover (cut June 28th)	28,500	26,593	55,093
With Mineral Manure	Wheat	85,800	12,206	98,006
	Barley	97,800	30,554	*128,354
	Beans	95,800	22,069	117,869
	Peas	86,000	10,405	96,405
	Clover (cut June 28th)	36,500	17,223	53,723
With Mineral and Ammoniacal Manure	Wheat	57,700	......	55,996
	Barley	74,300	10,824	85,124
	Beans (died)	......	......	......
	Peas (died)	......	......	......
	Clover (cut July 4th)	24,300	......	13,671

Wheat	Unmanured	79,800	33,727	113,527
	Mineral Manure	85,800	12,206	98,006
	Min. and Am. Man.	57,700	......	55,996
Barley	Unmanured	88,800	31,225	120,025
	Mineral Manure	97,800	30,554	128,354
	Min. and Am. Man.	74,300	10,824	85,124
Beans	Unmanured	87,800	24,431	112,231
	Mineral Manure	95,800	22,069	117,869
	Min. and Am. Man.	(died)	......	......
Peas	Unmanured	81,800	27,282	109,082
	Mineral Manure	86,000	10,405	96,405
	Min. and Am. Man.	(died)	......	......
Clover	Unmanured	28,500	26,593	55,093
	Mineral Manure	36,500	17,223	53,723
	Min. and Am. Man.	24,300	......	13,671

* The glass lid was broken by the pressure of the plants, and the soil therefore partly exposed.

been an average of about 100,000 grains of water given off by them during their growth, an amount far greater than was anticipated when the arrangements for the experiments were made; and it will readily be understood that, with such quantities as these, it was seldom necessary to conduct the weighings with the nicety for which we were prepared.

The first and second columns of the Table show the sources of the water given off, from which it is seen that an amount varying from 10,000 to 30,000 grains has been derived from the soil, the remainder having been supplied as the experiment proceeded. It should be remarked, however, that before the commencement of the experiment, 30 fluid ounces, or between 14,000 and 15,000 grains of water were added to each of the jars of soil, which, by exposure to the air for some time with shelter from the rain, and by the process of sifting, had become somewhat dry. The figures in the Table therefore overstate, by nearly the quantity just mentioned, the amount obtained from the normal soil. Nevertheless it is believed that the wheat and the barley plants suffered to some extent during the latter period of the experiment for want of a freer supply of water, and that to this cause may in part be attributed a defective development of their seeds as compared with those of the beans and peas.

We have not prepared any detailed account of the periodical supply of water, which was regulated both as to time and quantity, in part by the amount given off by the plants, and partly also by their apparent or supposed requirements. It may be stated, however, that none was added during the first few weeks of the experiments, and that the doses given varied from 250 grains to as much as 1, 2, 3, 4, 6, or even 12 thousand grains as the growth of the plants progressed.

A somewhat more detailed view of the amounts of water given off by the plants may be of interest, and we have accordingly supplied, in Tables 2 and 3 (pp. 47, 48), statements both of the total and the average daily loss during periods, in the main, as nearly approaching to one month each, as the details of our registry would permit.

The relationship of evaporation to rapidity of growth is, it is true, as yet a problem, but it may nevertheless be assumed as a general fact—and especially between plant and plant of the same description—that the comparative rate of the evaporation of water, or its amount within any given period, to some extent indicates the comparative activity of the processes of the plants; yet, since, with the advance of the season, and increased intensity of heat and light, the surface for evaporation was also constantly increasing, it is difficult to determine whether the increasing loss up to a certain period, as indicated in the tables, is, to any extent,

TABLE II.—Showing the Number of Grains of Water given off by the Plants during stated divisional Periods of their Growth.

Description of Plant and Manure.		9 Days. From Mar. 19 to Mar. 28.	31 Days. From Mar. 28 to Apr. 28.	27 Days. From Apr. 28 to May 25.	34 Days. From May 25 to June 28.	30 Days. From June 28 to July 28.	14 Days. From July 28 to Aug. 11.	27 Days. From Aug. 11 to Sept. 7.
SERIES I.—Unmanured	Wheat	129	1268	4385	40030	46060	15420	6235
	Barley	129	1867	12029	37480	45060	17046	6414
	Beans	88	1854	4846	30110	58950	12626	3657
	Peas	101	1332	2873	36715	62780	5281	..
	Clover	400	1645	2948	50100	..	..	..
SERIES II.—Mineral Manure	Wheat	106	888	3935	33800	41200	9364	8713
	Barley	157	2030	11249	38280	51830	14548	10260
	Beans	69	1528	4790	35440	59680	11626	4706
	Peas	111	1558	4249	37060	51520	1907	..
	Clover	353	1838	5008	46524	..	..	..
					Apr. 28 to June 28.			
SERIES III.—Mineral and Ammoniacal Manure	Wheat	139	866	..	10300	27710	15251	2030
	Barley	138	853	..	27270	37050	14606	5207
	Beans	80	1439	1851	(died)	..	..	..
	Peas	(died)	..	..	..	..	..	..
	Clover	..	..	..	..	..	..	..
No plant		109	633	362	1374	1066	300	..

		9 Days.	31 Days.	27 Days.	34 Days.	30 Days.	14 Days.	27 Days.
Wheat	Unmanured	129	1268	4385	59030	46060	15420	6235
	Mineral Manure	106	888	3935	33800	41200	9364	8713
	Min. and Am. Man.	139	866	..	10300	27710	15251	2030
Barley	Unmanured	129	1867	12029	37480	45060	17046	6414
	Mineral Manure	157	2030	11249	38280	51830	14548	10260
	Min. and Am. Man.	138	853	..	27170	37050	14606	5207
Beans	Unmanured	88	1854	4846	30110	58950	12626	3657
	Mineral Manure	69	1528	4790	35440	59680	11626	4706
	Min. and Am. Man.	80	1439	1851	(died)	..	..	..
Peas	Unmanured	101	1332	2873	36715	62780	5281 Cut Aug. 11.	..
	Mineral Manure	111	1558	4249	37060	51520	1907 Cut Aug. 4.	..
	Min. and Am. Man.	(died)	..	..	..	..	..	..
Clover	Unmanured	400	1645	2948	50100	..	..	..
	Mineral Manure	353	1838	5008	46524	..	..	..
	Min. and Am. Man.	..	..	..	..	..	..	..

TABLE III.—Showing the Average Daily Loss of Water (in Grains) by the Plants, within several stated divisional Periods of their Growth.

Description of Plant and Manure.		9 Days. From Mar. 19 to Mar. 28.	31 Days. From Mar. 28 to Apr. 28.	27 Days. From April 28 to May 25.	34 Days. From May 25 to June 28.	30 Days. From June 28 to July 28.	14 Days. From July 28 to Aug. 11.	27 Days. From Aug. 11 to Sept. 7.
SERIES I.—Unmanured	Wheat	14·3	40·9	162·4	1177·4	1535·3	1101·4	230·9
	Barley	14·3	60·2	445·5	1102·3	1502·0	1217·6	237·5
	Beans	9·7	59·8	179·5	885·6	1965·0	901·8	135·4
	Peas	11·2	42·9	106·4	1079·8	2092·7	377·2	..
	Clover	44·4	53·0	109·2	1473·5	..	..	..
SERIES II.—Mineral Manure	Wheat	11·8	28·6	145·7	994·1	1373·3	668·8	322·7
	Barley	17·4	65·5	416·6	1125·9	1727·7	1039·1	380·0
	Beans	7·6	49·3	177·4	1042·3	1989·3	830·4	175·4
	Peas	12·3	50·3	157·0	1090·0	1717·3	136·2	..
	Clover	39·2	59·3	185·5	1368·3	..	..	..
SERIES III.—Mineral and Ammoniacal Manure	Wheat	15·4	27·9	April 28 to May 12. 373·1	May 12 to June 28. 108·0	923·7	1068·0	75·2
	Barley	15·3	27·5	April 28 to May 9. 136·4	May 9 to June 28. 515·4	1235·0	1043·3	192·8
	Beans	8·8	46·4	April 28 to May 9. 168·3	..	..	..	..
	Peas	..	..	..	..	..	..	..
	Clover	..	..	..	..	..	..	..
No plant		12·1	20·4	13·4	40·4	35·5		

		9 Days.	31 Days.	27 Days.	34 Days.	30 Days.	14 Days.	27 Days.
Wheat	Unmanured	14·3	40·9	162·4	1177·4	1535·3	1101·4	230·9
	Mineral Manure	11·8	28·6	145·7	994·1	1373·3	668·8	322·7
	Min. and Am. Man.	15·4	27·9	14 Days 373·1	47 Days. 108·0	923·7	1068·0	75·2
Barley	Unmanured	14·3	60·2	445·5	1102·3	1502·0	1217·6	237·5
	Mineral Manure	17·4	65·5	416·6	1125·9	1727·7	1039·1	380·0
	Min. and Am. Man.	15·3	27·5	11 Days 136·4	50 Days. 515·4	1235·0	1043·3	192·8
Beans	Unmanured	9·7	59·8	179·5	885·6	1965·0	901·8	135·4
	Mineral Manure	7·6	49·3	177·4	1042·3	1989·3	830·4	175·4
	Min. and Am. Man.	8·8	46·4	11 Days 168·3	..	..	..	..
Peas	Unmanured	11·2	42·9	106·4	1079·8	2092·7	377·2	..
	Mineral Manure	12·3	50·3	157·0	1090·0	1717·3	136·2	..
	Min. and Am. Man.	..	..	..	..	..	..	..
Clover	Unmanured	44·4	53·0	109·2	1473·5	..	..	..
	Mineral Manure	39·2	59·3	185·5	1368·3	..	..	..
	Min. and Am. Man.	..	..	..	..	..	..	..

materially due to the *external* influence referred to, *irrespectively* of a corresponding enlarged surface and rapidity of fixation of constituents. So far, of course, as the process is one of *simple evaporation*, will an increase of temperature determine a greater loss of water; still the question arises whether—supposing there be no actual deficiency of the necessary and available constituents — this increased passage of water through the plants, carrying with it in its course many important materials of growth from the soil, and probably also influencing the changes in the leaves of these, as well as of those derived from the atmosphere, will not be accompanied with an equivalently increased growth and development of the substance of the plant. Upon this point some light may be thrown by an examination of the circumstances attending the development of "Roots," the more active growth of which is generally coincident with a declining and not an increasing temperature, as in the case of the seeding crops now under trial.

Until, however the relationship of the quantity of water given off to the amount of dry substance or its constituents fixed, under varied and known circumstances, be experimentally determined, any detailed consideration of the indications of the thermometer in connection with results of so initiative a kind would be unavailing, though a more or less complete registry was kept of the temperature during the period of the growth of the plants, and this point will not be neglected in our future progress.

As might have been anticipated, it is seen by the tables, that though, as the season advanced in temperature and the mass and surface of the plants increased, the amount of water daily given off was also greater up to a given time, yet towards the end of the experiment it rapidly and considerably diminished. It is probable that from the time of this apparent decline in the rate of passage of water through the plant the processes of acquirement of material were less active, those of the ripening and elaboration of its contents having commenced, and that the time of most active circulation as indicated by the daily rate of water evaporated was also that of the greatest *accumulation*. Some experiments which we conducted a few seasons ago, with the view of determining whether there was, in the formation and ripening of the cereal grains, any diminution in the amount of nitrogen previously stored in the plant, seemed, indeed, to show, that though there was no appreciable change in the amount of the nitrogenous compounds upon a given acre of land after the time of flowering, yet the amount of *non*-nitrogenous vegetable substance accumulated after this time had been very great; it is not, however, necessary to conclude that the rapid accumulation of carbon from the atmosphere at this period, though coincident perhaps with an apparently less succulent condition of the plant, was in reality attained with any less degree of activity of the fluids within it, or of watery exhalation from it, than during the earlier stages of its growth. Upon this point some information will probably be afforded by our results as we proceed.

The daily rate of evaporation in the cases of the two more healthy clover plants—those, namely, of Series 1 and 2—is seen to be in the main higher up, to the time of their being cut, than in those of the other plants; in explanation of which it must be remembered that the clover experimented upon, being the produce of seed sown in the previous season, these plants were, at the commencement, more advanced than those with which they here stand in comparison.

The total evaporation from the jar without a plant is seen to be 3844 grains during the entire period of the experiment. This total loss from the whole of the glass lid is certainly considerable, but it amounts on an average to little more than 3 per cent. of the entire quantity given off from the jars containing the plants, and it seems unsafe on several grounds to attempt to correct the indications of the latter by the deduction of the amount of loss from the no-plant jar. Thus the loss from the centre-hole of the no-plant jar might be supposed to exceed that from the rest, since in these the orifice was nearly closed by the stems of the plants: but, on the other hand, the much less active circulation of air through the unplanted jar would tend to an opposite result, as also would the fact, that in the absence of a fresh supply of water in this case, the surface of the soil would, after a time, become somewhat dry. That this was the case would appear from the figures in the table, which show that though the rate of loss from the no-plant jar increased for a length of time as the season advanced, yet afterwards it to some extent diminished. It may be remarked, however, that there was frequently in this case, as well as in the others, a condensation of water on the under surface of the lid. Upon the whole, then, we are inclined to decide that the indications of this experiment should serve rather to prevent any too nice application of the numerical results obtained in relation to the plants, than as providing any available means of correcting them.

Let us now turn our attention to the amount and composition of the produce obtained from the experimental jars. The wheat plants in all three of the jars appearing sickly from the time of transplanting, were cut down twelve days afterwards, viz., on March 31st, in the hope that they would then grow up more vigorously. These cuttings, when dried at 212°, in neither case weighed one grain, but they were saved, and their quantities are taken into account with the rest of the produce. Stems were also cut from the wheat grown by the unmanured and the mineral manured soil, as well as from all of the barley jars, on May 26th; the holes in the glass covers having become in these cases quite choked up. These cuttings were much more considerable in quantity than the former, and of course also considered as a part of the experimental product.

The several clover plants were respectively cut when in full flower. The pea with mineral manure was cut on August 4th, and that in the unmanured soil on August 11th. All the other plants, viz., wheat, barley, and the beans, were harvested on September 7th.

The corn of the peas and beans was well developed and tolerably ripened: that of the wheat and the barley was by no means so much so, especially that of the wheat. This was supposed partly to arise from a want of water, the plant having an appearance of drying up rather than healthy ripening. It is seen, indeed, by reference to Table I., at page 45, that the amounts of water derived from the soil were greater in the cases of one of the wheat jars and two of the barley jars than in the others, though the exhaustion, in this respect, of the beans, one of the peas, and one of the clovers was not much less. It had been remarked, however, from the commencement, that the apparent demand for supplied water was much greater in proportion to that given off in the cases of the gramineous plants than in the several leguminous ones; but it seems generally to have been found by experimenters that the cereals were much more difficult to bring to maturity under the somewhat artificial circumstances usually provided in experiments of this kind than any other plants.

The irregularities of cuttings and want of uniformity in the final maturation of the produce will be guarded against as far as possible in our future experiments. To these indeed may probably be chiefly attributed any want of definiteness or consistency in the results about to be considered; and it was on account of them deemed unnecessary to take the *fresh* weights of the produce of the jars.

The plants cut level with the surface of the perforated lids shortly after being taken from the jars were dried in a stove at about 140°, and then carefully stored for future examination.

Recurring to the subject for the purpose of this paper, the corn plants were carefully dissected—the seeds from the straw, chaff, &c. Each of them was then exactly halved. The one portion of corn and one each of straw, chaff, &c. (the latter being mixed together), were fully dried at 212°—the weight taken and then burnt to ash, and the other specimens, the corn separately from the straw, chaff, &c., being reserved for the determination of their nitrogen. The cuttings were also halved and treated in like manner, those taken at different periods from the same plant having been mixed.

In Tables IV., V., and VI., are given the results of the dryings and burnings of the produced plants.

TABLE IV.—Quantities of Dry Matter fixed in the several parts of the Plants and in the Total Produce of the Jars, &c.

Description of Plants and Manure.		In Corn.	In Straw and Chaff.	In Cuttings.	In Total Produce.	Proportion of Corn to 100 of Straw, &c.
Wheat	Unmanured	148·5	302·8	7·6	458·9	47·84
	Mineral Manure . .	111·2	321·9	7·6	440·7	33·74
	Min. and Ammon. Manure	65·4	206·2	0·3	271·9	31·67
Barley	Unmanured	188·7	253·74	23·1	465·54	68·16
	Mineral Manure . .	179·0	297·0	24·6	500·6	55·66
	Min. and Ammon. Manure	112·8	170·6	29·8	313·2	56·34
Beans	Unmanured	282·6	254·9	. .	537·5	110·86
	Mineral Manure . .	299·0	238·8	. .	537·8	125·20
Peas .	Unmanured	214·7	206·3	. .	421·0	104·07
	Mineral Manure . .	213·8	243·6	. .	457·4	87·76
Clover	Unmanured	. .	. .	. .	204·7	. .
	Mineral Manure . .	. .	. .	. .	234·8	. .
	Min. and Ammon. Manure	. .	. .	. .	92·6	. .

TABLE V.—Quantities of Mineral Matter fixed in the several parts of the Plants and in the Total Produce of the Jars, &c.

Description of Plants and Manure.		In Corn.	In Straw and Chaff.	In Cuttings.	In Total Produce.
Wheat	Unmanured	4·22	30·62	1·65	36·49
	Mineral Manure . . .	3·06	40·44	1·44	45·48
	Mineral and Ammon. Manure	2·16	29·74	0·048	31·948
Barley	Unmanured	6·2	36·38	3·34	45·92
	Mineral Manure . . .	6·8	39·22	4·6	50·62
	Mineral and Ammon. Manure	4·72	24·06	4·4	33·18
Beans	Unmanured	9·02	40·0	. .	49·02
	Mineral Manure . . .	10·6	36·16	. .	46·76
Peas .	Unmanured	6·76	36·4	. .	43·16
	Mineral Manure . . .	8·24	55·98	. .	64·22
Clover	Unmanured	. .	. .	. .	29·24
	Mineral Manure . . .	. .	. .	. .	35·44
	Mineral and Ammon. Manure	. .	. .	. .	13·10

TABLE VI.—Percentages of Ash in Dry Matter.

Description of Plants and Manure.		In Corn.	In Straw and Chaff.	In Cuttings.	In Plant (Clover).
Wheat	Unmanured	2·84	10.11	21·71	..
	Mineral Manure	2·75	12·56	18·95	..
	Mineral and Ammon. Manure	3·30	14·42	16·0	..
Barley	Unmanured	3·28	14·34	14·46	..
	Mineral Manure	3·80	13·20	18·70	..
	Mineral and Ammon. Manure	4·18	14·1	14·1	..
Beans	Unmanured	3·19	15·69	..	..
	Mineral Manure	3·55	15·14	..	..
Peas	Unmanured	3·15	17·64	..	..
	Mineral Manure	3·85	23·0	..	..
Clover	Unmanured	..	..	..	14·28
	Mineral Manure	..	..	..	15·11
	Mineral and Ammon. Manure	..	..	..	14·15

In Table IV. the *dry matter* in the several *parts* of the specimens is given, the quantities being calculated upon the entire produce of the jars. Excluding the clover-plants, which do not compare fairly with the rest, and those also having the ammoniacal manure, which were evidently injured by it, we see at least some general uniformity in the amount of dry matter produced; the beans, however, which were of all the plants the most healthy, yielding not only an amount almost identical with the mineral and the unmanured soils, but higher than any of the rest. And if we refer to the last column of the Table, we see that in their cases especially, but also notably in those of the peas, the seed (which in both is so highly nitrogenous) shows a *much* higher proportion to the entire produce than in the cereals.

These *actual quantities* of dry matters produced, though indicating perhaps to some extent the healthy development of the several plants under the conditions provided for them, will be more conveniently studied in their relationship to the amount of water given off, when calculated to a uniform standard, as in the Table which will shortly follow.

The figures of Table V., indicating the actual amounts of *mineral matter* fixed in the plants, are also of little independent interest. Those of Table VI. show the per centage of *mineral matter* in the gross dry substance in the several plants and parts of plants, and indicate it to be in every instance higher than is usual; though less so in the leguminous seeds than in the cereals, and more in the wheat than in the barley. The proportion is seen, moreover, to vary in the same description of plant with the different conditions of soil, it being generally higher where mineral manure was employed than with no manure. This general excess of mineral matter may be taken as being connected, to a great extent, with the defective state of ripening of the plants, and between plant and plant of the same description the amount of it may indicate their relative qualities in this respect.

Table VII.

Table of Actual Experimental Results.

Description of Plant and Manure.		Number of Grains of Water given off.	Number of Grains fixed in the Plant of		
			Dry Matter.		Mineral Matter (Ash).
			Inclusive of Ash.	Organic only.	
Unmanured . . .	Wheat .	113,527	458·9	422·41	36·49
	Barley .	120,025	465·54	419·62	45·92
	Beans .	112,231	537·50	488·48	49·02
	Peas . .	109,082	421·00	377·84	43·16
	Clover .	55,093	204·70	175·46	29·24
Mineral Manure . .	Wheat .	98,006	440·7	395·76	44·94
	Barley .	128,354	500·60	449·98	50·62
	Beans .	117,869	537·80	491·04	46·76
	Peas . .	96,405	457·40	393·18	64·22
	Clover .	53,723	234·80	199·32	35·48
Mineral and Ammoniacal Manure . .	Wheat .	55,996	271·90	239·952	31·948
	Barley .	85,124	313·20	280·02	33·18
	Clover .	13,671	92·60	79·50	13·10

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	Min. and Ammon. Manure	13,671	92·60	79·50	13·10

In Table VII. (p. 54) the total amounts of water given off during the growth of the plants, and the total amounts of dry matter, both inclusive and exclusive of ash, and of the ash itself, are given side by side. The relationship of the water given off to the matter fixed in the plant is, however, more clearly indicated in Tables VIII. and IX.

Table VIII.

Showing the Quantities of Substances fixed to a Standard Amount of Water given off.

Description of Plant and Manure.		Number of Grains fixed in the Plant for 100,000 Grains of Water given off, of— Dry Matter. Inclusive of Ash.	Dry Matter. Organic only.	Mineral Matter (Ash).
Unmanured	Wheat	404·2	372·0	32·14
	Barley	387·8	349·6	38·26
	Beans	478·9	435·2	43·67
	Peas	385·9	346·4	39·57
	Clover	371·5	318·5	53·07
Mineral Manure	Wheat	449·7	403·8	45·85
	Barley	390·0	350·6	39·44
	Beans	456·3	416·6	39·67
	Peas	474·4	407·8	66·61
	Clover	437·0	371·0	66·04
Mineral and Ammoniacal Manure	Wheat	485·6	428·5	57·05
	Barley	367·9	328·9	38·98
	Clover	677·3	581·5	95·82

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	Mineral Manure	449·7	403·8	45·85
	Mineral and Ammoniacal Manure	485·6	428·5	57·05
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Clover	Unmanured	371·5	318·5	53·07
	Mineral Manure	437·0	371·0	66·04
	Mineral and Ammoniacal Manure	677·3	581·5	95·82

Table IX.

Showing the Quantities of Water given off to a Standard Amount of Substances fixed.

Description of Plant and Manure.		Number of Grains of Water given off for One Grain fixed in the Plant, of—		
		Dry Matter.		Mineral Matter (Ash).
		Inclusive of Ash.	Organic only.	
Unmanured	Wheat	247·4	268·8	3111·2
	Barley	257·8	286·0	2613·8
	Beans	208·8	229·7	2289·5
	Peas	259·1	288·7	2527·3
	Clover	269·1	314·0	1884·2
Mineral Manure	Wheat	222·4	247·6	2180·8
	Barley	256·4	285·2	2535·6
	Beans	219·2	240·0	2520·7
	Peas	210·8	245·2	1501·2
	Clover	228·8	269·5	1514·2
Mineral and Ammoniacal Manure	Wheat	205·9	233·4	1752·7
	Barley	271·8	304·0	2565·5
	Clover	147·6	172·0	1043·6

Wheat	Unmanured	247·4	268·8	3111·2
	Mineral Manure	222·4	247·6	2180·8
	Mineral and Ammoniacal Manure	205·9	233·4	1752·7
Barley	Unmanured	257·8	286·0	2613·8
	Mineral Manure	256·4	285·2	2535·6
	Mineral and Ammoniacal Manure	271·8	304·0	2565·5
Beans	Unmanured	208·8	229·7	2289·5
	Mineral Manure	219·2	240·0	2520·7
Peas	Unmanured	259·1	288·7	2527·3
	Mineral Manure	210·8	245·2	1501·2
Clover	Unmanured	269·1	314·0	1884·2
	Mineral Manure	228·8	269·5	1514·2
	Mineral and Ammoniacal Manure	147·6	172·0	1043·6

In Table VIII. there are shown the amounts of gross dry substance, of dry organic matter, and of mineral matter fixed, for every 100,000 grains of water carried off from the soil by the plants, and in Table IX. the amount of water given off for the fixation of one grain of each of these is indicated.

The indications of these Tables are certainly not without the appearance of discrepancy, yet when we remember the circumstances of irregularity of growth already fully detailed, and also the greatly varying products, of which the substance of the plants is in several cases made up, the *general* uniformity of the figures is sufficiently siriking, and calculated to lead to the expectation of much more definite results in future, and more carefully conducted experiments.

Referring first to Table VIII., and taking the upper section of it, we see that the amounts of dry matter produced to 100,000 grains of water given off by the plant, range in the case of the wheat, the barley, the pea, and the clover, in the unmanured soil, between 371 and 404 grains; or, excluding the clover, between the latter number and 386 grains, an approximation sufficiently indicating some definite relationship between the passage of water through the plants and the fixation in it of some of its constituents. The *bean* in this series seems to be an exception, the amount of dry substance produced in this case being about 479 grains, or nearly one-fourth more than the average of the other unmanured plants. When we remember, however, the much larger amount of *nitrogenous* compounds which this product would contain than any of the other specimens, we see that with this variation in the amount of vegetable growth to a given quantity of water evaporated, there is, at least, coincident variation in the composition of the product itself; and the particular facts would lead to the suspicion that the water evaporated had a more definite quantitative relationship to the fixation of the *non*-nitrogenous than to that of the *nitrogenous* constituents of the plants.

Looking at the results of the 2nd Series (with mineral manure), we see a generally higher amount of dry substance produced for a given circulation of water than in Series 1 ; and also, the barley excepted, a much greater uniformity than in the former Series. The cause of this discrepancy in the barley may perhaps be explained by the fact already mentioned, that the lid of the jar in which it grew had been broken during a considerable period of the experiment; and though the pieces were cemented together, yet it is more than probable that water was lost from the soil by evaporation through the crack, in which case the amount of product would necessarily appear low.

In the case of this Series too, it is seen that the product of beans is exceeded by the peas, and nearly reached even by the wheat. On the view referred to above, therefore, it would be necessary to suppose that, provided the results are to be relied upon, the composition of the several products as regards nitrogen would be more nearly equal in the case of this Series than in the former one, and also that the per centage of it was higher in the specimens of the second Series than in those of the first—a result which would have to be attributed to the more or less direct influence of the manure.

The plants of *Series* 3, having an ammoniacal manure, were so manifestly unhealthy that the results afforded in relation to them must not be allowed much weight, and indeed they appear to be little worthy of confidence.

In the lower section of Table VIII. the comparison is made between the individuals of the same description of plant under different conditions of soil. A considerable difference is here shown to be coincident with the variations of manuring condition, and, setting aside the clover, more especially in the cases of the wheat and the peas. The composition of these when determined may, to a great extent, elucidate the fact: indeed the varying proportion of seed to straw in the several cases indicates a probable difference in this respect; and analogy would also lead us to believe that, with the varying observed degree of ripeness and the experimentally ascertained varying amounts of ash, the per centage of nitrogen in the several specimens of the same kind of plant would also vary very greatly. In support of this opinion we may state, that analyses already made of one of the products show that some of the cereals contained nearly twice the ordinary amount of nitrogen. The coincidences in this section are most striking in reference to the beans, and these, as has been already stated, were the most healthy and matured plants obtained from the experimental jars. The three barley plants, it is true, show a considerable uniformity, but, as has already been explained, the figures given for the mineral manure plant are probably somewhat in error.

Notwithstanding these discrepancies, as yet not fully and satisfactorily explained, we cannot but recognise in the results thus far obtained a very encouraging significance, and, indeed, it seems to us more than probable that future experiments may fix a definite relationship between the amount of the *non*-nitrogenous proximates fixed in the plant, and this even probably to a great extent irrespectively of their exact composition, provided their source were mainly in each case the *atmosphere*, as in the instances of the seeding plants now under consideration, and accumulating, as they are known to do, their chief supplies during the period of the most powerful influence of heat and light upon the plants.

In Table IX. the amounts of water passing through the plant for each grain of substance fixed are given—the indications being the inverse of those we have just been considering; and the differences are of course dependent on the same circumstances as those already alluded to.

It is a striking fact, that (excepting a single clover plant, which was always unhealthy) there is in every case more than 200 grains of water passed through the plant for one grain of material accumulated—an amount which, when calculated to the average or at least frequent produce of an acre of land, would very far exceed the annual fall of rain.

Referring to the column of water evaporated to mineral matter fixed, we see the amount of the former to be, on an average, 2000 times that of the latter. Whatever other explanation, therefore, we may receive as to the conditions of assumption of the plant of some mineral substances occurring in it, in insoluble combinations, we have here evidence sufficient to show that few of the substances required by plants, and which are generally assumed to be insoluble, are incapable of being taken up by them in an adequate quantity in rain water.

It was our hope to have given in this paper the results of the determinations of nitrogen, in the various specimens grown in the pots, with the view of showing what relation subsisted between the amount of nitrogenous proximates fixed in the plant, and that of the water passed through it. Unfortunately, however, the laboratory work in connection with this branch of the inquiry is as yet not so far advanced as to justify the discussion of the numerical results on this occasion, nor will our allotted time allow us to do so. We may, however, state that as far as our results have gone, it would appear that whilst for a given quantity of water evaporated the amount of *non*-nitrogenous substances fixed in the plant is within somewhat narrow limits identical, in the specimens now under experiment of the two natural orders of plants, that of the *nitrogenous* proximates fixed is, on the other hand, about *twice* as great in the Leguminosæ as in the Graminaceæ. This is indeed a significant fact, as bearing upon the distinctive functional characters of the various plants which enter into rotation. It is, moreover, perfectly consistent with the results of our experiments in the field with wheat and beans respectively, which show that under the same circumstances of growth, as to manure, &c., and in the same season, the acreage yield of nitrogen is twice or thrice as great in beans as in wheat.

It cannot be supposed, however, that with the larger amount of nitrogen harvested in the leguminous crop the soil would be proportionally exhausted of it, for common practice sufficiently teaches that, other things being equal, a larger produce of wheat would be obtained after a bean than after a wheat crop, notwithstanding its known dependence on the supply of nitrogen in the soil.

It may be supposed, indeed, that here we have evidence of a superior power in the leguminous as compared with the graminaceous plants, of obtaining their nitrogen from the atmosphere rather than from the soil. However this may be, many experiments of our own have convinced us that, especially in the growth of the graminaceous grains, there is never an increased acreage yield of nitrogen in any degree approaching that supplied by manure, and, independently of results of a more direct and practical kind, it has been observed by several experimenters, that during the growth of plants there is a constant evolution of nitrogen from their leaves.

Thus De Saussure, in his 'Recherches Chimiques sur la Végétation,' pp. 40-43, gives the results of experiments on this subject, and he comes to the conclusion that the amount of nitrogen given off bears a direct relation to that of oxygen assimilated by the plant from the absorbed carbonic acid. His experiments moreover were made with the *Vetch*, which, as will be remembered, is a member of the Leguminous family of plants, in which, as compared with the Graminaceous family, we would suppose the evolution of nitrogen to be less considerable.

Daubeny, again, in his 'Memoir on the Action of Light upon Plants, and of Plants upon the Atmosphere,' in the Philosophical Transactions for 1836, Part I., arrives at a somewhat similar result; whilst more recently Draper, in his 'Chemistry of Plants,' pp. 184, 185, and context, ascertained in several experiments the amount of nitrogen given off during the growth of plants, and seeks to establish the following conclusions: that "when the leaves of plants under the influence of light decompose carbonic acid, they assimilate all the carbon, and a certain proportion of oxygen disappears; at the same time they emit a volume of nitrogen *equal to that of the oxygen consumed.** This disappearance of oxygen and appearance of nitrogen are thus connected with each other: they are equivalent phenomena. The emission of nitrogen is thus shown not to be a mere accidental result, but to be profoundly connected with the whole physiological action. . . . . At this stage of the inquiry a remarkable analogy appears between the function of digestion in animals and the same functions in plants. Liebig has shown how, from the transformation of the stomach itself, food becomes acted upon, and is turned into chyme; an obscure species of fermentation, brought about by the action of nitrogenized bodies. So in like manner, in plants, the decay of a nitrogenized body is intimately connected with the assimilation of carbon; for, as I have stated, the process here under discussion is a true digestive and not a

* The italics are those of the author.

respiratory process. And as there are facts which seem to show that the primary action of the light is not upon the carbonic acid, but upon the nitrogenized ferment, the decomposition of the gas ensuing as a secondary result, *is it not probable that* CHLOROPHYL *is the body which in vegetables answers to the* CHYLE *of animals?* The oxygen which disappears during the decomposition of carbonic acid, disappears to bring about the eremacausis of the nitrogenized body. And have not the gum, the starch, the lignin, and other carbonaceous constituents of plants, all originally existed in and passed through the green stage?"

Mulder, again, from purely chemical considerations, and, like the observers alluded to above, altogether independently of the important practical application of the phenomena to which we wish to direct attention, admits the constant evolution of nitrogen during the growth of plants, and that the source of this nitrogen must obviously be the compounds containing it already existing in the plants; but he maintains with more or less apparent reason that the relation of nitrogen given off to that of oxygen assimilated from the absorbed carbonic acid must depend materially upon the composition of the compounds to be formed. Thus, referring to Draper's experiments, he says (see his Chemistry of Vegetable and Animal Physiology, Part IV., p. 778), "But this simplicity of relation is in my opinion accidental. The carbonic acid is employed for the production of various organic bodies, which cannot possibly be the same in *all* plants. Consequently, the quantity of oxygen given off cannot be a constant one. This variety of product also renders it impossible that a constant amount of nitrogenous substance should be required for the decomposition of the carbonic acid."

It may be taken then as a well-ascertained fact, that the evolution of nitrogen is a constant and coincident attendant on the growth and accumulation of a plant; whilst it would seem that both the results of practice and the reasonings of the chemist would lead us to suppose that this loss is greater in some cases than in others.

Let it once be admitted in agricultural science that there is a definite expenditure or consumption of the nitrogenous bodies derived through the roots connected with the fixation and elaboration of certain constituents of plants, and that this is greater or less according to the sources or the exact composition or state of elaboration of the products, and an important step will be gained towards a clearer conception of the principles involved in the alternation, in a course of cropping of plants, of varying products and habits of growth. In one of our papers *On Agricultural Chemistry* in the Journal of the Royal Agricultural Society (Part I., 1847), we have ventured an opinion as to the probable amount of nitrogen required in the manure of wheat to yield a given amount of it in the increased produce. Since that time we have accumulated much additional evidence on this point, which will enable us to modify or confirm the estimate already hazarded, but which it is not the object or the province of this paper to discuss: the results yet to be obtained, however, in continuation of the inquiry constituting the subject of this report, will, it is anticipated, furnish further data bearing upon this important question.

Before concluding these observations it seems fitting to call attention to some incidental, yet important indications of these and other of our experiments. Granting, as the conjoint results of the field and of the experimental plants here under discussion would show, that under equal circumstances of growth, and coincidently with the passage into the plant of the same amount of aqueous fluid from the soil, the Leguminous plants will yield a produce varying but little in gross amount from that of the Graminaceæ, but containing a much higher per centage, and, consequently, total quantity of nitrogen; it would, on the view that the analysis of a crop should indicate the manure required for its growth, at once be decided that, of their *organic* constituents, the Leguminous plants should be liberally supplied with *nitrogen*, and the Graminaceæ rather with *carbon*. But is this consistent with common usage or the dictates of experiment? The low nitrogenized and highly carbonaceous gramineous crop requires for its luxuriant growth a large supply of nitrogen by manure; but with this it seems practically independent of *supplied carbon*, whilst the highly nitrogenized leguminous plants are, other things being equal, by no means strikingly benefited by nitrogenous manures. We had, indeed, at one time supposed that clover was greatly dependent on an artificial provision of nitrogen, but this view does not appear to be favoured by further investigation; whilst with it, as well as with those leguminous plants valued in agriculture for their seeds, a mineral, and especially an alkaline manure seems to be more prominently indicated.

Again, judging from the composition of the ash of the turnip, which shows both in the leaf and in the bulb a proportion of alkalies to phosphoric acid of 4 or 5 to 1, we should be led to decide that the former rather than the latter were usually and specially the more appropriate manure for the turnip. Common practice has, however, definitely determined in favour of phosphoric aid rather than on the alkalies.

Indeed the whole tendency of agricultural investigation seems to show the fallacy of alone relying upon the knowledge of the composition of a crop as directing to the constituents probably more specially required to be provided for it by manures, and rather that the elucidation of agricultural principles must be looked for from a due consideration of vegetable physiology as well as chemistry—of the special functional peculiarities and resources of different plants, as well as their actual percentage composition.

We are convinced, indeed, that however important and useful miscellaneous agricultural analyses may be, the interest and progress of agriculture would be more surely and permanently served if its great patron Societies were to permit to their scientific officers a wider range of discretion, and more liberal means for the selection and carrying out of definite questions of research. Results of this kind promise, it is true, but little prospect of immediate and direct practical application, but by their aid the uncertain dictates, whether of common experience, theory, or speculation, may, ere long, be replaced by the unerring guidance of principles; and then alone can it reasonably be anticipated that miscellaneous and departmental analyses may find their true interpretation, and acquire a due and practical value.

VII.—*Some Memoranda concerning the Melloca.* By the Vice-Secretary.

A LETTER in the *Gardeners' Chronicle* for the year 1847, from Dr. Jamieson, of Quito, first communicated authentic information respecting this plant. In answer to certain queries which had been put as to the nature and botanical names of two different kinds of tubers, which D'Orbigny had spoken of as resembling potatoes, and as being cultivated in the temperate regions of Bolivia—the one called "Oca," and the other "Papa lisa"—Dr. Jamieson replied, that the one of them which is known in Peru by the name of Oca, as a common article of food, is a species of Oxalis, receiving precisely the same kind of culture as the potato, and that it thrives in cold situations which generally prove injurious to the latter. It is raised on the loose, volcanic soil of Pichincha, at an elevation of rather more than 11,000 feet; on Cayambe at a similar elevation; and still more abundantly at Cumbal, in the province of Pasto, a locality almost too cold for the production of grain. The crop is said to be from twenty to twenty-five fold. The tubers, which are long, and weigh about 4 ounces each, are dug up, washed, and exposed for 5 or 6 days to the sun, when they acquire a very agreeable, sweetish taste, superior, in the opinion of many, to that of the sweet potato. They are cooked in the same manner as the potato, either boiled or roasted, and are universally relished by all classes.

As to the other plant, spoken of by D'Orbigny as the Papa lisa, Dr. Jamieson suspected it to be the Melloca, a tuber that yields a very large proportion of fecula, and is consequently considered highly nutritious. It is cultivated like the Oca, and is largely consumed as an article of food by the Indian population.

The Editor added to this memorandum a figure of the Melloca and some botanical observations, proposing to call it Melloca tuberosa, and identifying it with the Basella tuberosa of Humboldt. It has since been suggested that the Ullucus tuberosus of Lozano is the same plant, erroneously described by the Spanish writer.

In the end of the year 1848 it was stated in the same periodical that the Melloca had been introduced to Europe by the French, and that it had been successfully cultivated by M. de Jonghe, a Belgian gentleman, whose account of it was to the following effect:—A rooted cutting was sent to him the 14th of April, by M. L. Vilmorin. It was nursed for eight days in a frame, and on the 3rd of May planted in a border of light, rich soil. It emitted a great number of branches, which were successively covered with soil, the extremities only being left exposed. This operation was frequently repeated up to the 20th of July. Having then remarked an appearance of flowers in the axils of the leaves, the earthing-up was discontinued. The flower-buds did not, however, expand, owing probably to the coldness of the season. On the 10th of September he discovered, below each of the branches, and attached to the roots, 6 or 8 tubers. The other part of this plant remained in the ground, and was perfectly green at the date of the communication. A single plant, struck from a cutting in spring, and occupying only a surface of 2 feet square, furnished 56 strong tubers, and 62 of smaller dimensions. M. de Jonghe thought that if a frame were placed over the plant, it would probably continue to vegetate and form a succession of young tubers throughout the winter; for, in the Cordilleras, it is said to be a perennial evergreen. Some trials with it as an esculent plant were unsatisfactory, but branches given to a stall-fed cow were eagerly swallowed, and formed excellent food for such animals.

The publication of M. de Jonghe's letter was followed by a memorandum from M. Louis Vilmorin, of Paris, from which the following are extracts:—

"The plant was introduced into France last January by M. C. Ledos, of Lima, who sent some tubers to the Minister of Agriculture and Commerce. This gentleman's information was very incomplete, and related almost entirely to the preservation of the tubers, 'which cannot be effected for more than three or four months in a dry, fresh place. If the tubers are kept longer than that, the eyes begin to develope; their growth does not, however, affect the tuber's power of germination. When spring—the time at which the tubers ought to be planted—is arrived, the shoots are taken off, and they themselves serve very well for propagation. So long as the tuber is not completely dried, it remains fit for planting. After the shoots are removed, the tubers are left in the sun for a few hours to dry.' The tubers received by me were in a very advanced stage of vegetation—withered and exhausted. Some were immediately planted in a frame—an unnecessary precaution; and at the beginning of May I had 40 good plants. The Melloca is half a runner; its shoots, without support, send out roots wherever the ground is touched; its leaves are thick and fleshy; from being large and spreading, they become erect and round like a shell in the fully developed plant. The flowers, which are small and greenish, spring in spikes from the axil of the leaves. The produce of the Melloca consists in its tubers, which, in their native country, attain a considerable size. They are yellow, very smooth, full of starch, and appear on runners proceeding from the base of the stem, and tending to rise to the surface of the soil; the plant must, therefore, be pretty well earthed up. In general my tubers did not begin to grow till the autumn rains had begun, so that they were still very small when the frosts set in. Some plants, however, under sashes produced tubers in April; but when planted out in May, although great care was taken not to disturb them, they did not continue to increase in size; they behaved like sets, shrinking and sending out new shoots. During the three summer months, vegetation was decidedly checked; this is to be attributed rather to heat* than to want of moisture. The plants, which were at this time well watered, produced plenty of leaves, but no tubers. The return of a lower temperature was remarkable, on the contrary, for the rapid development of adventitious buds on the tubers; and this effect was, I think, much more quickly perceptible on those plants which had suffered from drought than on the more vigorous ones which had been watered.

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* From the middle of the summer I had foreseen this result, in consequence of some valuable information given me by M. Boussingault respecting the atmosphere and temperature of the table-lands of the Andes. He advised me, at this time, when I attributed the abortion of the flowers to the coldness of our summers, not to raise the temperature of the medium in which my plants were, as I had intended doing, and it will be seen in the sequel that this advice was well founded.

"A little later in the season, and when the external atmosphere was damp, the stems presented another rather curious phenomenon; their extremities, which, a few days before, had very short internodes, and leaves in whorls, suddenly lengthened, and, becoming more slender, were at last transformed into a thread, bearing at long intervals small, nearly scale-shaped leaves: these threads, after running along the ground or over the neighbouring branches, with a manifest preference for dark places, entered the earth, where their extremities became tubers. They are, I am certain, direct prolongations of the stems, and not, so far as I could discover, axillary productions from the leaves at their extremities. This lengthening of the stem into a thread appears to me to be connected with moisture and a low temperature. It took place, in those plants which I had put in a cold pit, in the spring; but, being less general, it had not struck me so forcibly as it did in the autumn, when it took place on all the plants. In the spring plants, the first threads which were developed entered the earth and formed tubers, whilst those which appeared later, or which met any obstacle, again, under the influence of a higher temperature, gave birth to leaves regularly arranged; the internodes shortened, the stem assumed its natural size, and at the same time sought the light. I thus witnessed the curious phenomenon of stems undergoing two successive contractions and thickenings. This is certainly very interesting, and well deserves the attention of physiologists.

"We are not yet able to judge of the nutritive qualities of the Melloca. The tubers that came from Peru were not very pleasant to the taste; they were flabby, semi-transparent, and evidently exhausted by the numerous shoots that had grown during the voyage.

"The young tubers collected in 1848 were too young to give more than a very imperfect idea of the value the plant is likely to acquire as an article of food. Their taste was tolerably pleasant; but (in consequence, probably, of their not being ripe) they were very watery. With the aid of a microscope I found that there was an abundance of starch in the cortical or outer zones of the young tubers, but less (and that finer) in their interior or medullary portion; the thickness of these two zones, measured from the circumference to the centre, is pretty nearly equal. The grains of starch are roundish, very smooth, rather large, and not unlike those of Oxalis crenata or Oca. M. Masson recommends the leaves as Spinach. I must say that, for my own part, I did not like it; but I ought to add, perhaps, that Basella, and, in general, all those plants which become viscid when cooked, are not to my taste. M. Masson succeeded much better than I in cultivating the Melloca: his plants were in summer not so strong and vigorous as my own ; but when, on the first approach of frost, which was towards the end of October, I pulled my plants up, he covered his over with dry leaves, under which the tubers went on growing capitally: he showed me several weighing from 50 to 60 grammes. Notwithstanding this, the Melloca did not appear to me to be likely to become of much value in an agricultural point of view, at least with us; but I think it is worth keeping in our kitchen gardens, even if it is not at present of any great importance. The time may come when, in consequence of some change in temperature, different from that of this year, the fruit may ripen ; in which case there will be a chance at least of raising plants from seed, which may be more valuable than the original ones ; and, even without that, experience may teach us how to bring about the first development of the tubers soon enough to enable them to attain a considerable size, and to ripen completely before the frosts set in.

"From my own observations, I am inclined to think that the climate of England, or, still better, that of Ireland, would be more suitable for the Melloca than that of France. The attempt would be the more likely to succeed when the facility with which the plant is propagated is remembered ; in illustration of this, I may give you the following remarkable example:—Having observed that some flowering branches, which I had destined for my herbarium, had produced under the press several small tubers, I gathered the stems of some plants which I had pulled up 10 days or so before, and which had been lying on the ground ever since, and put them into a box between layers of dry straw. On opening the box at the end of a fortnight, I found the stems partly rotten, and that they had given birth to 500 or 600 small tubers, varying in size from a pea to a hazel-nut: some of the stems had as many as 25 tubers distributed over their surface. From the green stems cuttings can be taken, which will strike at any season of the year in the open air. M. Masson considers cuttings formed by a shoot placed in the ground, and merely covered with a handful or two of earth, as the best mode that could be devised of multiplying this plant."

The foregoing accounts were succeeded by a communication from Mr. Pentland, who describes the "Ullucus" as being extensively cultivated throughout the elevated regions of Peru and Bolivia, where it is known by the name of Oca Quina, and confounded under the same generic appellation as the two varieties of Oxalis (Oca). This distinguished traveller says, "I have found it in all the Andean valleys between the river Apurimac and Potosi, *i. e.*, between 13° and 19° 30′ S. latitude, and at an elevation of from 11,000 to 13,000 feet above the level of the sea. It is not improbable that the Ullucus, which has recently been imported to Europe from Quito, was introduced into the latter province by the Incas from the environs of Cusco, when they overran the equatorial regions of South America. The Oca Quina is extensively cultivated in the vicinity of the populous Bolivian city of La Paz, in common with the two varieties of Oxalis tuberosa (Oca Augris and Oca Esaños). It is planted between the 25th of July and the 10th of August, the seed employed being generally the smaller tubers unfit for food, and is gathered in during the last week of April. It will be recollected that these two periods of the year are the spring and autumn in the southern hemisphere. The mode of cultivation is in drills, into which the root is dropped with a little manure. I need scarcely state that at the great elevation of La Paz (upwards of 12,000 feet) the climate, even during the summer season, is severe, scarcely a night passing over without the streams being frozen over, the sky being in general cloudless at all periods of the year except during the rainy season (December to March). Mean temperature about 49°. The Oca Quina is chiefly used in the preparation of chuño, by alternately freezing the tubers and steeping, by which they are changed into an amylaceous substance, the form under which not only the Ocas but common potatoes are chiefly employed by the Indian population; an operation probably introduced from the difficulty of boiling the unprepared tuber at an elevation above the sea where the point of ebullition of water is scarcely high enough to cook raw vegetables—192° to 195° of Fahrenheit's scale."—(*Gardener's Chronicle*, 1848, p. 862.)

In consequence of the above statements the cultivation of the plant was tried in the garden of the Society, and the following is the result of the experiment as given by Mr. Thompson.

"Seven tubers of the Melloca were received from M. de Jonghe, of Brussels, November 1, 1848; two from J. B. Pentland, Esq., December 14th; and on the 10th of January, 1849, five more from Messrs. Vilmorin, of Paris. Some of these were planted in pots, whole; others were cut in sets like potatoes. The pots were placed in a frame, in a temperature of about 60°. It was observed that the cut sets vegetated first, and made the best plants. As these advanced, cuttings were taken from them and struck, some in light soil, others in moist sand. If the cuttings were thrown on the latter, and kept in a warm, moist atmosphere, they would readily strike root. No plant can be more easily propagated.

"April was unusually cold; on ten nights the thermometer was from four to seven degrees below freezing. Snow and hail as late as the 20th chilled the ground. The night of the 11th of May was frosty. At the end of May the Melloca plants were turned out into an open quarter. They were planted in rows 3 feet apart, and at the distance of 2 feet in the rows. They were partially earthed up in July, and additionally in August. On the 19th of October, according to the recommendation of M. Masson, a number of the rows were earthed up, so as to cover the whole of the plants. An innumerable quantity of tubers was in consequence formed on the buried stems, but many had only acquired the size of peas when it was necessary to dig up the crop, owing to the severe frost which set in on the 26th of November, the thermometer being then 14° below freezing.

"The produce of tubers from one row 34 feet long by 3 feet wide, and for which plants raised from cuttings were employed, was 8½ lbs., being at the rate of 1210 lbs. per acre. The produce of an adjoining row, in which the plants were those raised from sets, was 16 lbs., which is at the rate of 2277½ lbs. per acre, or 1 ton 37½ lbs. It therefore appears, that, like the potato, the plants fed by the old tubers are much more productive, in tubers, than those made from cuttings. But a far greater produce will doubtless be obtained when plants can be allowed to grow from tubers without being cut back, as the above were repeatedly, for the purpose of furnishing cuttings. Some of the tubers were nearly as large as those of the ash-leaved kidney potato, and bore considerable resemblance to them in appearance. The later formation of tubers are generally round.

"The Melloca is hardier than the potato. Seven degrees of frost completely killed the potato tops; but the Melloca withstood this degree of cold, on the 17th November, tolerably well. In Devonshire, Cornwall, and many parts of Ireland it would probably continue growing all the winter. It prefers sandy soil. When highly manured, the plants were found to be less healthy."

In addition to these statements I think it right to say that there is little probability of this plant becoming useful as a garden esculent. Its produce will probably be found large when it is cultivated in the manner which the experience already gained shows to be necessary to it; namely, when planted in the beginning of March, the little tubers being used for sets, earthed up in July, and harvested in November. But although the produce of the Melloca may repay the grower by its abundance, especially as it appears to prefer poor, sandy land to a richer soil, yet its bad quality will, I fear, render it uneatable by man. The leaves and tubers are no doubt nutritive, but so full of an insipid or somewhat earthy slime, that, whether as spinach or as boiled tubers, it will never be received at the table of persons of taste. It is, however, highly deserving of trial by farmers, especially as its leaves are greedily eaten by cattle, as well as its tubers.

Its cultivation will now be discontinued in the Society's garden, and the stock of tubers there will be distributed among such Fellows of the Society as may wish to try it as an agricultural plant.

VIII.—*Rose Stocks.* By John Saul, Durdham Down Nursery, Bristol.

(Communicated November 24, 1849.)

At no period perhaps in the history of gardening have roses been cultivated to such an extent as they are at the present day: formerly the nurserymen grew them by hundreds, or it may be with a few, *and these very few*, by one or two thousands, which, of course, was considered to be an immense number. But now they are not grown by hundreds, but by hundreds of thousands, in the large nurseries of this country; and contemporary with their extended cultivation has been the rapid improvement in their flowers. Formerly we had roses in June, now we have them not in June or July only, but in September, October, and down to December, when in vain they struggle against the wintry blast: these are equal, indeed I may say superior, to June roses in every point which constitutes a beautiful and fragrant flower. A good Yellow is, however, yet wanted, as well as White Perpetuals, some good Mosses, and one or two of other colours to make them perfect. We certainly have Perpetual Mosses, but they are not good flowers, with the exception of one, and that is a bad grower—so bad that I would recommend no amateur to purchase it; those who have tried it have in general been disappointed with it.

My object on the present occasion, however, is to draw attention to the different kinds of stocks upon which roses are generally worked in the nurseries—a point of no little importance when we consider that upon the stock much of the future well-being of the plant depends. In the 'Theory of Horticulture' we are told that "mere propagation is by no means the only object of the grafter [substitute budder]. Another and still more important one is to secure a permanent union between the scion and stock, so that the new plant may grow as freely and as long as if it were on its own bottom under the most favourable circumstances. If this is not attended to, the hopes of the cultivator will be frustrated by the early death of his plant." This is perfectly true of roses. Many cultivators take strong, vigorous stocks, such as Crimson Boursault, Celine, and others, and work on them the delicate Bourbons, Chinas, Teas, &c.; for, say they, "the stocks are vigorous and free growers. See what an amount of root they possess! look at their lungs and stomach, in the form of leaves, to carry on respiration and digestion freely! how rapidly they assimilate the food which is transmitted to them by such powerful feeders!" And upon such stocks are budded delicate roses. During the first year all goes on well; the stock having been in vigorous health when headed back, the bud is pushed out strongly, and in general many of the sorts I have named will bloom profusely the first season. But will this continue? It will if the variety is a free grower; but should the contrary be the case, it will go back even more rapidly than it progressed. This is, theoretically, what we might expect, and practice amply confirms the hypothesis. The lungs so much talked about are cut off with the heading back of the stock: the plant, with its thin, small, delicate leaves, has now to digest and assimilate all the gross food forced into them by such a mass of coarse and abundant feeders; the leaves are gorged to such an extent as to impede their healthy action; respiration and digestion go on slowly; and this continues to increase until all the functions of the plant are totally suspended, and death puts an end to its existence. I have frequently heard complaints made respecting the loss of valuable Tea and other roses, which have been purchased, it may be, at considerable expense, and surprise has been expressed at their early death; but if people would only examine the stocks on which the plants were worked, the fact of their living so long would be more a matter to be wondered at.

The Dog-rose (Rosa canina) is the kind of stock which is so extensively employed for roses in the nurseries of this country. It is almost exclusively used for standards and half-standards, and to an unlimited extent for dwarfs. All things considered, it is greatly superior to every other stock: with the exception of a few, which shall be hereafter noticed, most classes will grow well upon it. Provins, Gallica, Moss, Hybrid Provins, Alba, Hybrid China, Hybrid Bourbon, Damask, Austrian, Damask Perpetual, Hybrid Perpetual, with many of the free-growing Bourbon and Noisette kinds, will grow vigorously upon it. Many of the delicate varieties in the two latter classes, as well as a few sorts scattered through the others, will, however, not succeed upon this stock; but they are scarcely worth mentioning.

The Manettii stock claims attention next: it stands at the head of all cultivated stocks (not, of course, including the above), and is very superior to the Crimson Boursault, Celine, &c. Its good properties consist in its free, vigorous, and continuous growth; in this latter property it is superior to every other stock, continuing to grow until it is stopped by the winter's cold; it also ripens its wood well, becomes hard, firm, not subject to decay, nor are the shoots gross and pithy. On dry, warm, or sandy soils it is the best of all stocks: I have also seen it succeed well on stiff soils not over wet: it is the best of all stocks for Hybrid Perpetuals, and they force well upon it. It suits Bourbons and Noisettes equally well, and many of the dwarf and delicate varieties of these classes which will not succeed upon the Dog-rose will grow admirably upon this. Teas and Chinas will grow better and live much longer upon it than on either the Crimson Boursault or Celine. I must not, however, be understood to say that no Teas or Chinas will succeed on the latter stocks; some of the free-growing kinds will do on it, and exist for a considerable time, but they would do better on the Manettii. Many delicate Teas and Chinas, which will live only a year or two on Crimson Boursault and Celine, will thrive pretty well upon the Manettii; but they are much better worked upon the Rosa indica (common Monthly), or grown upon their own roots. This stock strikes as freely from cuttings as a willow. It was introduced from Italy by Mr. Rivers, and is worthy of the extensive cultivation he has given it.

The Crimson Boursault stock should be used with caution. I am aware that some growers speak highly of it, and have used it extensively; but it is nothing more than a *good nurseryman's stock*, namely, one on which delicate roses will grow beautifully for a time, but on which they will soon perish. Many strong-growing Perpetuals, Bourbons, Noisettes, &c., will grow well upon it, though not so well or so long as on the foregoing. This stock is softer, more subject to decay, and, in every point *worth considering*, inferior to the Manettii: it should, consequently, give way to the latter. For the beautiful and delicate varieties of Perpetuals, Bourbons, Noisettes, Teas, &c., it is infinitely inferior to Manettii, and should never be used where the latter stock can be obtained.

Some few years back nurserymen were in the habit of growing peaches on what is called the Brompton Plum stock, a very free growing variety, on which the peach grew beautifully for a season, but in many instances they had commenced decaying before they left the nursery: very few respectable nurserymen grow this stock now. The Crimson Boursault occupies the same place as a rose-stock which the Brompton Plum does as regards the peach. Gardeners who would object to have their peaches worked upon the latter stock, should pause and consider what sorts of roses they would have worked upon the other.

Celine is a very vigorous growing Hybrid China. Mr. Rivers considers it to be the best stock for the Cloth of Gold, and it suits many others equally well. In a general way it may be used for the same purposes and the same classes of roses as the Crimson Boursault and Manettii: it is very inferior to the latter, which must take precedence of all.

Duc Decazes is a vigorous growing Hybrid Bourbon, having many good qualities to recommend it, namely, free growth, firmness, and solidity of wood. I have seen Bourbons, Chinas, and many Teas and Noisettes succeed admirably on it.

Rosa indica, or Monthly, I have already noticed. This is suitable for delicate Teas, Chinas, &c.; and if they were more extensively cultivated on this or on their own roots, amateurs would not have so frequently to lament their losses.

Blush and other Boursaults I notice merely in order to caution growers against using them: they are at all times extremely subject to mildew, and when worked are liable to decay; indeed they but seldom grow well.

The old rose, Ornement de Parade, is sometimes employed as a stock in nurseries; it has very little to recommend it, consequently the sooner its cultivation for that purpose is discontinued the better.

I have offered these few remarks on Rose stocks with the view of drawing attention to the subject, because of the indiscriminate manner in which stocks are used for Roses. If we could but induce our great rose-growers to give us the result of their experience, a correct knowledge of this favourite flower would be speedily diffused, and those mistakes (the unsuitability of stocks) put an end to.

IX.—*Some Experiments in the Cultivation of the Pine-Apple on Hamilton's System.* By Robert Reid, C.M.H.S., Gardener to Mrs. Clark, Noblethorp, Barnsley.

(Communicated Nov. 8, 1849.)

As all attempts to cultivate Pine-apples on Hamilton's system have hitherto been chiefly confined to the Black Jamaica variety, I was anxious to ascertain what success would attend the growing the Queen, Providence, &c., on that plan. I had a pit to spare in every way suited for the purpose. It was heated with hot-water pipes and with tanks for bottom heat, and it could be regulated to any necessary degree of steady temperature. About a foot in depth of leaves was put over the rubble on the hot floor, then another foot of half leaf-mould and half turfy loam well mixed together. In the latter end of March I filled this pit with strong well-rooted young suckers of Queens (Ripley and Moscow) and Providences. The roots were carefully spread out horizontally in every direction, and covered, about 3 inches in depth, with soil; the distance from plant to plant was $2\frac{1}{2}$ feet every way, and each variety was planted in rows across the pit from back to front, for the convenience of getting easily amongst them should alterations with regard to any particular sort be necessary.

I commenced with a gentle heat and a moist atmosphere; the plants soon began to grow, and as the season advanced their progress became more rapid, the plants assuming a deep-green healthy colour, with a strong dwarf habit, altogether having as fine and healthy an appearance as could be desired. In about two months the plants appeared as if at rest after their rapid growth, when a number of suckers (five or six on each plant) made their appearance on all the Queens. On a portion of the plants the suckers were allowed to grow, on others they were thinned out to two to each plant, while on the remainder they were gradually but entirely taken off. Where the suckers were all retained they made rapid progress, and by autumn were so large that it was difficult to distinguish them from the parent plant, all of them being about equal in size, and large enough to all appearance to produce good-sized fruit in the following spring. The plants having two suckers only were very little, if any, larger in size than those with four. Late in the following spring nearly every plant and sucker fruited, but to my disappointment not a single fruit weighed more than $\frac{3}{4}$ lb., and nearly one-half of them were deformed and useless. In a very few weeks afterwards the other plants, from which the suckers had been entirely taken off, sent up another numerous brood, some below and some above where the first suckers had been removed; these were again taken off, and with similar result. In the end this weakened the parent plants so much that I considered they would never produce fruit of any size, and so I had them all pulled up, except one plant, which stood two years and six months before it produced a fruit of 2 lbs. weight. I was now satisfied that the Queen Pine is not adapted to this mode of culture. I now grow them in pots till they attain their full size for fruiting, and in the month of August or September, according to their forwardness, I turn them all out and plant them in the soil, where they remain till the fruit is cut in the following season. I find that they always produce much finer and better swelled fruit when planted out than when kept in pots, much less trouble and care attends their management, and there is less risk in over or under watering them. On planting out, it is necessary to ascertain that the balls are thoroughly wet through, for if turned out dry it is difficult to get them wet afterwards, and the consequence will be deformed or small fruit.

The Providences answered better than the Queens, but not so well as to satisfy me that it would do to plant out permanently for a succession of fruit, which was the main object of my experiments. The second season they produced fine fruit of 6, 7, and 8 lbs. weight, with two suckers to each plant, which, at the time the fruit was cut, were nearly as large as the parent. In the following spring the suckers grew amazingly, with leaves broad and strong, and to all appearance promised to produce very large fruit. In June all showed for fruit, but it never swelled beyond a sort of receptacle, with five or six good strong crowns growing upon it. Every plant exhibited this condition, and a more favourable time for them could not possibly have been; they received no check of any kind, and more splendid plants than they were could not exist. Since this trial I treat the Providence exactly as I do Queens, planting them out when they are large enough for fruiting.

The Black Jamaica, or Montserrat, of the north of England, as far as my experience goes, is the only Pine that can be depended upon for permanent planting out; and indeed it grows and thrives much better in this way than it does in pots, and the quantity of fruit will be nearly double, and larger in size, keeping up a succession all the year round, the winter fruit being superior in flavour to all others at that season: it thrives best in ten or twelve degrees higher temperature than is requisite for other kinds of Pine-apple, at the same time it will bear extremes of heat and cold, drought and moisture, with any Pine. I have never found any difference in the size of the fruit by thinning out the suckers from the stool. I find that a stool with three suckers will generally yield as large fruit as a stool with only one sucker on it: the main point to be observed is not to allow them to be too much crowded; the soil should be light and rather sandy, but the chief points are heat and a moist atmosphere.

X.—*On some Ornamental Umbelliferous Plants.* By Thomas Moore, F.B.S., Curator of the Physic Garden of the Worshipful Society of Apothecaries, Chelsea.

(Communicated Nov. 29, 1849.)

Umbelliferous plants are not generally placed in a very high rank in ornamental gardening, but, on the contrary, bear a weedy character. Indeed, if we except the genera Didiscus, Astrantia, and Eryngium, umbellifers are seldom seen in cultivation for the sake of their flowers or ornamental properties. This is certainly not in consequence of the absence of real elegance in their forms and proportions, but rather, it would seem, from the general absence of conspicuous colour in their flowers, and the great similarity of character which prevails among them. Yet it is true that, apart from gaudy colours, there is no paucity of elegant forms in this extensive and most natural group. The common Hemlock, when in a healthy and vigorous condition, may be cited as an example supporting this assertion.

But though asserting the beauty of such plants as the Hemlock, to which temporary reference has been made, it is not the merits of these in an ornamental point of view which it is the object of the following memoranda to set forth. It is rather hoped to draw attention towards some individuals of what may be designated the nobility of the order, the individuals referred to being some species of Ferula well adapted for pleasure ground embellishment, and an Heracleum worthy of a situation in what is called wilderness scenery. The latter, as being the least important, will be first disposed of.

The *Heracleum giganteum* is the species I have in view. Those who are at all acquainted with the genera of umbelliferous plants need not to be told that the Heracleums are a somewhat coarse-looking family; and to this characteristic the Giant Cow-parsnep offers no exception. Hence it is more appropriate to such situations as the bold openings of rude or wilderness scenery than for the more highly-kept departments of the garden. But despite its coarseness, it is a noble plant! Imagine a herb of which no trace is apparent during winter, save the crown of its root, putting forth in spring a circlet—one might almost from their magnitude say a forest—of leaves cut into a multitude of large but curiously-formed leaflets and lobes, and soon acquiring an immense magnitude, the leaves—usually three or four in number from a single crown—covering a space of 2 or 3 yards in diameter; add to this a flower-stem, growing some 8 or 10 feet high, nearly 3 inches in diameter below, and about June or July crowned by a central umbel of flowers forming a white convex head upwards of a foot across, around which branch out several semi-horizontal wide-spreading arms bearing at their extremities a series of scarcely smaller umbels, succeeding the first in the development of their blossoms; and a tolerable idea will be formed of the appearance of this giant herb, which, but for its large size, its roughness, and its stout proportions, might claim a more aristocratic position than has been assigned to it. It is of the easiest culture: a hardy perennial, perfecting seeds in abundance, which, if allowed to do so, spring up self-sown.

The species of *Ferula*, now specially recommended as pleasure-ground ornaments, are *F. tingitana* and *F. glauca*, both of which would form objects of the greatest beauty planted as single specimens on a nicely-kept lawn. Though of large size, they have no coarseness in their appearance, the stem being tapering, and though 8 or 10 feet high, not more than 1½ inch in diameter at the base, the leaves cut into an infinity of small segments, and the whole surface either polished or covered with a glaucous bloom. These plants moreover possess a strong recommendation in the fact, that their leaves begin to grow in autumn, and continue to advance during all the favourable intervals of winter, so that by the time spring has come, they are in full leaf. Like all herbs that have very large enduring leaves, they do not produce many in number, but the foliage forms a semi-hemispherical mass of 2 feet in height, lying close to the ground, which it densely covers for a space of some 2 yards in diameter. In this habit, both the species mentioned above agree, as they do also in producing a flower-stem of 8 or 10 feet in height, numerously furnished in the upper half with umbels of yellow flowers, the principal umbels each measuring from 4 to 6 inches in diameter. They come into flower towards the end of June, and last a long time in bloom, during which period the yellow masses are conspicuous: they continue to have an interesting appearance until the seeds are nearly ripe. The leaves are in both species many times divided, or, as it is called, supra-decompound.

Ferula tingitana, the Tangier Fennel, has the leaves divided into several pairs of arms, in a pinnate manner, and these are again and again divided, so that the leaf is made up of little segments of from half an inch to an inch in length, of an ovate or oblong lance-shaped form, deeply cut and more or less toothed, the surface shining as if polished. The lower pair of arms grows proportionately larger than the rest, and is often upwards of a foot long. One of the lower branches of a small leaf, now before me, just gathered (Nov. 29), has upwards of sixty of the small jagged leaflets, though it measures no more than 8 inches in length. The appearance of the immense tuft formed by the full-grown foliage, the innumerable shining leaflets hanging in varied curves, and glistening in the light-beams, is very pleasing, even when the majestic flower-stalk is absent. The latter, too, in every stage of its progress is curious and interesting—at first from the manner in which the inflated powdery petioles of the stem leaves ensheath the growing point, and become in turn unfolded; and, finally, from the numerous branching umbel-bearing arms, a foot or more in length, diverging from the stem in each direction, and ornamenting the upper 4 feet of its height with large heads of yellow blossoms, which, though individually simple, are conspicuous in the mass.

Ferula glauca, with the stature, habit, and general characteristics of the last, has altogether a different appearance in consequence of the different composition of its foliage. Instead of having oval or lance-shaped leaflets, its leaves are cut up into narrow linear, that is, longish narrow segments. The mass of the foliage is therefore less bold, but more compound, each of the linear leafy segments in this species corresponding with one of the teeth of the leaflets of the Tangier species. In the flowering stems there is no striking difference; but, nevertheless, from the distinctness of their leafing both species may be planted with advantage wherever there is space for them.

These Ferulas have large, deeply-penetrating, fleshy roots, and are perfectly hardy, as the fact of their continuing to grow unharmed through the winter abundantly testifies. In the light gravelly soil of this garden they flourish admirably, and in dry seasons, when from the very nature of the soil almost everything else becomes parched and withered, these Ferulas are found to stand unaffected to any extent, probably in consequence of the depth to which their roots naturally penetrate, and to which the subsoil offers no obstruction. They *may* be transplanted if the roots are taken up without being much broken or injured, but this condition is not very easily fulfilled, and they are better left undisturbed. For the same reason, though they might no doubt be occasionally propagated by the common process of division, if care were taken, and the wounds dried before replanting, this mode of increase is not to be recommended. When they produce flowers, seeds in abundance usually follow them, and from these they may be largely multiplied; but seedlings are some time in acquiring the strength to produce vigorous flowering-stems, such as are borne by old-established plants in a healthy state of growth.

These remarks have for their object to stimulate the dispersion from botanic gardens of some of the noble umbellifers, which are at present to be seen only, or but seldom, except in them; and to procure for these plants, some of the larger Ferulas especially, a general acknowledgment of the rank to which they are entitled in ornamental gardening. Flowers—gaudy colours—are too much relied upon for the decorations which art employs in the garden; while the grace of form or the nobility of aspect displayed by foliage and habit of growth, independent of flowers, are held in too little estimation.

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

1. Cheirostylis marmorata. *Lindley, in Van Houtte's Flore des Jardins*, July, 1848, t. 370. Dossinia marmorata, *Morren, in Ann. de Gand*, iv. 171, with a figure.

Presented to the Society, in 1848, by Mr. Hugh Low, of the Clapton Nursery.

One of the firm-leaved herbaceous Orchids, which have gained a place in gardens on account of the beautiful variegations of the foliage. In this case the leaves are of a deep reddish olive-green, with a velvety surface, and are traversed by fine golden veins, which disappear to a great extent when the leaves become old. It is far less beautiful than *Anœctochilus setaceum* or *Monochilus regium*—two orchids of similar habit. The flowers are white, with a reddish calyx, in a long, dark purple, downy raceme. Although destitute of striking beauty, they well repay a minute examination, being covered with pellucid glands, and frosted, as it were, over all the inner surface.

It requires to be grown in a damp heat, and in the orchid-house, and should be potted in a mixture of three parts chopped sphagnum and one-third well-decayed leaf-mould. It can only be increased when the plants are large, by separating portions of their creeping stems.

A kind well worth growing, where such plants are cultivated, on account of its fine, large, dark-coloured foliage.

Sept. 12, 1849.

2. Helianthemum scoparium. *Nuttall, in Torrey and Gray's Flora of N. America*, i. p. 152.

Raised from seeds, picked off one of Mr. Hartweg's Californian specimens, in June, 1848, and said to have been gathered on the Santa Cruz mountains.

A small, prostrate, dark green shrub, with nearly smooth wiry branches, and alternate linear leaves without stipules. The flowers, which are small and bright yellow, grow in twos or threes at the end of the branches on naked pedicels about half an inch long. The sepals are 3 oval acuminate, and 2 subulate. The petals are 5, oblong, blunt, wavy, twice as long as the calyx.

The seeds are about 12 in each capsule, angular, and minutely hispid.

There can be little doubt that this is what the North American botanists call *H. scoparium*, although the petals are not evidently cuneate, nor the seeds six in number and smooth. This garden-plant does not appear to differ from a small Californian specimen out of the late Dr. Coulter's herbarium, for which I am indebted to Dr. Harvey. Mr. Bentham also considers Hartweg's plant to belong to this species.

A hardy little shrub, growing freely in a mixture of sandy loam and peat soil, requiring the same kind of treatment as Cistuses, and easily increased by seed, which is produced by the plant very freely.

It is a very nice dwarf plant for rock-work, on which it thrives in the full glare of the sun. For no other place is it suitable.

Sept. 18, 1849.

3. Cleisostoma fuscum.*

Received from the East India Company in 1846.

Leaves distichous, leathery, about 9 inches long by 1¾ broad, with a rounded emarginate end; flowers of a dull, dingy, yellowish brown colour, much like those of *C. latifolium;* in a close panicle, on a long, dusky peduncle, fleshy and numerous. Sepals and petals oblong, spreading, very obtuse; lip yellow, with a blunt sac; its front division ovate and flat, the side ones shorter, rounded, and erect. Inside the sac in front is a large fleshy callus, which projects into the cavity; the dorsal tooth is like that of *C. latifolium*, except that it is shorter and truncate, not bifid. Perhaps it ought to be regarded as a mere variety of it.

Nov. 3, 1849.

4. Hoya imperialis. *Lindley, in Botanical Register*, 1846, *under plate* 68.

Presented to the Society by Messrs. Veitch and Son, of Exeter, in 1848.

There are two varieties in cultivation of this noble plant: one with long, flat, sharp-pointed leaves, figured in the Botanical

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* C. *fuscum;* foliis oblongis distichis canaliculatis apice rotundatis emarginatis pedunculo elongato multo brevioribus, paniculâ parvâ contractâ brachiis basi nudis, floribus congestis subcorymbosis, sepalis petalisque oblongis obtusis, labelli 3-lobi laciniis lateralibus erectis rotundatis intermediâ ovatâ acutâ lævi; calcare intus anticè carnoso gibboso dente dorsali plano erecto truncato eroso.—J. L. An *C. latifolii* varietas.

[Hoya imperialis.]

Magazine, t. 4397; and the present, with shorter, blunter, and wavy leaves, which is what was originally described. Both have large fleshy flowers, greenish on the outside, and stained with deep purple all over the inside of the corolla, the coronet remaining straw-coloured, and they are among the finest of the stove-twiners in cultivation. If the purple of the corolla were more brilliant, they would be almost unrivalled.

A strong climbing plant, growing freely in a mixture of sandy peat and leaf-mould, if placed in a strong moist heat. It is easily increased by cuttings in the usual way, and flowers freely at different times all the summer and autumn.

A fine shrub for places where there is plenty of room up the rafters, in the stove, or it may be trained round a trellis in a pot.

Sept. 4, 1849.

5. Calboa globosa. Morenoa globosa, *Llave and Lexarza*, *Nov. Stirp.*, *fasc.* ii. p. 5. Quamoclit globosa, *Bentham*, *Plantæ Hartwegianæ*, No. 603, p. 89.

Raised from seeds received from Mr. Hartweg in January, 1846, said to have been collected on the eastern declivity of Orizaba in Mexico.

A rambling perennial, smooth in every part. Leaves thin, dull green, on long stalks, extremely variable in form; some are cordate and acuminate; others sagittate; others completely hastate, with the lobes all narrow, and the lower ones deeply angular. The flowers grow in naked umbels, on a peduncle 9 or 10 inches long; the pedicels are from 1½ to 4 inches long. Each sepal has a long subulate process at the back. The corolla is 2½ inches long, deep rich red, with a curved cylindrical tube, and a campanulate erect limb, divided into 5 erect rounded wavy lobes. The stamens are declinate, and longer than the corolla.

This very curious plant was referred to Quamoclit by Mr. Bentham, but it appears to be perfectly distinct from that genus in its declinate stamens, and curved corolla with a great campanulate inflated limb. Whether or not there may be more than one species is somewhat uncertain. The Calboa vitifolia of Cavanilles, from St. Blas in California, is figured by that author with 5 long distinct reflexed segments to its corolla, which is said to be yellow on the outside, and purplish red in the inside. If so, it must be distinct from this. The plant in the Society's garden is undistinguishable from the Guatemala specimens brought home by Hartweg, and yet it was raised from Mexican seeds. This gives rise to a suspicion that Cavanilles' account is not to be trusted, and that there may be only one species; if so, it will bear the name of *C. vitifolia*.

A strong half-woody climber, growing freely in any good

[Calboa globosa.]

rich soil composed of loam and sandy peat. It is easily increased by cuttings of the young shoots, and requires to be kept rather dry in a cool part of the stove during the winter, but should be grown in a cool airy part of the greenhouse during summer, where it will flower from August to October.

Although undoubtedly a fine species, it is only fit for growing where there is plenty of room for its tops to spread. It will not flower in a pot, and must therefore be planted in the open ground.

Sept. 13, 1849.

6. TROPÆOLUM SMITHII. *De Cand.*, *Prodr.*, i. 684. *Botanical Magazine*, t. 4385. Tropæolum peregrinum, *Linnæus*, *Sp. Plant.*, ed. 2, p. 668.

From Messrs. Veitch and Son, whose collector, Mr. William Lobb, sent it from Peru.

[Tropæolum Smithii.]

A climbing annual, with smooth dark green five-lobed leaves, glaucous on the under side. The flowers grow singly from the axils of the leaves on very long stalks, are bright orange-red, with the petals divided at the edge into bristle-pointed teeth.

It is a very pretty species, which deserves to be more generally cultivated than it is. *March* 19, 1848.

7. Brasavola cucullata. *R. Brown, in Hortus Kewensis*, ed. 2, vol. v. p. 216.

Origin unknown.

This cut represents a flower of what I believe to be *B. cucullata*, almost lost in English gardens. It is pure white,

[Brasavola cucullata.]

and remarkable for the manner in which its long tail-like lip and other floral divisions fall to one side as soon as they are disengaged from each other in the bud. In the foliage there is nothing to distinguish the plant from several other species. If the old figure of the species in the Botanical Magazine, t. 543, is to be trusted, the lip must be subject to some variation in form; but we have no plant now in cultivation which corresponds with that figure, nor has such a plant been remarked by me in herbaria.

A neat little kind, more singular than ornamental.

August, 1848.

8. PENTARHAPHIA CUBENSIS. *Decaisne, in Annales des Sciences Naturelles*, Third Series, vol. vi., p. 108.

[Pentarhaphia cubensis.]

Native of Cuba, where it was discovered by M. Linden.

A plant was presented to the Society by Mr. J. A. Henderson, of the Pine-apple Nursery, in the Spring of 1849.

A shrub with a compact habit, and dark-green, convex, evergreen leaves, obovate, crenated near the point, and netted on the under side with green veins on a pale ground. The flowers grow singly in the axils of the leaves, on cinnamon-brown stalks an inch long. The corolla is about the same length ; tubular, curved and rich scarlet, with a projecting style. The calyx consists of five straight, narrow, sharp lobes, not unlike five brown needles, whence the generic name has arisen.

A dwarf shrub, requiring a temperature intermediate between the greenhouse and stove. It is easily increased by cuttings treated in the usual way, and grows freely in a mixture of loam, peat, and leaf-mould.

A very neat and pretty little plant, remaining a considerable time in bloom.

Aug. 4, 1849.

9. Pentstemon cordifolius. *Bentham*, *Scroph. Ind.*, p. 7. *De Cand.*, *Prodr.*, 10, 329.

Raised from seeds brought home by Mr. Hartweg in June, 1848, and said to be a shrub 4 feet high, from the mountains of Santa Ines, in California.

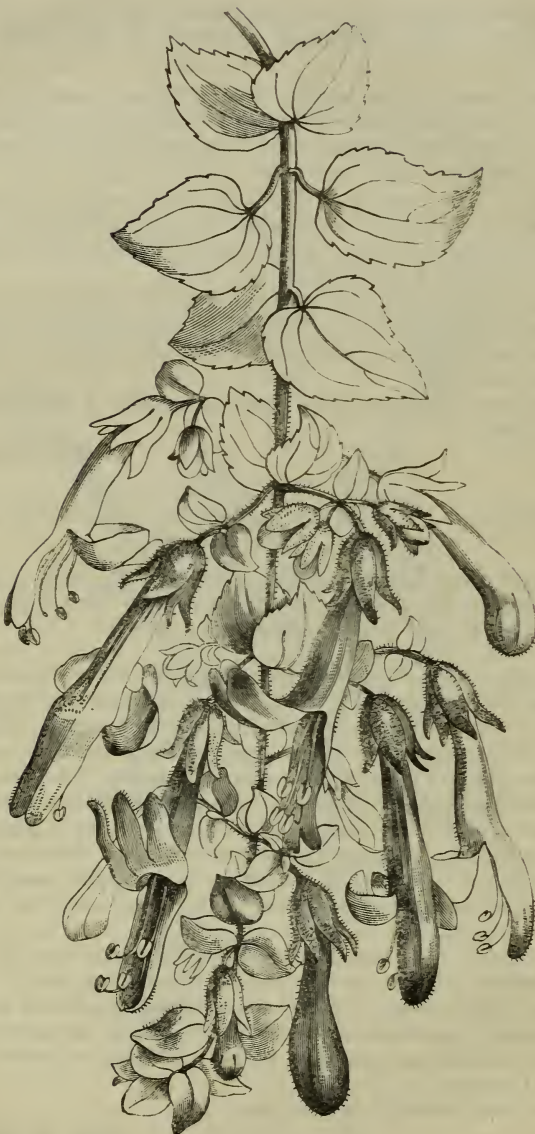
A downy-stemmed half-shrubby plant, with a trailing of spreading habit, so that it is well suited to hang down over stones or rocks. Leaves dark green, shining, cordate, serrate, slightly downy. Flowers in one-sided, narrow, leafy panicles, which sometimes measure more than a foot in length. The branches of the panicle are hairy, and bear each from three to five flowers when the plants are vigorous. Calyx covered with glandular hairs; corolla not quite an inch and a half long, rich dull red ; the tube almost cylindrical ; the upper lip straight, nearly flat, slightly 2-lobed ; the lower three parted, spreading at right angles to the upper.

It has so little the appearance of a Pentstemon that it may be expected to be regarded hereafter as a distinct genus.

A hardy little shrub, growing freely in any good rich garden soil, and easily increased by seeds or cuttings in the usual way. It flowers freely, one year from seeds, and lasts in flower from June to October.

It is a very desirable, hardy plant.

Sept. 12, 1849.



[Pentstemon cordifolius.]

ORIGINAL COMMUNICATIONS.

XI.—*Notes respecting a few Ornamental Winter and Spring Flowering Plants.* By George Fleming, C.M.H.S., Gardener to the Duke of Sutherland, F.H.S., at Trentham.

(Communicated March 2, 1850.)

As the value of winter-flowering plants cannot at any time be better appreciated than when the possession of them gives the greatest enjoyment, or the want of them is felt most acutely, I deem it a fitting occasion to make sundry recommendations as to what to prepare for a future season; and, in doing this, I hope to combine past experience with more recent ideas which have been suggested by reading, observation, or reflection, all being helped along together by necessity.

One common mode of proceeding is to make extensive use of hardy shrubs too early in the forcing season. The objections to this are, that the display produced by exciting plants at a season so very unnatural to them, is strikingly inferior to what they would create a few weeks later; and another objection is, that the plants, after being forced, must either be thrown away or else protected under glass until the season is warm enough for them to grow out of doors, which is a serious inconvenience; but by confining the use of such plants to a later period, their beauty and fragrance are greater, and after that is past, the temperate weather of spring, the period at which they would naturally begin growth, is so near at hand, that little difficulty is experienced in protecting them. We often hear of such plants as the Persian Lilac, Hyacinth, Moss Roses, Pinks, &c., being forced into flower early in January. Now, we know that when these plants have been previously well prepared for it they can be had as early as January; but they can seldom be kept under glass, and receive that attention which such early forcing renders necessary, and in nine cases out of ten they receive so much injury that it takes years to recover them. It is not reasonable to go to the expense of subjecting plants to too early forcing while so beautiful a display can be made by subjects which come into flower naturally during the winter months. For very useful plants during December and January I beg to refer the reader to List 1. The greater beauty of forced flowers, when only excited a few weeks before their natural time of flowering, is an inducement to make a better arrangement for future proceedings in these matters. Such plants as the Pink, Perpetual Carnation, Roses, &c., are most acceptable at all times; and as these are easily raised in any quantity, there is not so great an objection to a portion of them being subjected to the severe forcing they often receive. But in a general way, I am certain that much more satisfactory results would be obtained by exciting the majority of our favourite forcing plants only a short time before their natural period of flowering.

In the following remarks I have endeavoured to keep each plant to that portion of the winter when it can be made most useful with the least trouble. I have omitted many plants that are commonly used for the purpose of winter and spring decoration, but which are less beautiful than those selected; and I have passed over many which are condemned on account of the dull colour of their flowers, or the meagre appearance of their foliage, and others which, although winter is their season of flowering, do not blossom with sufficient profuseness to render them objects of interest. I think it preferable to grow only a *selection*, not a collection of plants, and thus obtain a greater display from the same quantity of glass; as we can afford to grow a larger number of those plants which are useful, and give them more room to display their beauties.

Subjoined are lists of plants which are really wanted, and generally easy of management. Those whose period of usefulness belongs to the earlier part of the winter, from the first appearance of frost to the middle or end of January, are marked 1; and others which serve to continue the display till abundance of flowers again greet us in the open air, are numbered 2. Many plants are useful during the greater part of both these periods, and are distinguished by the two numbers being affixed to their names.

In making these lists it is not expected that any one person will grow all the plants mentioned, but it is hoped that they may be useful in aiding parties to make a selection of such as will suit their particular circumstances.

List 1.

Plants suitable for Conservatory and Drawing-room decoration, which flower naturally during winter and early in spring, but which are either not adapted for forcing, or do not require it:—

Angelonia salicariæfolia	1	Cypripedium insigne	1
Cestrum aurantiacum	1	Acacia dealbata	1, 2
Chrysanthemum	1	——— discolor	1, 2
Epiphyllum truncatum	1	Begonia insignis	1, 2
Gesnera zebrina	1	——— fuchsioides	1, 2
Habrothamnus elegans	1	——— nitida, & several others	1, 2
Oxalis versicolor	1	Cineraria	1, 2

Clerodendron splendens	1, 2	Primula sinensis	1, 2
Codonophora elongata	1, 2	——— denticulata	1, 2
Cytisus fragrans	1, 2	Statice puberula	1, 2
Luculia gratissima	1, 2	Acacia linifolia	2
Canarina Campanula	1, 2	——— pulchella, & many others	2
Æchmea fulgens	1, 2	Begonia hydrocotylifolia	2
Daphne indica rubra	1, 2	Centradenia rosea	2
Dianthus perpetual	1, 2	Otaheitian orange	2
Erica hyemalis, &c.	1, 2	Brugmansia lutea	2
Genista ætnensis	1, 2	——— bicolor	2
——— canariensis	1, 2	Bilbergia iridifolia	2
Linum trigynum	1, 2	Pitcairnia flammea	2
Manettia bicolor	1, 2	——— angustifolia	2
Oldenlandia Deppeana	1, 2		

Bilbergias, Pitcairnias, and Achmea are Bromeliaceous plants, and require exactly such treatment as would suit the Pine-apple in pots.

Angelonia, the species of Begonias, Codonophora, or Gesnera elongata, Linum trigynum, Manettia, and Centradenia, should be raised from cuttings as early in the spring as possible, and at intervals during the summer; besides which the healthiest and handsomest of the old plants should be grown on again to form very large specimens, so that there may be plants of all sizes to suit the various decorative purposes for which they are required. Linum trigynum, though an old plant, is not so well known as it deserves; it is of very easy cultivation, and when it attains a large size nothing can be more beautiful. It may be truly called the Allamanda cathartica of the winter months.

Canarina is an elegant orange flowered greenhouse creeper of easy cultivation. Brugmansia bicolor and lutea are plants of easy growth, and are most ornamental when trained as standards. Luculia gratissima requires the temperature of a warm greenhouse during the early part of the year, after which it should be gradually hardened off to the temperature of the open air, where it should remain till the end of August. The Cypripediums are all beautiful, and easy to cultivate. The soil should consist almost exclusively of loam and broken crocks. They require to be confined in small pots to induce them to flower freely. Amongst hard-wooded plants Cestrum aurantiacum is a useful autumn flowering plant, and by picking the first crop of flowers off a portion of the plants, they are induced to continue in beauty till Christmas. Gesnera zebrina, if well grown, is beautiful for autumn and early winter, both in foliage and flowers; the tubers require starting in April, and after making their appearance above ground they should be potted at once into their flowering size. They will not endure the slightest check, and should therefore be grown steadily on in a brisk bottom heat with a moderate top heat. Epiphyllum truncatum is one of the most beautiful of our autumn plants, but it rather requires retarding than forcing. These plants do not require repotting every season, but when necessary, it should be done in May, and they should be placed in a favourable situation for making a new growth. When this is completed, they should be gradually hardened till they will bear full exposure to the open air, where they should remain till there is danger of frost: grafted on Periskea aculeata they make very elegant standards. Oxalis versicolor is a lovely little late autumn flowering bulb, if kept dormant till the middle or end of July; it requires the temperature of a warm greenhouse, where it must have full exposure to sunlight, as upon this the perfect expansion of its flowers depends. Acacia dealbata is most graceful in a large house, where it has room to form a small tree, and extend its graceful branches on all sides. It, and the other species mentioned, along with Cytisus, Genista, and Daphne indica rubra, require the usual treatment of hard-wooded plants, and to be kept in shape principally by pruning in the old shoots after flowering is over and before they begin to form new growths. The shoots of some of the strong growing Acacias, &c., will also require stopping during their growth, in order to equalise the strength of the plant; but this must never be done with Daphnes or other plants which produce their flowers on the points of the new shoots. Statice puberula requires no stopping; its soil should be rather rich and very open in texture. Winter flowering Heaths should be encouraged, and those who have time to spare for their propagation should attend particularly to these varieties, that they may be able to devote these beautiful plants to decorative purposes, and care less if some of them are destroyed thereby. Clerodendron splendens is well worthy of a place in every selection; it has a natural tendency to go to rest very early in autumn, and to start very early into growth again. It quickly produces short lateral shoots, with terminal racemes of beautiful flowers; it flourishes best in a strong porous loam. Oldenlandia Deppeana is a delightful little white-flowering plant, in appearance somewhat resembling white Forget-me-not; it is a plant of all seasons, for it never ceases to flower till it ceases to live. Temperature, that of a warm greenhouse; soil, peat and loam. Begonia hydrocotilifolia is an exception to its congeners mentioned above. The old plants require parting in spring, and repotting in leaf-mould and sand with a moderate admixture of loam. They should be grown through the summer in a warm frame, very close to the glass. The old plants of Primula sinensis should be parted in May, and after their roots have started afresh in a warm frame, they should be placed in a cooler one close to the glass. Three sowings should be made—in the end of March, the middle of May, and the end of June—to secure plants of various sizes; all the plants should be shifted into larger pots as fast as they need it. Old plants should be grown entire to form large specimens, unless in the case of the double varieties, which it is desirable to increase by division. As these plants are very liable to damp off in autumn and winter, they require perfect drainage, very porous soil, and careful watering. Chrysanthemums and Cinerarias are of such easy cultivation that it seems unnecessary to make any special reference to them.

List 2.

Plants, suitable for Conservatory and Drawing-room decoration, which flower naturally during winter and spring, and which may be induced to flower somewhat earlier by a slight forcing, or, in the case of hardy spring-flowering Plants, by simple protection under glass:—

Cytisus filipes	1	Pelargonium	1, 2
Eranthemum pulchellum	1	Pyrus japonica	1, 2
Euphorbia fulgens	1	Reseda odorata	1, 2
Franciseeas	1	Richardia æthiopica	1, 2
Helleborus niger (in pots)	1	Roses	1, 2
Poinsettia pulcherrima	1	Violets	1, 2
Amaryllis	1	Acacia armata	2
Veltheimia viridiflora	1	Caprifolium (Honeysuckle)	2
Abutilon venosum	1, 2	Cistus	2
Camellia japonica	1, 2	Cytisus Laburnum	2
Collinsia bicolor	1, 2	——— purpureum	2
Epacris	1, 2	Kalmia	2
Epiphyllum Russellianum	1, 2	Magnolia (several handsome sps.)	2
Gesnera Cooperi and Douglasii	1, 2	Viscaria oculata	2
Gloxinias	1, 2	Weigela rosea	2
Jasminum hirsutum	1, 2	Dendrobium nobile	2
Mimulus moschatus (Musk)	1, 2	Jasminum nudiflorum	2
Nemophila insignis	1, 2		

For the treatment of Cytisus filipes and Acacia armata, I must refer to remarks concerning plants of the same genera in List 1. Eranthemum pulchellum, Euphorbia, and Poinsettia should be treated as the Codonophora and similar stove plants. The Euphorbia does not like too much water, and therefore the soil must be very open and well drained; and to prevent extremes of drought or moisture they should, if possible, be always plunged. The soil for these plants should be loamy and rich. Abutilon venosum is a beautiful plant, which, though not generally known, should find a place in every collection. It is easy of cultivation, requires very liberal treatment, and the temperature of a warm greenhouse. Jasminum hirsutum is without doubt one of the most charming plants for this season; it may be propagated by cuttings of the half-ripened shoots or by pieces of the roots. As it preserves all its foliage, none of the shoots should be stopped; but by frequent repotting, open moderately rich soil, bottom heat, and occasionally rich water, the plants should be induced to grow with extraordinary vigour. Last year it produced shoots several feet in length, and as it throws out a succession of flowers almost at every axil, they have several times through the winter formed perfect wreaths. It is still very beautiful. Francisceas are among the few hard-wooded stove plants which are of any value in winter. They are fragrant and beautiful.

And as the flowers are produced on the young shoots, potting, and any pruning necessary for keeping the plants in shape, should be done before they are excited into growth. After the flowering is over, the plants should be kept in a warm temperature till their growth is completed, and then as the ripening process goes on, they should be gradually hardened off till they will bear full exposure during the greater part of autumn ; but as it is well to prevent their roots being saturated while their tops are dormant, they should be placed in a very airy greenhouse, where the side lights are open night and day. The Richardia (Calla) Æthiopica is one of the most useful plants in this section on account of the classic beauty of its leaf combined with the purity of its flowers. After their season of growth is over, and the foliage is perfectly ripened, they require a short season of rest, from which portions of the stock should be disrooted and potted as they show signs of growth, so as to secure a successional supply without having recourse to forcing, which renders the leaf-stalks too weak to support themselves, and thus deprives the plants of a great part of their beauty ; the pots used need not be large ; I have at this time handsome plants in 7 and 8-inch pots, which enable me to make use of them in filling small ornamental vases. The soil should consist of strong rich brown or yellow loam, mixed with road grit and broken crocks. In shaking out the old plants all the buds should be rubbed off, except the central one which is to form the plant. After potting, they should be placed in a cool vinery or similar situation, where they will come quietly on ; and as soon as they begin to grow they should be supplied abundantly with water.

Gesnera Cooperi is a plant easily excited into growth at any season, and is therefore particularly useful. If ripened off after the previous growth by the middle or end of August, it may be repotted and excited in the beginning of October. It requires little more than rich soil mixed with charred refuse, and a moderate bottom heat. The Gloxinia is generally considered a summer flowering plant, but those which were ripened very early should be started along with Gesnera Cooperii, and similarly treated. Young plants propagated from leaves in June, and grown briskly on, flower very nicely in 5-inch pots in February. Epiphyllum Russellianum is a later flowering species than truncatum, and is beautifully adapted for small vases which are placed rather above the eye. Of the varieties of Camellia japonica, it is scarcely possible to confine my remarks within sufficient brevity, and as treatises on the subject are plentiful, I must refer my readers to them. Of Pelargoniums for winter and spring flowering, the fancy varieties take the lead; and as they are so admirably adapted for flower garden purposes, as well as for summer display in the greenhouse, I cannot do better than recommend their very extensive propagation. As they have such a tendency to produce flowers on very short shoots, it is necessary, for the purpose of obtaining a supply of suitable cuttings, to grow a few plants of each variety in very rich soil, and to divest them of flower-buds as soon as they appear. It is still useful to grow a few plants of the old forcing kinds, as Napier and Multiflora alba, to produce flowers for glasses, as a sufficient length of stalk cannot be cut with the blossoms of fancy kinds without destroying successional buds. There are several hardy annuals which are very useful if a little pains is bestowed on them. First of these stands Mignonette, but as we cannot spare much room for individuals, I shall merely say, in passing, that dependence should not be placed upon one sowing, made on any special day, as much depends upon the peculiarities of the season. We make three sowings here—in the beginning, middle, and end of August; if the earliest comes in too quickly, the flowers are pinched out as soon as they are distinguishable, by which the plants are considerably strengthened. The soil should consist of moderately light loam, rendered porous by the addition of some clean road grit; a little leaf-mould may be added, if reliance can be placed upon its being free from insects, which are very injurious to the young plants. The plants should be occasionally watered with soot-water, and to give them additional strength, a little weak guano-water will be very useful. If they are very much cut from during the winter, a sowing should be made about the middle of February, to precede the earliest sowing in the open air. Nemophila and Collinsia bicolor are also useful for flowering in spring, in 5 or 6-inch pots. The seeds should be sown at the same time in which the two last sowings of Mignonette are made, and should receive the same treatment, except that the soil may be rather richer, and, as they are very hardy, a cold frame will be ample protection for them at all times. They will not need manure-water till they begin to expand their flowers. Viscaria oculata is a beautiful thing for flowering in pots late in spring. They should be raised from seed in the end of July or beginning of August, and transplanted into 5-inch pots, three in each, as soon as they are large enough to handle. They should be grown very hardy by giving abundance of air.

I must conclude this section with a few remarks on the hardy plants it contains. These may all be made very useful if not subjected to excessive forcing. If it be possible to command such a convenience, a large very light frame or pit should be devoted to preparing them for a slight forcing; from this it is merely necessary to exclude frost, and to give them abundance of air in fine warm weather. The plants should be placed in such a situation a few weeks before even the slightest forcing commences, as the sap will then be gradually set in motion, and the buds will begin to swell. If this course be pursued, and the transition to the forcing-house be gradual, the results will be most satisfactory, as the plants will be more healthy in appearance, and the flowers will be finer, larger, and better coloured. All the plants intended for this purpose should if possible be grown in pots the whole of the season previous, in order that their roots may be thoroughly established, and avoid the check produced by taking them up out of the ground as they are wanted. They should be potted in rich soil, and plunged in a bed of ashes in an open, sunny situation during the growing season, and where they may remain till they are removed to the preparatory frame. The plants referred to in these last remarks are Pyrus japonica, Honeysuckle, various species of Cistus, the Yellow and Purple Laburnum, Kalmia, Magnolia, Jasminum nudiflorum, Weigela, and Roses. Of the latter, the most useful kinds are the Chinese and the Fairy for autumn and early winter, and Moss, Provins, and Tea-scented Roses for late winter and early spring. The Hybrid Perpetual and Hybrid Bourbon varieties, in the open ground, would continue to flower at intervals through the winter if simply protected from cold and wet; and are therefore excellently adapted for pot culture, if immoderate forcing be avoided. If Magnolias are grown into nice pyramidal bushes, they are very ornamental, as they flower freely. Amongst the most useful varieties may be mentioned Conspicua, purpurea, Soulangeana, Thompsoniana, acuminata, Hammondii, speciosa, and Norbertii. Helleborus niger is a winter flowering plant in many localities, and merely requires the protection of a cold frame in more unfavourable ones. Musk is easily excited into growth, and as many are partial to its fragrance, a few roots may be potted and placed in the several houses. Violets are everybody's favourites, and with a little attention in preserving them from red spider, they are of easy cultivation. Runners planted in May, on a bed of rich loamy soil behind a north wall, require no further attention till they are taken up and potted early in September, or planted in a frame from which frost can be excluded. The Neapolitan and the double Blue Tree Violet are the best varieties. The noble flowers of the many coloured varieties of the Amaryllis entitle them to a place in every collection of winter flowering plants. Their cultivation is very simple ; they merely require good soil, a moist growing atmosphere, and a moderate bottom heat—a season of growth and afterwards a season of rest. Veltheimia requires the same treatment.

I have not included many Orchids in my list, but I cannot omit to recommend Dendrobium nobile. Its cultivation is easy ; it requires liberal pot-room, and while it is making its growth, a very hot *moist* atmosphere ; after that is completed, it requires a hot and *dry* temperature to induce the formation of flower-buds, and a dry and moderately cool situation to expand them in.

List 3.

Plants, suitable for Conservatory and Drawing-room decoration, which naturally flower later than these, but which will endure harder forcing than those mentioned in List No. 2.

Azalea indica	1, 2	Gardenia Fortunii, &c.	2
Bletia Tankervillia	1, 2	Amygdalus persica plena	2
Anna Boleyn Pink	1, 2	Cerasus japonica multiplex	2
Pæonia moutan	1, 2	Convallaria majalis	2
Rhododendron hybrid	1, 2	Common Pinks	2
Tulips, Hyacinths, &c.	1, 2	Hydrangea japonica and hortensis	2
Wistaria sinensis (standards in pots)	1, 2	Rhododendron ponticum and Catawbiense	2
Azalea belgica	2	Syringa chinensis and persica	2
Gardenia radicans	2	Viburnum Opulus (Guelder Rose)	2
——— florida plena	2		

As soon as the plants of Bletia Tankervillia (Phaius grandifolius) have done flowering, they must be repotted in a compost, consisting of strong turfy loam, rough peat, sand, and broken crocks ; first removing as much of the old soil as can be got away without injuring the roots. After potting, the plants should be plunged in a moderate bottom heat, with a moist growing atmosphere, which, as the season advances, must be gradually raised till their growth is completed ; after that the temperature should be gradually reduced to that of a warm greenhouse ; from this the plants may be removed to the forcing-house as they are required. Gardenias require the ordinary treatment of hard-wooded stove plants. The soil in which we find them grow best, is rough, sandy peat and reduced cow-dung, with a small proportion (say one-fifth) of loam. Perhaps the most useful of all the plants enumerated are the numerous varieties of Azalea indica and Hybrid Rhododendrons. To enter into a detailed account of their treatment would occupy too much space in this notice, so I will merely recommend that repotting be done in autumn, immediately after the flower buds are set, rather than in spring, just when the young growths are commencing. The latter is the method commonly practised. The varieties of Belgian Azaleas, with those of Rhododendron ponticum, are very useful, and give hardly any trouble, as they need not be taken up and potted till their buds are fairly set; thus giving an opportunity of selecting those which are the best furnished. In forcing this, and the other hardy shrubs mentioned in the above list, the same course should be pursued as recommended for similar plants in List 2. Wistaria sinensis is a charming plant, often grown on the walls or pillars of conservatories; but the handsomest way of growing it is as standards in pots, about five feet high: it is easily induced to form nice heads. The treatment of Tulips, Hyacinths, and other Dutch Bulbs, is well known. The Lily of the Valley forces well in a frame near the glass, with a gentle heat beneath it. Anna Boleyn and other Pinks are very useful: for forcing the cuttings from which they are raised should, if possible, be taken from plants which had been similarly treated, as they are earlier and complete their growth much sooner, thereby fitting themselves for early flowering. If the plants in the open garden are layered very early, and some of the strongest of the young plants potted into a light rich soil, they will throw up flower stems in October and November.

In the foregoing remarks I have only noticed the peculiarities necessary in the treatment of different species, and, to avoid repetition, I consider it better to conclude with an abstract of principles which are of general application, and which must be carefully observed in order to obtain perfect success.

As the season in which these plants are to produce their flowers is, of all others, the least favourable for the healthy development of vegetables, it is necessary that, in the course of their previous cultivation, one object should be kept constantly in view, namely, the hardening of their constitution, so as to fit them to endure winter excitement. This is to be effected only by a very careful consideration of the treatment which is necessary to grow them vigorously, but not exuberantly; carefully supplying the agents —light, air, heat, water, soil, &c.—in adequate proportions; avoiding deficiency on the one hand, and superfluity on the other. One point, which will contribute very essentially to success, is to encourage the roots to progress rather faster than the tops, so that they may always be in advance of the latter.

Light.—With comparatively few exceptions, light cannot be too freely supplied, unless in the shape of very bright sunshine;

or which reason plants grown under glass should be placed as near the latter as possible, in order that they may have all the light that can be obtained in dull weather; and when the sun is too powerful they must be protected from it by a thin shading, so fixed that it can be quickly drawn down or rolled up with facility. Shading should only be tolerated at any time as an unavoidable evil, rendered necessary in some measure by the artificial treatment which the plants receive; and that the necessity may be reduced as much as possible, their natural requirements should be our constant study. As the natural habitats of plants embrace every variation of shade and exposure, we must provide situations which vary in a similar manner; but to decide upon the proper position for each plant a very watchful eye is necessary. The rate of growth, whether scalded or lanky, or sturdy and vigorous, must be carefully noted, and the plants exposed to all the sunlight that they will endure uninjured. The houses, pits, or frames, in which the plants are placed when being excited into growth in winter, should be of the lightest description, in order that the small quantity of light obtainable at that dull season may be made the most of. The glass should be kept perfectly clean, the whole of the interior of the house should be painted or coloured white, and the plants placed upon or plunged in white sand, that the light may be reflected amongst the foliage. It is impossible that the plants can derive the full benefit of the sun's influence if crowded together, as is too commonly the practice; it will, therefore, be well to consider the importance of placing the plants so far asunder that the direct rays of light can fall unimpeded upon the greater portion of each plant; and those intended to be seen on all sides should be frequently turned round, in order that all parts of the plants may have an equal share of light. But although the plants themselves should be so sparingly shaded, it is important that the sides (not the surfaces) of the pots should be carefully guarded from the scorching rays of the sun. When the plants stand on stages this may be managed by making the tops of those of one row shade the pots of the row immediately behind them; or, if arranged upon a flat surface, the pots should, if possible, be plunged, by which the sides are protected from excessive drying without the plants being crowded together.

Air.—It is only by the liberal use of this agent that plants can derive the hardy character so necessary to a successful endurance of their winter excitement. The quantity of air must be regulated by the state of the weather, and the temperature required for the growth of the plants; but at all times a sufficiency should be admitted to produce a circulation, and as much more as can be given without starving or checking the plants. Cold draughts must be carefully excluded; and to prevent the injurious effects of these, when it is necessary to admit a large volume of air, the ventilation should be so arranged that the current shall come in contact with the surface of the pipes or flues before it is diffused amongst the plants. Under artificial excitement it is especially necessary that they be liberally supplied with air, or they will not so well endure the removal to where their beauties are to be exhibited, nor will their flowers be so fine, either in size, colour, or durability.

Water.—Under this head I must say a few words on liquid manure, which is useful either in stimulating the progress of free growing plants, or in assisting them during the development of their flowers, especially when the pots are very full of roots; taking care, however, not to use it too strong or too often. For the purpose first mentioned, twice a-week is ample; and for the latter, once a-week should never be exceeded. The liquid which soaks away from common farm-yard manure, with some soot added, is the cheapest: but if such is not attainable, recourse must be had to guano. One pound of genuine guano to 30 gallons of water, and some soot (say a spadeful), tied up in a piece of coarse cloth to prevent it from swimming on the surface of the water, will make a liquid manure fit for any gross-feeding plant. In recommending soot I feel certain that, although little cared for, it is one of our best manures; and, as insects perish where it is employed, it is also valuable on this account. In using the guano and soot-water, draw it off as clear as you can get it, for if used in a turbid state it leaves a very unsightly sediment on the surface of the soil. With regard to the general watering of plants a few suggestive hints may be given; but to know when water is necessary and when it is not, requires considerable experience. A judicious waterer must have the exact present condition of the plant before his "mind's eye;" this will include not only the state of the soil as regards moisture, but the activity or dormancy of both top and root; and whether it has been recently potted, or is much in need of it. All these points require careful consideration; and as the situations in which different plants flourish in their native climes include every variation, from the arid desert to the stagnant marsh, the cultivator must take every means of informing himself of their natural habits, that he may proportion the supply of water accordingly.

I could scarcely adduce a more potent argument than this for showing the advantage to the Horticulturist of an acquaintance with the laws of *Vegetable Physiology.* This study not only gives him correct notions of the structure of plants and the functions of their several organs, but it aids experience in teaching him to judge from the physiognomy of the plants what kind of treatment is most likely to be suitable to each individual species.

While upon this part of my subject, a few words should be said upon atmospheric moisture. This is essential to plants in general, and is abundantly supplied to them in their natural state. If the structures in which the plants are grown are heated by fermenting material, the evaporation arising therefrom is generally sufficient; and notwithstanding the preference we give to hot water as a heating medium, especially in winter, on account of the facility it affords of preventing too damp an atmosphere, and the general cleanliness and economy connected with it, we always find quick-growing plants thrive much better when exposed to the gaseous exhalation from leaves and dung in a fermenting state. When this cannot with propriety be introduced, the deficiency as regards moisture must be supplied by means of evaporating troughs, accompanied by gentle syringings in fine weather.

Heat.—This is an agent which must be used with great care, giving enough to ensure healthy growth, but avoiding any excess which will produce a weak, elongated shoot. Mild bottom heat is a great aid to plants, when the means exist of applying it, as the roots are thereby kept in advance of the tops; the temperature of the soil should never be more than ten degrees higher than that of the atmosphere. In forcing plants into flower, the excitement should be as moderate as possible, scarcely sensible at first, and increasing very gradually in proportion to the top heat, which will be regulated by the state of growth.

Soil.—A few general remarks on this head will not be out of place when so many different plants are concerned. In the selection of loam (when a choice is offered) as far as colour can be a guide, choose that which approaches yellow or brown in preference to red, which contains a greater proportion of iron. The next thing which should be examined is the quantity it contains of clean sand, and consequently of fibre, selecting that which contains the greatest quantity of turfy fibre without being impoverished by the roots of trees. The advantage of the fibry matter is in assisting to keep the soil in an open, pervious state, and to secure a greater proportion of it, the turves should be pared off not more than from 3 to 6 inches thick. It should be cut in winter and turned with the grassy side downwards, to be acted upon by the frost; and all turf which cannot be so exposed should be charred or baked, sufficiently to destroy both animal and vegetable life. By the latter means the annoyance of weeds is got rid of, and all plants that I have tried in charred soil root much more freely in that than in the same uncharred. Peat is a material which varies very much in quality, and in its consequent usefulness for pot-plants. The best is obtained where the native varieties of the heath flourish in wild luxuriance. Two qualities are useful; one from where the Caluna vulgaris grows finest; such ground is generally damp, and the peat consists of a very fibry mass of decayed sphagnum, heath, and other vegetable matter, containing only a moderate proportion of sand. This, after being baked or slightly charred, and mixed with an additional quantity of sand, is applicable for the softer wooded heaths, and for mixing with loam, leaf-mould, or dung for other plants, but not for the hard-wooded varieties of heaths and other fine-rooted plants, for which a much better material is necessary. Those who are acquainted with that obtained from Wimbledon Common need no further description of what constitutes good peat; but, where this is not procurable, that should be selected which contains a large proportion of sand with much vegetable fibre. The best peat I ever met with was obtained from a moss over white freestone. Leaf-mould should be thoroughly decomposed before it is used, and the insect tribe which it contains destroyed by warming the soil thoroughly on a proper iron kiln. Good sand is a desideratum, not only for propagating purposes, but also for mixing with composts. Its qualities are fineness, sharpness, and absence of argillaceous, calcareous, or metallic admixtures: these impurities are removed by washing, and for this reason sea, river, or drift-sand is preferable to pit-sand; but when only the latter can be procured, it should be cleansed by hand-washing before it is used for delicate plants.

A few words on manures will close this section. Our motto is, always to make soil as rich as the plants will bear without injury, remembering that as solid manure has a tendency to render the soil cold, close, and heavy, sand or other porous material must be added in proportion. Many plants are too delicate in their habits to admit of crude manure being mixed with the soil, and to such we prefer giving all that is necessary in a liquid shape, while they are growing most vigorously. Manure for mixing in soils should be thoroughly decomposed by being laid into heaps for several years and cased over with soil, charcoal, or some other absorbing substance, to prevent the escape of gases, first mixing with it some soot to destroy insects. During the winter before it is used it should be opened out and turned over several times to equalise the quality, and to expose it to the action of the frost. In mixing composts for pot-plants, the proper proportions of sand and manure should be rubbed together, and thoroughly incorporated, before the rest of the material is added; the sand aids in finely comminuting the manure, and allows of its being diffused equally through the soil.

Some animal manures are very strong, such as pigeon or hen-dung, and should be used very cautiously.

Training, &c.—In this matter carefully avoid formality; endeavour to give the plants support without distorting them. Let it be an object to make the lower branches of all dwarf-growing plants conceal the rims of the pots, but permit the upper ones to retain in a great measure their natural habits, assisting the slender branches with stakes, in such a manner as to form plants of symmetrical appearance, and occasionally stopping such shoots as are unduly taking the lead, or where it is desirable to induce a more bushy habit.

XII.—*On the Cultivation of the Cauliflower.* By Henry Baily, C.M.H.S., Gardener to G. Harcourt, Esq., at Nuneham Park, Oxon.

(Communicated February 12, 1850.)

"Of all flowers," said the great lexicographer, "give me a cauliflower;" and although the public taste has been much elevated by the exhibitions of rare and beautiful plants, which are now so general, still there are not wanting converts to Dr. Johnson's opinion. A large and regular supply of this delicious vegetable is indispensable in large establishments, and woful is the lot of the unhappy gardener who limits the demands of the inexorable *chef de cuisine.*

To detail a mode of culture which has been found to answer in yielding an ample supply of this favourite "flower" may not, therefore, be foreign to the objects of the Horticultural Society, which, while it cherishes the *dulce* of gardening, professes not to overlook the *utile* of the art.

It is not proposed to retrace the steps of our old authors on gardening by a compilation from their works, when treating of this useful vegetable, but to offer some hints which are altogether at variance with old and empirical usages, and this with becoming deference.

To commence, then, with the course of cultivation, it may be proper to observe that I only grow the true Walcheren. It is a kind that many have as to name, but few in reality. It is remarkable for its bluntly-rounded and broad leaves, and the closeness and almost snowy whiteness of its flowers, even when grown to a good size.

The first sowing for the spring crop is made about the 25th of August, and another for smaller successional plants a week later, upon an open border. As soon as the plants are large enough they are transplanted (in the phraseology of gardeners, "pricked down"); and as soon after this as they have made a few roots, they are again transplanted into small pots, called "sixties;" they are then placed in any open, airy situation (either a frame, vinery, or peach-house, which is dormant), simply requiring protection from severe frosts; as they fill the pots with roots larger ones are provided, and early in February the first crop, or handlight division, is planted out in a south border; the holes for their reception having received a barrow-full of rotten dung, the mould is returned, forming a little hillock, on which three plants are placed, and covered with the glass till they begin to be established. The smaller plants are reserved for a successional crop, potted into larger-sized pots, and placed in temporary frames covered with mats in severe nights, but fully exposed in mild, genial weather. This crop is generally planted out in the alleys of the asparagus beds, completes its growth before the tops of the asparagus become too high, and then has its duration prolonged by the shade of its branches.

For the next crop in succession I sow in pots about the middle of February, subjecting the plants to the same routine of potting, &c. Other sowings are made at intervals between this and the 20th of May, when the last crop is sown, which should be planted on a south border for autumn use, extending up to Christmas with protection. For the February supply an early White Broccoli, grown by Mr. Wilmot, of Isleworth, is invaluable. It is sown the end of May, and should be taken up and protected in a cool vinery, as our winters will not admit of the production of cauliflowers at that season as the fine climate of Naples does.

The roots should never be allowed to get matted in the pots, or the plants to suffer any check. It will readily be conceded that our object in the cultivation of those culinary vegetables whose stems, leaves, or flowers are eaten, is to grow them in the most rapid and luxuriant manner, avoiding (as with the pine-apple) any check at any period of its growth: any curtailment of those resources of plants which have a tendency to increase their luxuriance, and consequently render them more tender, must, therefore, be detrimental, and it is to avoid checking the growth of the plant that the practice of potting is adopted. In dry weather, when plants are drawn out of the seed bed, and planted with a common dibber, receiving daily dribblings of water, many will perish, and all are materially injured. By the mode I have described this is avoided, and labour saved in the end; after planting out, a copious watering is given, either in the evenings of bright days or in dull and cloudy weather, when it is not rapidly evaporated.

All the class of vegetables alluded to are what we term gross feeders; the soil can scarcely be too rich for them, and they are benefited by the application of liquid manure.

The intelligent gardener will always adapt means to obtain a desired end. In the culture of those plants in which the fruit is useful, he will appreciate the value of salutary checks to excessive vigour. He will see the value of transplanting early peas, as a means of inducing early and great productiveness; with a knowledge of first principles he will unite the habit of close observation, by which means only the greatest excellence is attainable in the culture of fruit or vegetables.

XIII.—*Will Tubers Grow after the Destruction of the Leaves of a Plant?* By John Lindley, Ph.D., F.R.S.

In the summer of 1849 the Belgian Government communicated to H. M. Minister at the Court of Brussels a statement by M. Tombelle Lomba, of Namur, that he had saved his crop of Potatoes from disease every year by cutting off the stems after flowering, and whilst yet fresh and green, and then covering the ground with earth to the depth of about 1½ inch; the top dressing thus applied not being disturbed till the potatoes were ripe.

Lord Howard de Walden having caused further inquiries to be addressed to M. Lomba, an extract from his reply was given in the 'Gardener's Chronicle,' July 7, 1849, in the following words:—"I can state in the most formal manner, that when the potato stems are cut off with a sickle properly sharpened, the tubers are not at all interrupted in their growth; that they remain attached to the stem until they are ripe, just as if the haulm had not been removed; and that they acquire as large a relative size as potatoes which have not undergone the operation. I have so often observed this continuation of growth, that I can speak positively to its going on without the slightest interruption, and that the treatment which I have recommended is not attended by any loss whatever of size or quality. It is only necessary to take great care that the instrument employed in cutting off the haulm shall be so sharp that the stems may be separated without disturbing the roots. It is also proper that the stems should be removed from the ground immediately after being cut off; and especially that no time should be lost in covering the surface of the ground with a layer of earth at least half an inch thick."

With a view to testing the constancy of this fact Mr. Thompson was directed to repeat M. Lomba's experiment; and he reports as follows:—"In the beginning of July, 5 rows of Jersey Blues were cut close by the ground when in flower, with a sharp knife; and the ground immediately covered over with soil as recommended. Besides these, the north half of a row was cut over and covered in the same way, whilst the south half was left; and another row had the south half cut over, its other half not. In short, due precautions were taken to insure a fair result. On the 30th of August the rows cut over were dug up, and the produce weighed and compared with that from adjoining rows of Jersey Blues of which the stems had been allowed to remain. The rows were $2\frac{1}{2}$ feet apart, and 24 feet in length. The average sound produce of rows cut over was 4 lbs. $5\frac{4}{10}$ ozs., which is at the rate of 1 ton 8 cwt. 19 lbs. per acre. The average sound produce of rows not cut over was 28 lbs. $9\frac{1}{2}$ ozs., which is at the rate of 9 tons 7 cwt. per acre. Hence, the difference in favour of stems *not* cut down amounts to 7 tons 18 cwt. 93 lbs. per acre. With regard to diseased tubers, there were none in the rows cut down. In the rows not cut down the diseased portion averaged 13 ozs. per row, being at the rate of 5 cwt. 29 lbs. per acre.

"It may be proper to observe that the potato plants experimented upon had not been earthed up, so that they were cut over by the ground-level. On taking them up, it was found that the portion of stem left under ground was quite dead. In some cases a fresh shoot had pushed; and such shoots were found to be making fresh roots, and commencing to form runners for tubers; of course these would be too late for attaining either size or maturity of any importance. Their tops were fresh; but had no living connexion with the tubers that had been formed from the original stems. These first-formed tubers were small, but firm and sound. Their growth must have been almost entirely arrested by the cutting down of the stems. The soil was dry. In former years, in moister soil, I have observed, since the disease commenced, that the tubers in many cases increased considerably in size after the total, but premature, decay of the tops.

"The results of the experiment are unfavourable to the proposed method of cutting off the stems; for although the tubers from the plants deprived of their foliage were sound, yet they were obtained at the loss of more than five-sixths of the crop which would otherwise have been produced.

"On referring to vol. iii. p. 180 of this Journal, it will be seen that some experiments were tried in the Society's Garden in 1846, with reference to cutting off the stems as soon as disease manifested itself upon them. It was found to have a somewhat beneficial effect where the tubers had previously acquired considerable size; but was found to have a diminishing effect on the amount of produce where the crop was not so far advanced."

From this it would appear that nothing is gained by the operation, and that the rate of growth was so impeded that, although the crop was saved from disease, the amount of loss in the crop that was untouched was trifling compared with that sustained by the removal of the stems. The experiment, moreover, does not show whether the tubers increased in weight or not after the operation.

But an experiment by Mr. Dooville, of Alphington, near Exeter, recorded in the 'Gardener's Chronicle,' does not confirm Mr. Thompson's conclusions. That gentleman says:—

"In the beginning of last November I planted the Early Frame Potato, a later white sort, and the Queen's Noble, a still later Potato. Fresh slaked lime was spread over the ground and turned in upon the sets as each row was planted, to prevent the ravage of slugs during the winter. No other manure was used.

"On the 14th of July, the Potatoes being still in flower, I cut off the stems of two rows of the later white sort, and earthed them over about 2 inches, leaving two rows in their natural state. Adjoining were several rows of the Queen's Noble. I cut down three rows of these and earthed them over. Early in July I perceived symptoms of disease (black spots) upon some of the leaves; it spread more after some showers which fell about the 24th. The haulms of the Early Frame had then assumed an appearance of natural decay. I cut them all down. They were taken up on the 21st of August, all sound, and a fair average crop.

"Finding the disease was spreading, and that the stems as well as the leaves of the Queen's Noble had become much affected, I, on the 14th of August, cut down the remainder, and earthed them over. On the 4th of September I caused three rows of the Queen's Noble, cut down on the 14th of July, and three rows cut down on the 14th of August, to be taken up. Those cut down July 14th produced—

1 row, 55 feet in length	..	15¼ lbs.,	tubers	all sound.
2 do. do.	..	18¼	do.	all sound.
3 do. do.	..	16¼	do.	all sound.

"The tubers small; the largest size weighed 3 oz. Those cut down on the 14th of August produced—

1 row, 55 feet in length	..	44¾ lbs.,	32	tubers	diseased.
2 do. do.	..	42¾ do.	27	do.	diseased.
3 do. do.	..	39 do.	8	do.	diseased.

"The tubers generally of good average size; the largest weighed 8 and 9 oz. I was, I must confess, disappointed with the result in the first case. I then proceeded to take up two rows of the White Potato, cut down on the 14th of July, and two rows which had been left untouched. Those cut down on the 14th of July produced—

1 row, 55 feet in length	..	41 lbs.,	tubers all sound.
2 do. do.	..	42 do.	all sound.

"The tubers generally of a good size; what would, in fact, be called a fair sample: some of the largest weighed 5 and 6 oz. Those rows which had been left untouched produced—

1 row, 55 feet in length	..	60¼ lbs.,	7 tubers diseased.
2 do. do.	..	69 do.	10 do. diseased.

"The tubers generally much larger, and many weighed 8 oz. The result in this instance is more favourable, and I think it may be accounted for in this way:—The White Potato is an earlier sort than the Queen's Noble, and, although both planted at the same time and under the same circumstances as to locality, soil, &c., it came into flower earlier, and I had, as is my usual practice, picked off the first flowers a week or ten days before the stems of both sorts were cut off. The tubers, therefore, were, in all probability, in a more advanced state, and in a better condition to draw nourishment, by their own vitality, from the soil.

"There is here, I opine, strong presumptive evidence that the tubers do, as affirmed by M. Lomba, grow unassisted by the stem and leaves, as it cannot be supposed they would attain a size to weigh 6 oz. whilst the plants are yet in flower. The difference in produce may probably arise from my having cut down the stems too soon. I think, indeed, the result in both cases, but more particularly in the Queen's Noble, clearly proves this to be where I have erred. The error, however, is instructive. It would also appear that the disease is communicated by the leaves and stem to the tubers; for in no instance where the stems were cut off before attacked by the disease are the tubers diseased, whereas in both of the other cases many of the tubers are diseased.

"The result of these experiments will, I think, justify the conclusion, that by autumn or early spring planting there is a better chance of a healthy crop, as the plants would, under favourable circumstances as to weather, &c., put forth blossom before the time the disease usually makes its appearance, and by adopting M. Tombelle Lomba's plan there would be a reasonable hope of securing an average crop."

I have also from Mr. Alexander Burnett, gardener at Roby Hall, near Liverpool, a further statement upon the same subject:—

One drill, "Pink-eye Kemps." Dug up Aug. 20. Same length as the other four.		Four drills, "Pink-eye Kemps." Tops cut off August 20. Dug up September 21.							
		Tops not cut off.		Tops cut, not earthed.		Cut off, earthed, and trod.		Pulled up, earthed, and trod.	
Good.	Bad.	Good.	Bad.	Good.	Bad.	Good.	Bad.	Good.	Bad.
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
70½	20	88	49½	62½	21½	83	13	74	10¼

"The above were selected in the middle of a plot facing south, 105 feet long.

One drill, Robyhall Seedlings, a round Potato. Taken up Aug. 4.		Three drills. A Seedling raised here from Seeds of 1846. Tops cut Aug. 4. Taken up Sept. 21.					
		Tops not cut.		Cut off, but not earthed.		Cut off and earthed.	
Good.	Bad.	Good.	Bad.	Good.	Bad.	Good.	Bad.
lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
19½	..	21½	3¼	17	½	22	½

"The above were selected, side by side, from a plot upon a west border, each drill 15 feet in length. As soon as they were dug, I washed them clean and spread them out for an hour or two to dry previous to weighing them; and in order that there might be no mistake in the different operations, all was performed by myself."

In this case it would appear as if the removal of the leaves actually *diminished* the crop at the instant of removal, which is incredible. A space which produced 90½ lbs. on the 20th of August, the tops being untouched, produced only 84 lbs., in two instances, a month later; one such space, however, yielded 96 lbs., having gained 5½ lbs. after the removal of the tops. The second experiment was of the same nature. And although both are of very small value, they seem to show that M. Lomba's statement is not confirmed by English experience.

On the other hand, Mr. Gwatkin, of Parc Behan, near Tregony, entirely confirms the Belgian account. In the 'Gardener's Chronicle' of August 25, 1849, he says:—

"After reading the 'Belgian Farmer's' recommendation on the treatment of Potatoes at the time of flowering, I had my crop of 'Red Roughs' watched, and as soon as the flowering had ceased, I caused the haulms to be cut off within an inch of the surface, and the earth drawn over the plants an inch thick. This was done to two rows, leaving double the quantity of the same crop in its natural state. Yesterday the Potatoes of both were drawn: in the rows left untouched, two-thirds of the crop were found to be more or less affected; but in the rows on which the experiment was tried, every Potato was found perfect, and in size and quantity the same as the others. I beg to add that the same result followed a similar experiment, made in a garden by one of my workmen, upon a small crop of 'Snow-balls.'"

Here then is a result diametrically opposite to that obtained by others, and in accordance with the statement of M. Tombelle Lomba. The experiment must, therefore, be repeated. It is probable that the discrepancy in the results arises from the plants under experiment not being in the same stage of growth. It appears to me essential to success that the flowering shall have been completed, and that the fruit shall have begun to form. At that time the office of supplying the tubers with matter from which they may organize their starch is nearly over, and the leaves are chiefly occupied in the nutrition of the growing fruit; so that the loss sustained by the tubers may be little or nothing.

That tubers and roots will grow for many years, although their tops are removed, is an undoubted fact, be the explanation of the process what it may. It is now seventeen years since M. Dutrochet brought to the notice of physiologists the unexpected fact that in the Jura may be found the roots of fir trees still alive and growing, at the end of forty-five years after the trunks were felled. A similar example is recorded by the Rev. Mr. Berkeley in the case of an Ash Tree which had been sawn over level with the ground. (See 'Gardener's Chronicle,' 1850, p. 99.) Gardeners know very well that the tuberous Tropæolums, the stems of which have been accidentally broken off, will continue to grow for a long time afterwards: as also will tuberous Bindweeds. These are notorious facts, though they have never been recorded with the exactness which is desirable in scientific questions. And it so happens that I have now before me a very illustrative case, which places the matter beyond all further question.

It chanced that in the Conservatory of Chiswick House a plant of Sello's Ipomœa was, in November, 1840, destroyed to the ground by frost, *since which period it has neither made buds nor leaves.* Nevertheless, its roots have continued increasing rapidly in size. In fact, it has been frequently repotted as its increase in size demanded it; for in 1840, at the time of the accident, it was but a small root. During this long period it has been subjected to a high temperature. At this moment the root forms a coil, not unlike a boa constrictor, a foot across, 6 inches deep, and weighing $7\frac{1}{4}$ lbs. Although we have no record of its weight at the time when the stem perished, yet, as it has continued to grow for nine years and a half, and was originally in a small pot, it is not unreasonable to assume that it has acquired at least seven times its original weight. Although no leaves have been formed, yet many attempts at the production of stems are visible upon the specimen, in the form of short stunted tubercles or incipient branches; and the root is now so full of vitality that I entertain no doubt of the possibility of compelling it, by artificial means, to resume its growth.

Here then is a very striking proof that plants have an inherent power of growth without leaves. It is probable that in this case the bark, of which a large surface has been exposed to light, has acted as a substitute for foliage, perspiring, and assimilating food, as all green parts do, whether leaves or not. It is also probable that the surface of the root which rested upon the earth, and which still is colourless, has constantly attracted from the soil the food which the bark is assumed, in this case, to have assimilated. But if such a power can be recognized in an Ipomœa, we must also admit its existence in the tuber of a Potato, even although that tuber is not exposed to light; and the vital force of the latter must be allowed to be capable not only of converting into starch the gum which was supplied by the leaves, but of absorbing gaseous and fluid matters from the soil, and, by their assimilation, of continuing to grow, although perhaps for only a limited time.

It would indeed be an experiment worth trying, whether, by some artificial means, the Potato itself might not be made to go through the same kind of leafless enlargement as that now recorded in the Ipomœa.

XIV.—*On the Deodar.* By Robert Errington, C.M.H.S., Gardener to Sir Philip de Malpas Grey Egerton, Bart., M.P., F.H.S.

(Communicated November 24, 1849.)

This splendid tree bids fair to become a general favourite, from the prince to the cottager, and most deservedly so. At the present moment our nurseries are becoming well stocked with it, and from the great facilities offered for obtaining seed, I have no doubt that in a very few years they will be advertised by their hundreds of thousands, precisely as the larch and other forest-trees.

As a very general planting, therefore, will doubtless take place, both with regard to timber purposes and to ornamental or landscape gardening, I would beg to call the attention of planters to the effect it is qualified to produce in scenery, and some other points connected with its culture.

In the first place I would direct attention to its hardihood. I have watched the effects of severe winters on plants in a variety of situations, and in various stages of growth, and I cannot say that I ever knew even the leader (which is of a very succulent character from its continuing to grow so late) to suffer from low temperature. I have indeed known them to become discoloured through cold and dry winds, especially if planted in stagnant soil; but on the whole it may safely be affirmed that the tree is as hardy as any of our other forest-trees, and quite at home in the humid climate of Britain.

With regard to soils too it is an astonishing tree; almost any kind seems eligible. I have found it to thrive equally well on tenacious loams and on light sandy soils, or on any of these with a mixture of peat, leaf soil, or any other vegetable matter.

Another circumstance of some import may here be referred to concerning its endurance of moisture at the root. This is a point which deserves the planter's particular attention. The Deodar will not thrive in a swamp; at least my experience does not lead me to infer that such is the case. I have planted several, however, within the last five years, both on sandy knolls and on the margin of a pool, where the ground is only about 3 feet above the water-level, and where also the soil is of that consistency that it might be taken for ditchings or pond-bottoms; in fact, a moist alluvium.

Now in such a situation and at this period we have the Deodar exuberant with health: I must, however, observe that such were planted *on* the ordinary ground-level, and moreover I took the precaution to cut an issue for the water (which might otherwise lodge) down to the edge of the pool. A slight excavation was made where the tree was to be planted; the excavation communicated with the outlet or issue; and both excavation and outlet were filled to nearly the ground-level with bricks, stones, or other imperishable material. On this the Deodars were planted, and of course when filled up and the turf restored, they stood on a slight mound, which, in consequence of the amount of organic materials (as new tree-leaves, &c., which I invariably throw beneath the tree of whatever kind) has gradually sunk, and now the Deodars on this moist site appear as though they had been planted below the ordinary level, as other common trees or shrubs on sound soils.

I mention these little matters in detail, in order to assist in guiding those who are still somewhat unacquainted with the *real* habits of the Deodar, as to the selection of places to plant it in, and in order to show that this beautiful tree is eligible for as great a variety of conditions—high or low, moist or dry—as most of our common forest-trees; whilst in point of beauty of contour it excels most of them.

I must now advert to another feature of much importance in Deodar-planting; I allude to the facility with which they may be removed at almost any size. It becomes necessary, in remarking on this portion of the subject, to consider the character of the root, on which of course so much depends.

It is well known that the roots of many conifers spread horizontally, like so many strings, near the surface of the soil. The Deodar, on the contrary, is exceedingly fibrous, and descends somewhat lower than ordinary; indeed I have moved several lately from 6 to 9 feet in height, with balls of earth adhering as well as to a well-rooted holly, or other evergreen shrub. It would indeed be much greater risk to move a Scotch fir 8 or 10 feet high than a Deodar of similar dimensions. I have removed some scores during the last few years, and the loss has been trifling indeed, and chiefly confined to some which had been propagated from cuttings, and were taken up from a sandy spot, where they had been planted from the cutting-pots, at only about 3 or 4 inches apart. The loss here was unavoidable, when it is recollected that no soil whatever adhered to them, and that as cuttings they possessed somewhat less root-energy than transplanted seedlings would have done.

Rapid growth is another great consideration on behalf of the Deodar. It is no uncommon affair for them to rise at least 1 foot in a season; and the extension of their beautifully curved branches, both in length and thickness, is commensurate with the progress of the "leader." Their mode of growing too is rather singular; they appear to continue extending in a steady way until the early part of September, and it is strange that (so succulent as such late-made shoots must of necessity be) the frosts of winter do not destroy or damage their tender-looking points.

As a timber-tree, if the accounts we have so frequently received are correct, the planting of the Deodar extensively may be considered a national benefit.

As ornamental trees they stand pre-eminent with every person of taste; indeed it would be difficult to conceive a form of tree more expressive or more beautiful. Its beautifully nodding plumes possess all the grace of our old favourite the weeping-willow, to which it adds finely grouped and dense masses of foliage in the interior, the tufted character of which but adds to the elegance of the curvature of the delicate leading points, which appear to chase each other in a steady progression from the waving leader down to the very soil.

As an avenue, the effect of a line of Deodars would doubtless be magnificent; a double line on each side would be excessively imposing, supposing the back row trained carefully to leading shoots, and the front row having their leader destroyed when some 12 or 15 feet high. In such a case, I have little doubt that the front rank would continue to sweep the turf for a long series of years; for, of all the fir-tribes, they seem to retain even the most subordinate branches and foliage the longest unscathed.

Indeed as part decoration in any approach they will soon be considered indispensable; for advancing taste will not, I conceive, long rest content with our old forest-trees alone in our park-drives. People will begin to think that where the Holly is admissible, there can exist little reason to exclude the Deodar, possessing, as it does, so majestic a character.

On the sides of precipices too, or steep hill-sides, in picturesque scenery, such as the far-famed Hawkstone in Salop, how much grandeur would Deodars here and there impart, peeping from among the oaks, and stealing down the hill-sides, giving elegance to the glade and enfringing the vista!

Even the small villa garden will ere long find a place for a Deodar or two, which will add an amount of dignity to the grounds before unknown.

Finally, why not have the Deodar in all our cemeteries and burying-grounds? Surely its weeping character carries a funereal cast! The ancient Pine and the Deodar would each serve to heighten the other's beauty. It might indeed be considered in the light of a vegetable mourner, and would seem emblematical of gentle feelings; whilst the Yew and the Cypress would represent solemnity.

XV.—*Some Remarks on Draining, with an Account of its Beneficial Effects on an Orchard in which the Trees had fallen into a very unthriving condition.* By Robert Thompson, Superintendent of the Orchard and Kitchen Garden.

The climate of Britain is generally considered to be too moist; but trees, grain, and other crops have not a greater supply of moisture on an average than is necessary for their respective wants, provided the ground is sufficiently drained and otherwise put in proper condition. There are grounds naturally so situated and constituted, that they are rarely too wet or too dry; but frequently on the same estate, grounds may be found on which the crops suffer from both extremes, although each portion receives equal, or very nearly equal, quantities of rain. The owner of such lands cannot, of course, prevent the rain from falling on the wet as well as on the too dry grounds; but in nine cases out of ten, or perhaps ninety-nine in a hundred, the rain which falls may be economized to the benefit of the crops on dry ground, and the excess of moisture may be drained off, so as not to be injurious to those in ground naturally too wet.

In draining land the condition of the adjoining higher grounds ought to be the first consideration. If they too rapidly part with their moisture, tending thereby to inundate the lower ground, whilst they soon after suffer from drought, that should, if possible, be prevented. Trenching will afford greater depth of soil for absorption, and consequent detention of moisture, till the time of need—till the growing crops require it to supply their evaporation; and on such high ground, if moisture is present, the crops will evaporate a vast quantity: thus so much moisture will be most advantageously intercepted for the necessary supply of the crops where it falls, and also be prevented becoming injurious to those on lower ground, where it is not wanted, and from which it would consequently require to be drained off.

The proportion which evaporation from various surfaces bears to the quantity of rain which falls, has not been sufficiently investigated to enable us to form any very correct estimate: that from a surface of water has, however, been found to be more than the amount of rain; that from earth much less; and a tree with a large mass of foliage requires more moisture than falls on the space of ground it covers. When the surface of the ground is dry, the evaporation from it is almost nothing; but the surface may be dry and yet much moisture, if it exists below, may be drawn up and carried off by evaporation from the leaves of growing crops. Thin land is soon saturated by heavy rains; saturation is an evil which, in this case, is often remedied by drawing surface-furrows, along which the rain-water is readily carried off, without its being remembered that probably in less than six weeks that water would be required to feed the crops growing where it fell. In the generality of cases, I believe, it will be found that none of the rain which falls on ground sloping to the south should be carried off by the surface. Snow-water may be drained off with propriety as quickly as possible from the north sides of hills, but in all cases the summer rains should be permitted to sink through the ground.

This detention of water may be looked upon as the opposite of draining, and therefore foreign to the latter subject. These operations are, however, intimately connected; for if the former were properly understood and practised, less draining would be necessary. If we detain for local use the water which falls on the higher grounds, we, in effect, render the lower grounds drier than they otherwise would naturally be, and to an extent that, in some cases, might render draining unnecessary, or at least would greatly modify the operation.

It has been stated above that trees usually require all the rain which falls on the space of ground they occupy. It may, therefore, be concluded that ground for them requires no drainage if not liable to an influx of moisture from adjoining grounds. This conclusion is correct in some cases, but in others, however paradoxical the assertion may appear, it is not.

Fruit-trees do not thrive well in any soil that is saturated with water. Some soils are naturally so retentive, that comparatively little rain is sufficient to maintain them in a saturated state—less even than the trees would require if thriving in a porous soil. Water is not in itself poisonous to plants; the evils which it produces when the soil is saturated with it arise chiefly from its mechanical properties, pressure and specific gravity.

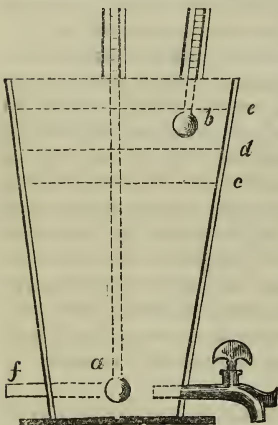
In order to become aware of the pressure of water on any body immersed in saturated soil, we may take a box 2 feet square and 15 inches deep: place in the middle of it an empty box, 1 foot square, 13 inches deep, and weighing, say 5lbs.; then fill in the space round it with soil to the depth of a foot; place in the empty box an elastic ball or small bladder distended with air; suspend over this a quarter of a hundredweight so as to nearly touch the ball. This arrangement being made, let the whole of the soil be slowly moistened throughout by means of a watering-pot with a tolerably fine rose. When this has been effected, a little more water will cause saturation. The soil may be considered completely saturated when the water begins to stand above it. Then a pressure of 62½ lbs., the weight of a cubic foot of water, will be exerted on the bottom of the empty box in which the ball was placed; the box and ball will, of course, be forced upwards, the ball will be squeezed against the 28 lb. weight till it bursts, unless strong enough to support that weight. In fact, instead of 28 lbs. the box would require to be loaded with 57½ lbs. in order to prevent its being raised up; or if its bottom were composed of a multitude of air-cells, they, collectively, would be subjected to a pressure of 62½ lbs. the moment saturation takes place to the height of a foot above them. A root placed in a similar position would have the same proportion of pressure on all parts of its surface with which the water comes in contact, and just so much more than it would have were those parts in contact only with air in the pores of the soil. Air, and even carbonic acid, the great source of the food of plants, must be driven from their recesses by a fluid exerting such pressure as that above mentioned.

It has been ascertained that the specific gravity of water is greatest at a temperature between 39° and 40° Fahrenheit: therefore in any quantity of water not of uniform temperature, that which is 39° or 40°, or, if hotter or colder, that which is nearest to the above, will always be at the bottom; it will not be displaced by the addition of a quantity of the temperature of 60°, nor will the two mix so as to acquire a common temperature without mechanical force. Hence if a retentive soil is saturated with snow-water, or that from rain of about 40°, such water will not be displaced by lighter, warmer rains. The water derived from the latter must run off by the surface, or stand exposed to the cooling effects of evaporation: in either case its heat is lost without benefiting the soil. The only remedy is to drain deeply; the coldest water, because the heaviest, will then be the first to move, and the pores of the soil which it previously occupied will be filled with air, except when the latter is partially displaced by the descent of rain-water, which can then pass freely through spaces no longer exclusively occupied by colder, denser water.

It is shown by Mr. Parkes, in his 'Essay on the Philosophy of Drainage,' that in draining the Red Moss, near Bolton-le-Moors, the thermometer in the drained land rose in June, 1837, to 66° at 7 inches below the surface, while in the neighbouring water-logged land it never rose above 47° at any time throughout the year. From within 7 inches of the surface to the depth of 30 feet, the bog in its natural state maintained, in winter and in summer, an invariable temperature of 47°. This, it may be remarked, is about the mean atmospheric temperature of the year in that locality, and the difference between the hottest and coldest months is there 24° or 25°; but it must be inferred from the uniformity of temperature in the saturated undrained land, that summer rains are ineffectual as regards the communication of heat downwards, and that on such land the intensity of the sun's rays is lost.

The fact that heat cannot be transmitted downwards through water is well known; but that it is as impossible to heat saturated soil downwards should be also familiar to every one engaged in either horticultural or agricultural pursuits. Some experiments are detailed in the *Gardener's Chronicle*, No. 3, 1849, p. 35, by which it was proved that a mixture of peat and water, constituting an artificial bog, could not be heated at a foot below its surface by pouring a quantity of boiling water upon it. I have recently made a similar experiment with saturated yellow loam; and as some may wish to repeat these experiments for their own satisfaction, I shall here state the mode of proceeding and the results.

Experiment No. 1.—A square box was made of the form represented by the annexed diagram, 18 inches deep, 11 inches wide at top, and 6 inches wide at bottom. It was filled with peat saturated with water to *c*, forming to that depth (12½ inches) a sort of artificial bog. The box was then filled with water to *d*. A thermometer (*a*) was plunged so that its bulb was within 1½ inch of the bottom. The temperature of the whole mass of peat and water was found to be 39½° Fahrenheit. A gallon of boiling water was then added; it raised the surface of the water to *e*. In five minutes the thermometer *a* rose to 44°, owing to conduction of heat by the thermometer tube and its guard. At 10 minutes from the introduction of the hot water the thermometer *a* rose to 46°, and it subsequently rose no higher. Another thermometer (*b*), dipping under the surface of the water at *e*, was then introduced; and the following are the indications of the two thermometers at the respective intervals, reckoning from the time the hot water was supplied :—



	Thermometer *b*.	Thermometer *a*.
20 m.	150°	46°
1 h. 30 m.	101	45
2 h. 30 m.	80½	42
12 h. 40 m.	45	40

The mean temperature of the external air to which the box was exposed during the above period was 42°, the maximum being 47° and the minimum 37°.

Experiment No. 2.—With the same arrangement as in the preceding case, a gallon of boiling water was introduced above the peat and water, when the thermometer *a* was at 36°; in 10 minutes it rose to 40°. The cock was then turned for the purpose of drainage, which was but slowly effected, and at the end of 20 minutes the thermometer *a* still indicated 40°, at 25 minutes 42°, whilst the thermometer *b* was 142°. At 30 minutes the cock was withdrawn from the box, and more free egress of water being thus afforded, at 35 minutes the flow was no longer continuous, and the thermometer *b* indicated 48°. The mass was drained and permeable to a fresh supply of water.

Accordingly another gallon of boiling water was poured over it, and in

3	minutes the thermometer *a*		rose to	77°
5	,,	,,	fell to	76½
15	,,	,,	,,	71
20	,,	,,	remained at	70½
1h. 50	,,	,,	,,	70½

In these two experiments the thermometer at the bottom of the box suddenly rose a few degrees immediately after the hot water was added; and hence it might be inferred that heat was carried downwards by the water. But in reality the rise was owing to the action of the hot water on the thermometer, and not to its action upon the cold water. To prove this the perpendicular thermometers were removed: the box was filled with peat and water to within three inches of the top; a horizontal thermometer (*a f*) having been previously secured through a hole made in the side of the box by means of a tight-fitting cork, in which the naked stem of the thermometer was grooved. A gallon of boiling water was then added. The thermometer, a very delicate one, made by Newman, was *not in the least affected* by the boiling water in the top of the box.

Experiment No. 3.—Silver-sand was put into the bottom of the box so as to be a little above the bulb of the thermometer *f a*, with the view of protecting it when introduced; the box was then filled with yellow loam as far as *c*. The loam was then saturated with water from the rose of a watering-pot. Numerous air-bubbles rose when saturation had been nearly effected, the whole surface of the soil being just covered with water: the latter subsided as the air found its way out. The thermometer *f a* was then introduced, and it soon acquired the temperature of the mass, 45°. A handful of straw was squeezed together and laid on the top of the soil to break the force of the hot water, a gallon of which when boiling was poured on. The hot water cooled by evaporation, but produced not the least effect on the delicate thermometer *f a* near the bottom of the box. Another gallon of boiling water was added when the first had cooled down to 100°; but the thermometer *f a* still indicated 45°. Any person can easily make similar experiments. It is best to introduce the thermometer through the side of the box, as at *f*; for if plunged from the top the boiling water surrounding a portion of the tube of the instrument expands the fluid and indicates an elevation of temperature, although none takes place in the medium in which the bulb at *a* is situated. There are rules for correcting the expansion which occurs in such cases, but they are very complicated.

We have now seen that water exerts an enormous pressure even at the depth of a foot; what effect this of itself may have on the health of plants I do not pretend to know. It expels air and other gases, the food of plants, from the vicinity of the roots, and all agree that in this respect it must be considered injurious. It prevents heat from being carried down to the roots; and when these are chilled they cannot support a healthy vegetation. Finally, it is more stagnant in summer than in winter; the retentive nature of the soil, where saturation exists, prevents water of any temperature from moving downwards; but the colder will displace the warmer. For example, water at 47° having possession of a retentive soil in spring, will not change its position in consequence of the fall of warm rains during summer. Unless carried off by evaporation it will remain stagnant during the warm season, and will only give place to winter rains, or those that may supply colder and heavier water than itself. Stagnant water is known to be very pernicious to the health of plants, excepting to that of some species naturally adapted for growing in it. As proof that the roots excrete, it could be told in many cases from the smell of the soil what plant had been growing in it; and if roots are long in stagnant water it becomes impure. Want of drainage, therefore, deprives the roots of proper nourishment, subjects them to a chilling temperature, and forces them to absorb a vitiated fluid.

I now proceed to give an account of the beneficial effects of draining, as instanced in the case of an orchard belonging to Robert Manning, Esq., situated on Norton Heath, near Blackmore, Essex, about seven miles north-west from Ingatestone. The ground lies high, and is naturally a retentive marly clay—red when burned. The extent inclosed is about three acres. It was planted in 1828, with apples, pears, plums, cherries, and filberts. The trees were 12 feet apart each way, and intended to be trained as dwarfs. Mr. Manning's object was to possess specimens of the very best sorts for private use for himself and friends, and after that to look only to profit. The ground had but a shallow trenching. The trees grew tolerably well for some time, but after seven years they began to exhibit symptoms of ill thriving, and were every year getting worse: I saw them in 1840, and instead of increasing in size they appeared to be decreasing. In 1841, Mr. Manning states that the absence of growth was such that he could not find scions to regraft some trees of bad sorts. In 1842 he remarked that the orchard at Norton Heath had proceeded from bad to worse. In August, 1842, he writes, "I have just returned from visiting my orchard, with, I am sorry to say, little or no hopes in favour of its continued existence. The five Bigarreau cherry-trees, three of which were blossoming well, and two but feebly, when I left them at blossoming time, I found dead on the 2nd of July. There was about the same proportion of blossoms on the eleven May Duke cherry-trees, three trees only of which I found alive, and those in a sickly state." When some twelve or fifteen pear and cherry trees were rooted up, the holes not filled up were found some time after filled with water to the brim. Subsequent observations led to the idea of draining, as will appear from the following extract:—"In remarking that the highest ground is the N.E. corner, and the lowest the S.E., to which the fall is between three and five feet; that the bulk of the fruit comes from near the sides of the moat, or the southern boundary-ditch, and that the three rows next that ditch are the three most healthy rows in the orchard; and that half the orchard on the north, taken in a line diagonally from N.W. to S.E., does not produce above a tenth of the fruit, though protected on the two cold sides by the fir-trees, some useful thought may surely be gained. I have observed that the disposition to be in a bad state, before the death of the Bigarreaus, was almost entirely confined to that north half. My mind seems to be made up, that the want of a thorough draining, as water stands in many places, is a main cause of decay and death. In many parts, where the trees had died, water stood all the winter of 1841–2 in holes dug only a foot deep; I have it, therefore, in contemplation to tile-drain the whole orchard; my speculation being, that should this not resuscitate the orchard, the land, if reconverted into a field or meadow, will be valuable in proportion to the expense incurred, inasmuch as my farmer says, if he were to take the land into cultivation he would have to encounter a great expense in draining, although his draining, it is true, would not be with what I am told are everlasting tiles, but with the old wood draining, 22 or only 20 inches deep, which, he says, would last ten years, to a much better purpose than the deeper tile-drain."

Faggot-drains are not, I think, to be despised if they work well for ten years; and if they last that time at 20 inches deep, they would certainly last much longer at a greater and more preferable depth. However, in the orchard in question 3000 feet of draining-tiles were laid, 3 feet deep, in parallel lines 48 feet apart, in the spring of 1843; and in the autumn of the same year 3000 feet of drain-pipes, $1\frac{1}{4}$-inch bore, were laid at 30 inches deep, so that the drains were then only 24 feet apart.

After the drains were covered in the whole ground was dug 8 inches deep, having been previously grass between the trees. The latter were, at the same time, cut in on two sides, so as to spread out thinly like espaliers.

In the following year, Mr. Manning, the proprietor of this ground, states, "The result—whether of the draining only or of the two other operations, and the good fruit season combined with the draining—has been most miraculous. I have had some tolerable crops of Court of Wick (the year before last seven bushels); I have now at least 10 bushels of much finer fruit than I had ever before seen. In short, I never housed anything like 50 bushels of fruit before; now there are to be seen at least 75 bushels, while my summer disposed-of fruit was at least double the usual quantity."

The lopping-in of the trees and digging the ground, as above described, were doubtless advantageous proceedings, but the draining of the ground was unquestionably the main cause of the extraordinary change in the condition of the trees; for stunted specimens that previous to the draining were covered with moss, had made no shoots for years, and were in such a state of decrepitude that there was nothing to cut away but dead wood, these had produced vigorous shoots when I saw them in 1847, and have continued to do so up to the present time. Such vigour cannot be attributed to the cutting-in, for in these cases it was not practised; nor to the digging of the ground, for although this was done before draining was thought of, yet the trees went backwards, the decay of their branches increased under all circumstances till 1843, when recourse was had to draining, and since then they have continued to do well, producing vigorous shoots—shoots upwards of 3 feet in length; and in the present season the fruit was abundant, large, and highly coloured.

XVI.—*Protected Trellises for the Cultivation of Tender Fruit Trees.* By George Fleming, C.M.H.S., Gardener to the Duke of Sutherland, F.H.S., at Trentham.

(Communicated February 20, 1850.)

It is now somewhat more than twelve months since Mr. H. B. Ker published an account of his new method of growing the more delicate kinds of hardy fruits on trellises, and protecting them simply by means of a glass roof. The object he had in view was to bring to perfection those choice but more tender varieties of Peaches, Nectarines, Apricots, &c., which seldom ripen their fruit perfectly in our precarious climate; and the means by which he proposed to effect this had the additional recommendation of costing much less in the way of construction than ordinary walls, which are far from answering the desired end.

In Mr. Ker's experiments the top only was covered, and the sides and ends were left open, except during the prevalence of very cold winds, when a common net was hung in front of the trellis, in order to prevent to a certain degree the strong current of air passing between the glass and the blossoms. When I read the description I was delighted with the novelty and excellence of the idea; but at the same time it seemed incomplete so long as the sides and ends were open; and as several improvements have suggested themselves to me, I beg leave to forward a section and description of them, in order that others, about to erect protective trellises, may, if they please, take advantage of my experience.

The effect of the glass roof alone is chiefly useful in checking the upward radiation of the heat; but the slight difference of temperature, which is obtained either by night or day, is the means of creating a constant current of cold air between the branches and the glass; and in keen, frosty weather this is particularly severe and injurious. It is evident that something more is necessary than a simple netting being hung in front; and I think it will be generally admitted, that after going to the expense of fixing trellises, making glass sashes, preparing borders, and purchasing trees, it is worth while to go one step further, and make perfect trellised frames by closing up the apertures on all sides. Without this provision to husband the heat derived from the sun's rays, the trees are scarcely so well off during the day as they would be without the protection; for an increase of temperature is prevented by the constant current, and, by the glass acting as a shade, the crop is retarded rather than forwarded.

Another objection against the original design is in the roots of the trees being outside the trellis, and exposed not only to the rain which falls directly upon the soil, but also to that which runs off the roof. This evil may of course be obviated by covering the border with tarpauling or some other material; but it is a much simpler arrangement to have the border made beneath the trellis, as the roots will then be in a temperature exactly proportioned to that in which the branches are growing, without the use of fermenting litter or other covering material.

I propose to close up the back and ends of the frame with cheap ½-inch boarding, and to hang the board nearest the top upon hinges, so as to form a ventilator; in addition to which the sashes can be pushed down in very hot weather, and to keep the trees back after the wood is well ripened in autumn. In regard to the front it would be better to enclose it with small glass sashes, fixed at an angle about twice as steep as the roof; this would afford additional training room, and ensure the free access of light to every part of the tree. These front sashes should also be on hinges, in order that they may be propped open to any extent, and thus a free circulation of air be secured, and increased or diminished at pleasure. The whole of the interior should be painted or coloured white, that the greatest possible quantity of light may be reflected amongst the foliage.

It may be urged that the entire closing of the frame, and the consequent introduction of ventilation, will add to the trouble of management, but the additional advantages gained by these arrangements are so obvious as to destroy at once any objections made against the trifling labour of opening and closing the small sashes, and the board at the back. I admire the original idea so much that I wish to see it worked out perfect and complete in all its parts, so that the plan may do away in a great measure with the necessity of constructing walls for the cultivation of these fruits, as they are much more expensive, and, as I have stated, do not answer the desired end. This induces me to urge the propriety of a slight additional outlay to that which was proposed in the original plan, and thus make it twice as serviceable. When completed, the peach-frame, if I may so call it, will have every advantage possessed by a peach-house, excepting artificial heat; and as the trees are not designed for forcing, the rays of the sun will supply all the heat that is required. If it be desired to take advantage of the warm, sunny days in spring, to start the trees somewhat earlier than they would naturally break, the roof should be provided with shutters or a roll of canvas or matting, to assist in retaining the heat which has been accumulated during the day, and especially to exclude cold spring frosts. If canvas or light tarpauling be adopted, it may be made to work very easily by nailing one edge to the upper end of the lights, and the other to a light roller of a convenient length. A cord of sufficient strength must be nailed to the woodwork, near each of the upper corners of the canvas, and after passing under and returning over it, the ends of the two cords should be tied together at the back of the frame; by pulling these ends the piece of canvas or tarpauling will be drawn up and secured in much less time than I have taken to describe it. The length of each roller may be from 18 to 28 feet, according to the weight of the material employed for covering.

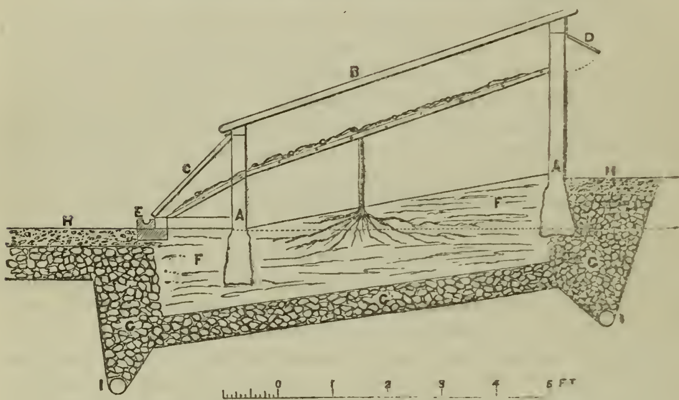
Another advantage gained by entirely closing the frames is, the facility which is thereby afforded for fumigating aphides, which are so troublesome to our peaches on walls, and where the easiest method of getting rid of them is by means of the engine.

These pests visit peach-trees during the gardener's busiest season, and are in consequence very liable to be neglected, or if the matter be attended to in proper time, the means employed are of so clumsy a description, and the operator, in his zeal, uses so much physical force, that the leaves are injured more by the engine than they are by the insects ; in fact, the cure is worse than the disease.

It is true that one suggestion leads to another, *ad infinitum*, and the desire of making the protected trellis as perfect as possible leads us to the consideration that with all the improvements proposed above, it is still deficient in point of durability. Up to the present time it has been proposed to construct the whole of the framework of wood ; but it is an established fact that, in the long run, it is very much cheaper to use iron instead of wood wherever it is within the influence of causes which hasten decay ; and especially where it is placed in contact with the earth. The old adage, that "what is worth doing at all is worth doing well," is doubly true in this case, as the effects of the decay would just begin to show themselves, by the rickety state of the framework, about the time that the trees had arrived at their greatest perfection,—when they had covered the trellis with healthy, fruitful wood. To avoid such an annoying state of things, I would at least suggest the use of iron uprights, leaded into unhewn blocks of stone immediately beneath the surface of the soil ; and those who would carry out this principle with still greater spirit would also employ rafters and wall-plates of iron. The uprights should have on each of the two sides a plain groove, about three-quarters of an inch wide and an inch deep, commencing at the ground line, and continuing within twelve inches of the top, which twelve inches should consist of a plain rabbet. The groove is to receive the boards which are to close the back ; and to retain them in their places, they must be secured by wedges. The rabbet is intended to form a frame for the topmost board, which is to be hung on hinges, to serve as a ventilator.

The accompanying sketch will show that I attach great importance to securing a free passage for the water, by laying a drain at back and front, by giving the border a good slope, and by keeping a considerable portion of it entirely above the ground level. To this end, also, a row of grooved bricks should be laid along the front, to receive the rain which falls on the roof, and convey it immediately to the drain, without allowing it the chance of penetrating into the border. For the sake of neatness as well as convenience, a good gravel path should be constructed both at back and front ; and as there is ample space for the roots within the frame, this is perfectly practicable, and is also an advantage, inasmuch as the rubble used in filling the drains and forming the walks, in connection with the stratum beneath, prevents the indulgence of the natural tendency which the roots have of seeking their way into the soil, either adjoining or beneath them.

SECTION OF PROPOSED PLAN OF PROTECTED TRELLISES.



A. Uprights with the bottoms unsawn.
B. Top sash.
C. Front sash.
D. Ventilator at back on hinges.
E. Row of Drainbricks to convey water to gratings.
F. Soil 18 inches deep.
G. Rubble for Drainage.
H. Gravel.
I. Drains.

XVII.—*Mural Gardening.* By Peter Mackenzie, West Plean, Stirling.

(Communicated November 26, 1849.)

GARDENING at the present day is divided into many branches. We have landscape-gardening, teaching us how to lay out our grounds to the best advantage, how to plant our woods and dispose of our water, how to build our houses, and make our roads, fences, and walks, so that we may gain the world's applause. We have kitchen-gardening, teaching us how an abundant supply of esculents may be obtained at all seasons of the year. We have flower-gardening in many a style and character, besides market-gardening, botanic gardening, window-gardening, &c., and another may be added to the list, namely, mural or wall gardening.

Many are in love with flowers, but have little space to spare for them; they would take delight in watching the beautiful gems as one by one they open their eyes to the bright beams that shine upon them, but they want the ground to grow them in.

Multitudes of delightful flowers may be cultivated in situations where at present "the wild flower on the ruined wall, and roofless homes, a sad remembrance brings." The teeth of time acting upon bad bricks and mortar have made many inroads upon old walls, so that in frequent instances they have become eyesores to every passer-by. Where such walls are allowed to remain, I would recommend a plan whereby they would be clothed with flowers that are the delight of old and young. "Their hearts may beat in unison with these bright gems of Flora's train, their ears attuned to their sweet music when the summer-breezes shake their soft bells ere yet the overshading trees know of the soft caress."

By increasing our *wall-flowers* the pleasures of many may be enlarged, and these flowers can be multiplied with little trouble. Why should they be confined to so small a number? The *Cheiranthus Cheiri* and its numerous varieties are plants well deserving attention, and their delightful fragrance in spring is welcomed by thousands ;—

> "Cheerful midst desolation's sadness, thou,
> Fair flower, art wont to grace the mouldering pile,
> And brightly bloom o'er ruins like a smile,
> Reposing calm on age's furrowed brow.
> Sweet monitor, an emblem sure I see
> Of virtue and of virtue's power in thee."

In the *Arabis*, or wall-cress, we have another family, where many individuals may be had to blossom in our wall-garden ; then we have the *Parietaria officinalis*, or Pellitory of the wall, and it will not require much trouble to grow another pretty little native plant in the general collection, namely, the *Dianthus deltoides*. These are a few to begin with, whose native homes are old walls ; but those who may turn their attention to the subject, and look about them a little, will soon see that many other plants thrive well that find their way by accident to such situations.

In many parts of the country walls are built without mortar ; on these mosses and lichens commonly abound, and their annual decay provides a soil suitable to many other plants of higher orders which we find growing in the chinks or openings of walls. The walls of sunk fences that are erected without mortar afford shelter for many other plants which receive moisture from the soil behind the wall ; and where a hedge is growing on the top of the wall, it gives protection from frost at a late season of the year, so that flowers of many plants may be had in such situations when they can be obtained nowhere else.

By a little ingenuity plants of different natures may be made to grow in the same collection; for instance, where there are sunk fences the soil in most places will require draining, the water from the drain or drains may be made to trickle among the stones of the wall to a certain extent without injuring the building. In such places the *Chrysosplenium alternifolium* and *C. oppositifolium* and plants of a similar nature will grow freely.

The Woodroof (*Asperula odorata*) is common enough in shady places and woods, but we never find it more luxuriant and later in the season than when we meet it in company with the Golden Saxifrage. In the practice of gardening there are flowers for particular purposes, such as the concealment of local defect or for the production of local beauties; among the former are classed the covering of naked walls, posts, parts of ruins, or other upright objects, concealing horizontal defects, as naked, sub-barren spots, or unsightly banks producing vegetation under the shade and drip of trees.

The above remarks are merely to draw attention to the subject. From what I have learned of it I am satisfied that wall-gardening with little trouble and expense could be made both useful and ornamental, and form a distinguishing feature in many places that have no interest at present in the eye of the lover of flowers.

XVIII. — *The Cultivation of the Strawberry.* By James Cuthill, Camberwell.

(Communicated Nov. 20, 1849.)

The cultivation of Strawberries, whether under glass or in the open ground, requires much more attention than is generally given to it.

The great secret with pot plants is to get them strong and well rooted before winter. Where only a small number is grown the following is undoubtedly the best plan of proceeding. Take pots eight inches deep, place an oyster-shell in the bottom of each, and on this put a good handful of soot; then fill up the pots with a compost consisting of half strong loam and half light rich mould. The mixture ought to be moderately dry, for if wet mould be put into the pots, it is very often the cause why plants do not thrive. Carry the pots to the strawberry-runners, place one in the centre of each pot, and have a basket of small stones at hand, so that one may be laid upon each runner, just behind the plant, in order to keep it steady, until it has taken root. I do not follow this plan myself because I have such a large number (4,000) of pots. I prepare them as above, and plunge them all to the brim in a piece of vacant ground; then, on the first dull day, I cut off the runners, merely removing the strings, and by no means cutting the roots or the tops, for both these operations are injurious to the young plants.

I have found the following the best method of cultivation for the British Queen. Plant the runners out in beds, four inches apart each way, and in the spring cut off all the blossoms. Take them up in August, and remove a few of the upper leaves in order to induce the plants to form top roots. The winter treatment is of great consequence. I never give a drop of water from November, and from being kept quite dry, nearly all the large leaves die off. During this time the plants may be kept under glass in pits, or stacked up on their sides against a wall out of doors. I always plunge the pots to the brim in the pits, for the plants do much better there than standing on the surface of the mould, and the pots ought never to be less than a foot from the glass.

When brought in to be forced a very low heat must be applied, and only increased at the rate of about three degrees weekly. In confirmation of my views on this point, I take the liberty of quoting from an article by Dr. Lindley in the *Gardener's Chronicle* of April 10th, 1847, which every strawberry grower ought to get by heart.

"Those who would understand the philosophy of strawberry-forcing should begin at the beginning, and first determine what it is they have to deal with. This can only be ascertained by examining the young flower-buds as they exist in the plant when it makes its first move towards growth. At that time they are collections of tiny scales, placed over a small spongy centre. By degrees they take on the forms of calyx, corolla, stamens, and pistil. They form successively, in the order in which they are named, the calyx first, the pistil last. The calyx and corolla are the most simple, grow the quickest, and most easily bear to be hastened; stamens require more time for growth; the pistil most of all. When high temperature, night and day, with abundance of moisture, and as much light as February yields, are suddenly applied to the strawberry, it is compelled to grow; the predetermined parts advance, and, obedient to the influences which their nature cannot disregard, they by degrees unfold; but how? The oldest parts, namely, the calyx and corolla, simple in structure, and already advanced in their formation, suffer no injury, but appear in their usual state, arraying the blossom in gay apparel of white and green. The next, however, the stamens, having less time to form, acquire perhaps their yellow colour, but are powerless for their allotted office; while the pistil, the most complicated of all the parts, that which demands the longest period for its perfect formation, but which is the latest that the flower produces, and which is to become the fruit, is a mere tuft of abortions, incapable of quickening, and shrivelling into pitch-black threads as soon as it is fully in contact with the air."

When plenty of air is given at all times, strawberries will set in a heat of seventy degrees, while if kept without or under such a temperature, many flowers will be more or less blind, and what fruit does ripen will be badly formed.

I have raised large crops from plants that have never been in pots at all, on a plan which I described in Loudon's Magazine, in 1837. The plants were Keens' seedling; the runners were taken off as soon as they had rooted well, planted in a bed of prepared mould, and attended to with water during the autumn. Towards February they were taken up, with good balls, and planted, eight or ten inches apart each way, in a frame or pit. They were then brought on gradually, and strange to say, after they have set, they thrive well with a bottom heat fit for the cucumber. It was astonishing to see how fast the fruit swelled when kept moist. The pits (at Dyrham Park) held each 150 plants, and the plants produced double the quantity of fruit that could be grown in pots.

I have often practised this plan since with excellent results.

After the crops have been gathered the pots are taken out of the houses, or pits, and the plants are either planted out in the open ground at once, or kept till the ground becomes vacant for the next year's crop, and for the runners for the present year's potting. The plants turned out invariably bear an excellent crop the second year, and after this is gathered, I destroy them; I have practised this plan these fifteen years. No doubt they would bear a third year, but not to remunerate me while I pay a rent of 35*l.* per annum for one acre of ground and a small cottage.

From single plants in the open ground, both of the British Queen and Keens' Seedling, treated in the above manner, I have taken 2*s.* 6*d.*, selling them in pottles weighing each twelve ounces. With this fact before them people will scarcely adhere to the old plan of beds all huddled together; where the plants get no sun, no air, and are full of snails, slugs, wire-worms, &c.; where they give a small stinted crop one year and none at all the next. It will be almost needless for me to mention sorts. Mr. Myatt, of Deptford, has done much in improving our breeds of strawberries by raising seedlings; no one can doubt this who has seen a British Queen.

My Black Prince is a very prolific kind, and very early. I have had it in my possession for three years, and have exhibited plants with two hundred fruit upon them; these plants were three years old. It is a fruit of medium size, very dark-coloured, well-flavoured, and a first-rate sort for preserving. I think it will become a general favourite.

By accident I discovered an excellent plan for producing a late crop of strawberries. I turned out about 300 pot-plants in full flower, during very hot weather in April; a severe frost about the 1st of May destroyed all the bloom, and at the end of June the plants showed abundance of blossom, and produced a good crop. They were planted in the open ground.

Soils make a wonderful difference in strawberries; the very best of all is a sandy loam. They will not grow in this more to root and top than is necessary for the formation of good buds for the next year, while in a rich, light mould, if the autumn prove wet, they will produce a large, watery mass of tops, growing on to the middle of October, and producing no buds in the centre.

I have practised the following plans on light soils. Where the strawberries were planted out in poor sandy soil, I have obtained a famous crop by giving plenty of liquid manure in spring. A similar result followed when, before planting out the runners, I have taken out a spit of mould, and put in its place a spitful of loam, and then planted the runners in this. I have also planted the runners in small pots filled with loam, and about the 1st of November planted them out for the next year's crop. I may state here that I never put more than one plant in a pot eight inches deep, and in planting out these for the next year's crop, they are put a foot apart in the row, the rows being two feet asunder. Care should be taken not to save any runners from plants that have not borne well; all those that do not should be pulled up at once. The strawberry is very liable to deterioration from neglect of this point, the plants becoming unfruitful from an excessive luxuriance of growth.

Where persons do not force, it is a good plan to trench the ground well, and plant the runners a foot apart each way. By this means a good crop will be insured for the first year, and after this has been gathered every second row should be cut away with the spade, leaving the others for the second year; after this they should be destroyed as soon as they have produced enough of runners for a new plantation. For many years I have mulched between the rows with fresh stable manure, about an inch thick all over the ground, just as the strawberries were coming into flower. If the weather be dry, water should be given several times; this carries the strength of the manure down among the roots, and by the time the fruit begins to ripen the straw will be quite clean and free from smell. It then forms an excellent safeguard against heavy rain dashing grit over the fruit, a thing much to be guarded against. I have found this plan much better than that of using clean straw or short grass, but if plenty of liquid manure can be had the case would be altered.

Mr. Braithwaite, of Weymouth, once sent me a cask of schist, a bituminous earth; I tried it and found the effect excellent upon young cucumbers, melons, potatoes, strawberries, and indeed upon plants in general.

I may add, in conclusion, that the runners from pot plants always bear a week earlier than those from plants that have never been in pots.

The above is my plan of treating this fine fruit, so universally grown and liked, but which, I believe, I should be justified in saying has been more roughly treated than any other plant, except, perhaps, the potato; and this too in places where better things might have been expected. It is only a year since persons were advocating, in the Gardening Periodicals, the barbarous system of mowing down the leaves, the consequence of which is a new growth of the plant, too late in the autumn to form buds for the next year's crop, not to speak of the drain on the system of the plants that takes place in consequence of the operation. Such a proceeding must be the result of experimenting without thought or purpose, and it would be much better to leave Nature alone than interfere with her in such a way.

Sound cultivation can only be founded on observation of the natural tendencies of plants, so that by artificial means we may favour their unfolding in the particular direction we require. Thus we lead Nature to furnish us with products which, under common conditions, are not developed, and this without injury to the plants; but all attempts to *force* the production of particular results, in opposition to natural tendencies, must either fail or be accompanied with the destruction of the health of the subject.

XIX.—*On Amaryllids.* By D. Beaton, gardener to Sir William Middleton, Bart., Shrubland Park, Ipswich.

(Communicated Dec. 11, 1849.)

When the late Dean of Manchester had split up into fragments the mass of bulbous plants which formerly passed as species of Amaryllis, and divided them into separate genera, which he distributed into the different sections of the order, I well remember the discontent and heartburnings which obtained among many of our best bulb growers with his arrangement, and these lamentations forced strongly upon the mind the different ideas of utility entertained by botanists and mere gardeners. The arrangement was certainly not very flattering to those who would "let well alone," and yet it was so mysterious to the grumblers that they feared to show their opposition to it in public print. How I came to know how the tide ran was by mere chance. Mr. Loudon sent an early copy of the Amaryllidaceæ to me in the end of April, 1837, with a request that I would write a notice of it for the Gardener's Magazine, to be in time with it for the next June Number, which I did, and for which I was thought a fair target for the shafts of the grumblers, having spoken favourably of the work. I thus became aware of how far honest men differed from the author and from each other on the arrangement of Amaryllids. I was asked over and over again what difference could be found between a Hippeastrum and an Amaryllis, or between a Pancratium and a Hymenocallis, and what affinity there could be between a Vallota and a Cyrtanthus to warrant their alliance so closely in this new arrangement. Looking at Vallota and Cyrtanthus with a gardener's eye, it does seem strange that plants so dissimilar in their outward forms should still be related botanically—the Vallota being to all appearance a true Amaryllis, while the Cyrtanthus looks as if it rather belonged to the section in which Clivia and Coburgia are found—Phædranassa was not then established. But the Dean, who had a wonderful insight into the true affinity of bulbs, thought otherwise, and instead of following those who took a gardening view of the subject, or of drawing a mistaken comparison between Clivia, alias Imatophyllum, and Cyrtanthus, to which Clivia has no true affinity, divided them into hollow and solid-scaped sections, and he afterwards asserted from his own experience that a plant from either section could no more cross with any plant in the other section than it could with an Oak tree; and thus in his arrangement Vallota is placed side by side with Cyrtanthus on account of their flowers being borne on a pipy stalk or hollow scape, while the Cyrtanthus-like flowers of Coburgia and Clivia availed nothing in his eyes, as these flowers are produced on solid stalks, and he placed a host of other plants between them in the two sections thus distinguished. Nevertheless in his intercourse with gardeners he wished them not to give up any point on which they might differ from him in this arrangement until they proved it by repeated experiments with the pollen, and for the last ten years of his life he allowed a great latitude of correspondence to the writer of this article with respect to such experiments, and was always willing to suggest the most likely mode of conducting them.

Some years since he seemed quite positive about the impossibility of obtaining a cross between a Pancratium and Hymenocallis, although it is very difficult to point out any distinction between some species of the two families, in the absence of the seeds—on the diversity of which he founded his argument against their union—that of Hymenocallis being as green and fleshy as a pea, and in some cases as large as horse beans, while those of Pancratium are invariably black and shelly. Now this is as near as possible the only difference between the seeds of Clivia and those of Cyrtanthus, and it is well known that the Dean had latterly some misgivings as to the value of this distinction between Hymenocallis and Pancratium, for he avowed as much in this Journal in 1847. Therefore if it should turn out that a Pancratium will breed with Hymenocallis, are we to infer that a Cyrtanthus will cross with Clivia? I fear not: the insurmountable barrier in the difference of the flower scapes still intervenes —a feature, as we have already seen, which renders a Clivia as unfit to cross with a Cyrtanthus "as with an Oak," although the two individuals look as much alike as if they were twins, while Cyrtanthus has crossed freely with the Vallota, with which it has hardly one point of outward resemblance; but I believe it will be found that their seeds are very similar, and they agree in having a pipy stalk like the Hippeasters.

I have laid the foundation for crossing the Cyrtanthus by the pollen of Vallota some years since at the request of Dean Herbert. In 1845 I sent three curious new bulbs to him which were received here from Captain G. Broke, R.N., from Algoa, and he requested particularly that I would procure some flowering bulbs of either of the evergreen Cyrtanthi fresh from their native soil through Captain Broke, alleging as a reason that he was anxious to see if I could effect a cross between them and the Vallota, and that there was more certainty in our being able to flower a fresh specimen than those we already possessed, after they had stood a long time in pots with little disposition to bloom: accordingly a couple of fine bulbs were here in due time, not as I wished them, however, for I sent out instructions to have as many of their old roots saved as possible—always a good provision in the case of such bulbs as are known to be shy bloomers with us—but the commission was entrusted to a Cape Town seedsman, and these collectors never think of looking after the roots of such bulbs as they gather and offer for sale, and no roots arrived with the Cyrtanthus bulbs, but after two full seasons' growth one of them flowered last July, being the third season after potting. The treatment was suggested by the Dean, and may be stated thus:—The two bulbs were potted in pure yellow loam, considerably reduced with sand, in upright pots not wider at the mouth than to allow half an inch space between them and the bulbs, which were covered up to the neck; that being the safest way to protect pot bulbs from the effects of the variable atmosphere of our plant-houses. They were then plunged in a brisk bottom heat, but no water was given till the leaves were about 3 inches long and roots began to appear through the ball, when they were removed to a cool and more airy place. This was late in the summer of 1846, which for heat and light was not much behind a South African summer, and the following summer of 1847 was also favourable to the growth of these bulbs. During summer they were kept in an airy greenhouse and watered freely, and by the beginning of September they were removed to a front shelf in a late vinery, where a constant draught of air passed over them day and night whenever the weather permitted, and where the glass was seldom lower than 60°, with a very dry atmosphere. They stood here till the grapes were all cut in January, and the house was allowed to cool down to near the freezing point, and all this time they received very little water. They were then removed to the cool end of a stove, where they remained till late in April, and afterwards they were taken to the greenhouse. I believe a dry atmosphere, abundance of air, and a temperature of about 50° to 55°, are necessary to these evergreen Cyrtanthi from September to May. One of these two bulbs produced 11 fine flowers, red, orange, and green, and the scape was 2 feet 11 inches long, seven inches of which being made after the plant had done flowering—a circumstance I do not recollect having ever seen in any other bulb; but a change of temperature might have caused it, for the plant was removed to a closer house, though not hotter, than where it flowered. Four of the flowers were dusted with their own pollen, and four with the mixed pollen of the two varieties of Vallota purpurea; the rest were cut off to ripen the pollen for future use. In about ten days I began to tremble at the issue of the experiment. On the seventh or eighth day after the flowers were dusted, those which received their own pollen slackened their growth and ultimately perished; those which were crossed with Vallota held on. I took every known precaution, and I do not believe that I can be deceived in the cross. The pollen was extracted long before it was fit for use. Every alternate flower was dusted with one kind of pollen, and a coloured string then tied to each—the colour of the string and the name of the pollen plant was marked in my memorandum book before the other pollen was applied to the rest of the flowers.

Now, although I have taken every possible precaution to secure this experiment free from error, I confess I should have looked on it as a total failure as soon as I perceived the falling off of those flowers that were dusted with their own pollen, had I not been aware that a similar circumstance was quite familiar to Dean Herbert in Hippeastrum—a family next door to Cyrtanthus. He said he could cause any Hippeastrum to cast its seed-pods that were fertilised by its own pollen, by introducing the pollen of a neighbouring species to the rest of the umbel, and yet I have failed in many instances to prove this freak in all the Hippeastrums that I cultivate. But that there should be no room for mistake, I requested Dr. Lindley to take charge of one of the seed-pods, and see that the seedlings from it should be properly attended to, in case that I should meet with some unforeseen accident or bad luck in nursing the rest. The seeds began to sprout in the three pods which I kept before the pods bursted, so that we are sure of their vitality.* Three flowers of the Vallota purpurea were dusted with the pollen of Cyrtanthus obliquus at the same time, but, before the week was out, this experiment was sealed, at least for this season ; and I mention it merely to "show cause" why I do not follow out such experiments of this nature as are sometimes recommended, as some wise people think that gardeners in large places can do anything, and especially be able to carry out their own hobbies. Our case is often the reverse of this.

A correspondent to the 'Gardener's Chronicle,' who signed himself "Mucklewell," very kindly sent me some of his Vallota pollen for this experiment, for which I feel very much obliged to him, and also to Mr. Leach, Clapham Park, for pollen of his three beautiful Brunsvigias which he exhibited before the Society last autumn. I dusted a score of flowers of the Amaryllis Belladonna with the pollen of the Brunsvigias, and as many with their own pollen, but the whole refused to seed ; it was probably too late in the season for them to seed, being the very end of September, and they were in the open border.

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* [The seeds here alluded to have grown, and have produced about a dozen young plants, with long, linear, somewhat glaucous, blunt, curved, deep-green leaves. But at present no opinion can be formed of what they will eventually become. The curvature and slight bloom may possibly be derived from the oblique Cyrtanth (*Cyrtanthus obliquus*), but the habit is more that of a Vallote.]

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

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10. Griffinia Liboniana. *De Jonghe.*

Presented to the Society in 1848 by M. de Jonghe, of Brussels. Probably a native of Brazil.

A hothouse bulb, with narrow, oblong, flaccid leaves, which much resemble those of a Drimia, being mottled with pallid blotches upon a dark green ground. The scape is about 6 inches high, and round. The flowers are small, pale ultramarine, with very narrow segments, whitish on the lower half. Stamens very short, and declinate.

All the flowers of the plant now before me are so much deformed that it is not desirable to describe it further. It is no doubt a very distinct species of the genus, the narrow, unstalked, blotched leaves being quite peculiar to it. But it is not likely to possess any interest as an object of beauty.

March 25, 1850.

11. Garrya elliptica. *Douglas, in the Botanical Register*, vol. xx., t. 1686. The Female.

A plant collected by Mr. Hartweg in California; was received at the Garden in a living state.

Hitherto the male only of this fine Evergreen bush has been known in our Gardens; in which its good foliage and long massive tails of yellowish catkins, appearing in the earliest days of spring, have deservedly rendered it a universal favourite.

The female, which in foliage is like the male, has flowered now for the first time in Europe, and proves to be as destitute of beauty as the male is conspicuous for it. The catkins are short, green, and, at a little distance from the bush, are not to be observed. To Botanical Gardens the plant is an acquisition, as it is to Horticulture, inasmuch as it will probably now ripen fruit, and thus afford a ready means of propagation. It is possible, also, that the deep purple berries, with long clusters of which the plant is loaded in North-West America, may prove ornamental; but of that we can at present have no certain knowledge.

March 16, 1850.

12. GALANTHUS PLICATUS. *Bieberstein, Flora Taurico-Caucasica, Supp.*, p. 255.

Received from Dr. Fischer, from the Imperial Botanic Garden, St. Petersburgh.

This beautiful Snowdrop, although long cultivated in gardens, is hardly known to the public. It is from the Caucasus, whence it seems to have found its way to Constantinople about the year 1592. Aucher Eloy also appears to have met with it on the borders of the Black Sea.

[Galanthus plicatus.]

There appears to be no doubt as to its specific difference from the common Snowdrop, its leaves being very much broader, and, as it were, plaited, not flat, its flowers being larger, and the green on the petals far more conspicuous. In a horticultural point of view it is a much finer thing than the old Snowdrop, just as hardy, and as easily managed.

March 3, 1850.

13. Cyanotis vittata.*

Received from an unknown correspondent, supposed to have been obtained from Mexico.

This plant, known in some hothouses under the name of Tradescantia zebrina, is an undoubted Cyanotis, with which genus it corresponds in all essential circumstances. I do not, however, find that the two ovules are collateral, one being erect and the other suspended, a peculiarity ascribed by Dr. Robert Brown to the seeds: but I have not been able to examine the ripe fruit.

The stems, which are much branched, lie prostrate, or hang down from the shelf on which the plant is placed, and are of a deep rich purple; the leaves have the same colour, but are striped with a greenish grey, and when fresh are exceedingly pretty; on which account the plant is a favourite for covering rough unsightly places in hothouses. The flowers are insignificant; they appear for a long time, one after the other, from within a couple of terminal bracts, or spathes, of which one is shaped like the ordinary leaves, except being sessile, the other is much shorter, and boat-shaped. The calyx of these flowers is a short tube, irregularly 3-parted. The corolla forms a tube, much longer than the calyx, and has a flat 3-lobed limb, with ovate divisions. The stamens bear a tuft of jointed hairs in the middle, and protrude beyond the tube of the corolla; the anthers are transversely linear, or almost crescent-shaped, with a small cell on each horn. The ovules are 2 in each cell, ascending, and one placed above the other. When the young fruit begins to swell, it turns itself stiffly downwards by a bend of the stalk, loses one of its cells, and becomes 2-celled and 2-seeded.

14. Galphimia glauca. *Cavanilles*, *Icones*, vol. v. p. 61, t. 489.

Sent from Mexico by Mr. Hartweg in 1837.

A beautiful shrub, easily kept in the form of a bush. The leaves are a deep bluish green, ovate, obtuse, glaucous on the

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* C. *vittata;* procumbens, ramosa, pilosa, foliis oblongis discoloribus viridigriseo vittatis vaginis ore fimbriatis, floribus intra spatham duplicem hinc foliaceam illinc cymbiformem recurvam aggregatis.—J. L.

[Galphimia glauca.]

underside, and furnished with a pair of glands on the edge near the base. The flowers, which are golden yellow, appear in close terminal racemes, between 3 and 4 inches long in strong plants. Each has five distinct petals, with almost exactly the form of a trowel.

This slender stove plant grows freely in a mixture of loam and sandy peat, and is easily increased by cuttings of the half-ripened young shoots. It requires to be kept rather dry for a few months, and afterwards, during the growing season, to be freely supplied with moisture both to the roots and in the atmosphere.

It is a very desirable species, as it flowers during the latter part of the autumn.

Sept. 10, 1848.

15. Ternströmia sylvatica. *Chamisso and Schlechtendahl, in Linnæa*, vol. v. p. 220.

Raised from seeds brought home by Mr. Hartweg, probably from Mexico.

A small evergreen shrub, not unlike a Sweet Bay, but more spreading. Leaves narrow, oblong, bluntly acuminate, deep green on the upper, very pale on the under side, perfectly smooth. The flowers grow singly on short curved stalks, and are quite hidden among the leaves. They are of the pale, dull, greenish purple of Magnolia fuscata, and quite destitute of beauty.

This plant corresponds with authentic specimens in my possession gathered near Jalapa by Deppe and Schiede. Mr. Bentham, who examined a flowering specimen produced in the Apothecaries' Garden at Chelsea, remarks that "it is the Ternströmia sylvatica of Chamisso and Schlechtendahl, which I think—as they even suggest may be the case—is the same as T. lineata, *D. C.*, *Mem. Ternstr.*, p. 17, t. 1 (in *Mem. Soc. Phys. Gen.*, 1823). De Candolle's figure is the copy of a rude one of the Mexican Flora he so often quotes, and the stunted habit and blunt anthers are probably artistical imperfections. He figures a red line across *all* the petals; Chamisso and Schlechtendahl found it on *none*; in the specimen you sent, it exists on *two* out of the five petals."

Mr. Thomas Moore, the only grower who has yet flowered it, remarks that the blossoms, when fresh gathered, have a very agreeable hawthorn-like scent. It is, however, a species of no horticultural interest. Those who may wish to grow it must keep it in a greenhouse.

Feb. 24, 1850.

16. Boronia spathulata. *Lindley, Swan River Botany*, p. 17.

Received from Mr. J. G. Henderson under the name of *B. mollina*.

An erect greenhouse shrub, of little beauty, with compressed branches, which are rather rough when young. The leaves are of a dull olive-green colour, simple, veinless, smooth, short and roundish obovate on the early branches, becoming narrower and spathulate on the later. Flowers pink, small, in small terminal cymes, inconspicuous; their stalks are defended by coarse glands. All the plant has a heavy, unpleasant odour, resembling Rue.

Even in its native country, after having been burnt down, and reduced in stature to 9 inches or a foot, this can be a plant of very small interest. When extended by cultivation into long straggling branches sparingly covered with leaves, it is quite destitute of interest for gardens, and must be regarded as the worst of the Boronias.

March 18, 1850.

17. Boronia tetrandra. *Labillardière, Nov. Holland*, i. p. 98, t. 125.

Received from Mr. J. G. Henderson under the name of *B. microphylla*.

This little shrub is not unlike a dwarf Boronia pinnata; but it has a less number of leaflets, and seldom produces more than 1 flower at a time in each axil. These are pale pink, rather large, and very pretty. The leaflets are usually 7, but occur to the number of 5, or even 9; they are narrow, blunt, and smell rather agreeably. The whole plant is destitute of down or hairs.

The name of *B. microphylla*, erroneously applied to this plant in gardens, really belongs to a totally different plant. According to Dr. Hooker's views of the variations to which *B. tetrandra* is subject, this clearly belongs to that species; but it must be confessed that it is materially different from the form to which its discoverer gave the name.

March 18, 1850.

18. Ceanothus papillosus. *Torrey and Gray, Flora of North America*, vol. i. p. 268. *Hooker, Icones Plantarum*, t. 272.

Raised from Californian seeds sent home by the collector Hartweg.

An evergreen bush, covered with coarse hair and resinous tubercles, in a wild state forming a compact mass of branches, in cultivation growing longer and weaker. Leaves small, deep green, narrow-oblong, obtuse, with a single mid-rib, and numerous lateral veins, covered with down on the under side. Flowers in small roundish terminal stalked bulbs, bright blue as in C. azureus.

In the autumn of 1849 a few flowers opened of this curious species, but too late to be perfect. They will render the bush pretty, if there is enough of them. But it is uncertain whether or not the plant is hardy, and fears are entertained that it may not be. Even in that case, however, it will be worth growing as an evergreen greenhouse plant of good habit, bright blue flowers being much wanted.

Oct. 12, 1850.

19. Oncidium varicosum. *Lindl., in Bot. Reg.*, sub t. 1920.

Presented to the Society by M. de Jonghe, of Brussels.

This is a fine glaucous strong-growing Orchid, of considerable beauty. The leaves are firm and ligulate-lanceolate. The scapes, which are strong, very glaucous, and about 3 feet long, having a great branching panicle, loaded with from 80 to 90 large showy flowers. Of these, two lower sepals are united, while the upper and the petals are pale dull green banded with dull brown. The lip is large, very bright yellow, with two ovate lateral ears, somewhat crenate in front, and a somewhat 4-lobed central portion. The crest consists of two triple teeth, one standing before the other, and of a little ring of varicose veins placed on each side of it. The wings of the column are oblong, whole coloured, and finely notched.

The earliest knowledge I had of this was derived from an examination of specimens in the herbarium of Dr. v. Martius, collected in Brazil by the Prince Maximilian of Wied Neuwied. Since that time M. de Jonghe brought it into cultivation, and it must be confessed that the varicose Oncid is one of the finest yellow species in our gardens.

Oct. 11, 1849.

20. Calamintha mimuloides. *Bentham, Plant. Hartweg.*, p. 331.

Raised from Californian seeds sent home by the collector Hartweg.

A hairy, half-shrubby, herbaceous plant, covered all over with viscid glands. Stems erect, regularly and simply branched, about 1½ foot high. Leaves stalked, ovate, acute, coarsely crenate-serrate except at the base, which is entire. From the axils of the upper leaves rise solitary stalked labiate flowers, about 2 inches long, with a somewhat cylindrical, striated, 5-toothed, hairy, and glandular calyx, and a yellow corolla deeply stained with orange at the upper part.

One of the best of the hardy herbaceous plants obtained from Hartweg's expedition to California, but too leafy for a bedding out species. It seems best adapted to cultivation apart from other plants, when it forms a deep green summer bush of some beauty.

Although the flowers are described above as growing singly in the axils of the leaves, yet it is to be observed that each flower is succeeded by five or six others, so that there is a long succession of bloom.

Sept. 20, 1849.

21. Pentstemon azureus. *Bentham*, *Plantæ Hartwegianæ*, p. 327.

Raised from seeds brought home by Hartweg in June 1848, and said to have been collected among the Sacramento Mountains in California.

A smooth, glaucous, erect perennial, about 2 feet high. Leaves linear-lanceolate, quite entire upon the stem, but near the root oblong and slightly heart-shaped at the base. Flowering racemes about a foot long or rather less, slightly downy, with one short peduncle in the axil of each opposite bract, bearing from 1 to 2 flowers. The latter are rather more than an inch long, clear violet blue, much deeper in the limb than on the tube.

This hardy perennial is stated by Mr. Bentham to have been gathered in the dry river beds of the valley of the Sacramento. Hartweg wrote on his seed papers that it was a mountain plant. It is very handsome as a border flower, but, as its narrow foliage is not good, it is best grown among other species, such as Pelargoniums, &c.

Sept. 17, 1849.

REPORT FROM THE COUNCIL

TO THE

ANNIVERSARY MEETING, MAY 1, 1850.

It will probably be in the recollection of the Society that at the last Anniversary the Council expressed their desire not to incur "any material expenses which are not absolutely required for the maintenance of the Society in a healthy state." In pursuance of this resolution the Council have refrained from embarking in any pecuniary undertaking which did not appear to be of pressing necessity. Circumstances have, however, occasioned a larger outlay for extra work than was contemplated in May, 1849.

For many years the Exhibitions at the Garden were accompanied by such constant fine weather that precautions against rain appeared needless. From 1833 to 1843, a period of eleven years, only two afternoons out of thirty-three were wet, and of these one was very slightly so. In 1845 and 1846 every day was fine; but since that time the weather in May, June, and July has changed so much, that out of nine meetings in 1847, 1848, and 1849, five have been more or less stormy. In 1849 one day only proved wet, but so much inconvenience was then experienced that the Council have felt obliged, from a regard to the convenience of visitors, to endeavour to devise such a remedy as is possible where very large numbers assemble in the open air.

With this view the old entrances to the Garden have been paved and drained, and a new double entrance has been opened into the Arboretum, from the Duke of Devonshire's road, whence a gravel walk, 630 feet long and 15 feet wide, has been made as far as the large Conservatory. On either side of this walk the tents will be pitched, and it is expected that a dry line of communication will be secured, in the event of rain, from one range of tents to the other. This alteration would not, however, have alone completed a convenient approach to the tents from the more distant entrances to the Garden, and therefore it has been found desirable to construct another gravel walk, 15 feet wide and 667 feet long, from the old gate in the Duke of Devonshire's road as far as the new approach to the Conservatory. In doing this the opportunity has been taken of reconstructing the Flower Garden, which had for many years been much in want of remodelling. The Garden Committee, under whose charge these works were placed, availed themselves of plans prepared by Mr. Glendinning, to whom the execution of the groundwork and planting was also intrusted. The Council trust that this operation will be found to have added greatly to the convenience of visitors to the Garden as well as to have improved its appearance. In order to render these alterations useful to the Exhibitors, a yard expressly for the purpose of receiving their waggons and carts has also been formed out of a portion of the Orchard, in the neighbourhood of the tents.

The charge to the Society of such part of these works as had been completed when the accounts were made up, was 161*l.* 15*s.* 10*d.*; the remainder of the expense will come into the accounts of the current year.

The necessity of providing additional accommodation for the Exhibitors having induced the Garden Committee to inquire into the state of the Orchard itself, they arrived at the conclusion that the whole of this important part of the Garden demanded immediate reconstruction. The object of ascertaining the quality of the varieties of hardy fruit-trees, and of determining the identity of the multitudes of names under which those varieties have been known, had been in a great measure accomplished and embodied in the Fruit Catalogue of the Society. The Garden Committee therefore felt that the original purpose of the Orchard had been substantially attained; and that it would be desirable to reconstruct it with a view to other applications, such as the trial of new kinds of fruit-trees, and the exemplification of the best method of Orchard pruning, training, and management. They also found that the trees of Plums and Cherries were so decayed that it had become indispensable that they should be at once removed. The Council, concurring in these views, authorized the execution of the work proposed by the Garden Committee, and the accounts of the present year include a charge of 70*l.* 2*s.* 3*d.* on this head. The above two sums, making together 231*l.* 18*s.* 1*d.*, are entered in the balance-sheet under the head of New Works at the Garden.

Exhibitions.

The Exhibitions of 1849 were more numerously attended than those of 1848.

The number of tickets issued was . .	18,517
,, ,, presented at the gates	17,624

Showing that no fewer than . . . 893 tickets were taken more than were used. This was an increase of 403 in the issue of tickets. As regards the financial result of the meetings, the Council have to report that the receipts of 1849 exceeded those of 1848 by the sum of 222*l.* 6*s.* 6*d.*; and that the expenses of 1849 were more than those of 1848 by the sum of 8*l.* 11*s.* 3*d.* In the outlay of the present year 297*l.* 8*s.* 9*d.* (estimated at more than 300*l.* in the last Report) is charged for new tents, while in 1848 no such charge was incurred; so that upon the whole the account is better to the extent of 511*l.* 4*s.*

The following table shows the comparative expenditure on account of Exhibitions in the years 1847, 1848, 1849:—

	1847.			1848.			1849.		
	£.	s.	d.	£.	s.	d.	£.	s.	d.
Miscellaneous timber	41	18	10	29	1	10	50	18	1
Repairs of tents	12	9	2	17	18	3	..		
Miscellaneous repairs, ironmongery, &c.	19	8	9	14	1	9	27	1	3
Oil, paint, &c.	13	12	7	9	13	9	13	11	1
Turf, gravel, &c., and road repairs	39	2	0	3	19	6	7	6	0
Handbarrows, water-pots, &c.	25	6	6	17	9	4	17	15	7
Carpenters, painters, tent-pitchers, &c.	162	10	8	138	14	1	146	6	10
Miscellaneous labour beyond the ordinary service of the Garden	295	13	4	251	2	10	255	14	2
Hire of crockery	12	13	0	12	5	0	10	0	6
Miscellaneous printing	70	18	0	90	15	0	39	8	2
Admission tickets	49	1	0	43	10	0	37	15	0
Advertisements	93	4	6	76	2	6	86	16	0
Judges	47	5	0	39	18	0	27	6	0
Extra clerks and temporary rooms	54	1	0	56	9	0	54	7	0
Police	115	18	0	115	11	0	112	6	0
Bands and all musical expenses	314	4	0	306	17	0	277	2	0
Provisions for exhibitors, police, &c.	53	11	3	56	17	3	57	2	0
Watering roads	12	0	0	28	5	0	28	5	0
Miscellaneous expenses, including stationery, carriage, postage, &c.	88	1	9	65	18	0	56	10	11
Cost of new tents	..			..			297	8	9
	1520	19	4	1374	9	1	1603	0	4
Medals awarded	1262	0	0	1204	15	0	*984	15	0
	2782	19	4	2579	4	1	2587	15	4

The experiment of increasing the prizes offered for fruit in the month of July, and of offering no scheme of fruit prizes in May and June, but nevertheless of giving prizes to such fruit as might be produced in those months, not having been productive of the advantage expected from the plan, the Council have announced that, in 1850, the fruit of May, June, and July will be placed on an equality, as in previous years.

In looking at the financial operations of the year, in com-

* This is part of the sum of 1038*l.* 1*s.* 6*d.* entered in the balance-sheet as medals awarded; the balance of 53*l.* 6*s.* 6*d.* being for awards at ordinary meetings at Regent-street.

parison with those of the preceding one, irrespective of the points now adverted to, the Council find that the RECEIPTS have diminished to the extent of 548*l.* 0*s.* 11*d.*, as will be seen by the following comparative statement:—

	1848–9.			1849–50.		
	£.	s.	d.	£.	s.	d.
Compositions for life from Fellows . . .	294	0	0	84	0	0
Annual subscriptions	3023	10	0	2963	5	6
Admission fees from Fellows	214	4	0	176	8	0
Transactions and Fruit Catalogue sold . .	48	17	3	31	15	9
Quarterly Journal sold	64	15	0	66	6	11
Rent of apartments let off in Regent-street .	150	0	0	150	0	0
Garden produce sold	24	8	5	17	15	9
Receipts from Members for garden charges.	47	4	6	42	1	0
Miscellaneous receipts.	4	5	7	6	6	7
Garden Exhibitions, 1848	3867	14	0	3937	15	0
Ditto ditto 1849	302	12	0	..		
Profit on purchase and sale of Exchequer Bills	9	3	4	..		
Dividends on 3 per cent. Consols . . .	..			26	18	8
	8050	14	1	7502	13	2

From this it appears that the diminution alluded to has been caused, in a great measure, by the newly-elected members preferring to pay their subscriptions annually rather than to compound for them, the falling off in receipts under this head alone amounting to 210*l.* The number of admission fees paid was also six fewer than in the previous year. It will also be observed that there are no receipts entered on account of the Garden Exhibitions of the current year, and in this way is caused a decrease of 302*l.* 12*s.* The reason of this omission is that the Exhibition receipts were so small up to the 31st March last as only to defray the preliminary expenses incurred. The accountant has therefore not included the receipts and payments under this head on either side, but has carried them forward to next year, by which means the total amount of receipts and payments on account of the Garden Exhibitions will be seen at once, without having to refer to two years' statements.

On the other hand the expenditure of the Society has been reduced from 7691*l.* 13*s.* 4*d.* to 7392*l.* 14*s.* 4*d.*, notwithstanding the unavoidable extra outlays already referred to, which amounted to 231*l.* 18*s.* 1*d.* This results in part from the reduction of that portion of the Society's debt which bears interest, and in part from increased economy in the ordinary branches of expenditure: an economy which it is the anxious desire of the Council to carry to the utmost possible extent compatible with the essential interests of the Society.

The particulars of the EXPENDITURE in 1848–9 and in 1849–50 will be found in the following table:—

	1848–9.			1849–50.		
	£.	s.	d.	£.	s.	d.
Interest on loan notes, &c.	334	7	10	279	7	4
Rents, rates, taxes, &c., Regent-street and Chiswick	663	6	1	660	17	6
Repairs, furniture, &c., Regent-street . .	32	11	11	30	6	1
Housekeeping expenses ditto . .	36	0	6	33	14	7
Salaries, collector's poundage, &c. . . .	1102	16	2	1086	5	2
Cost of Quarterly Journal	375	19	8	370	15	4
Cost of Transactions and Fruit Catalogues .	49	15	1	7	10	11
Library charges	13	8	10	18	0	0
Printing, stationery, &c.	93	7	5	68	2	1
Foreign missions and imports	73	11	7	15	5	3
Expenses of meetings, postage, carriage, &c.	156	13	3	132	5	6
Garden labour	1024	6	10	1010	15	0
Implements, mats, seeds, &c..	118	17	9	113	15	5
Tan, dung, &c.	42	5	6	28	6	1
Coals and coke for garden	89	10	0	147	16	1
Miscellaneous expenses at garden . . .	258	7	11	183	13	2
Garden repairs.	298	6	11	107	6	11
Distribution expenses	242	0	0	214	13	8
Exhibition expenses, 1848	1340	3	10	1562	10	10
Ditto ditto 1849	40	9	6	..		
Cost of medals awarded	1305	6	9	1038	1	6
New works at garden	..			231	18	1
Law expenses, 1846 to 1849	..			51	7	10
	7691	13	4	7392	14	4

Upon the whole the effect of the policy of the Council during the past year has been to reduce the debt to the extent of 217*l.* 6*s.* 6*d.*,* which, considering the diminution of the Society's income to the extent of 548*l.* 0*s.* 11*d.*, as already stated, will, it is hoped, be found satisfactory to the Society.

The following Report from the Auditors embodies the particulars upon which the preceding statements are founded:—

* Income as detailed above	£7502	13	2
Deduction from outstanding accounts 1st April, 1849	32	16	11
Ditto from medals ditto .	30	4	6
Profit on Consols sold	44	6	3
	£7610	0	10
Less expenditure, as detailed above . . .	7392	14	4
Surplus of income over expenditure in 1849–50 .	£217	6	6

Which agrees with the account of Reduction of Debt at foot of balance-sheet.

AUDITED ACCOUNT OF THE HORTICULTURAL SOCIETY OF LONDON.

Receipts, Payments, and Liabilities from the 1st of April, 1849, to the 31st of March, 1850.

RECEIPTS.

RECEIPTS		£. s. d.
To compositions for life from Fellows, 2 at 40 Guineas each		84 0 0
To annual subscriptions		2963 5 6
To admission fees from Fellows, 28 at 6 Guineas each		176 8 0
To Transactions and Fruit Catalogue sold		31 15 9
To Quarterly Journal sold		66 6 11
To rent of apartments let off in Regent Street		150 0 0
To garden produce sold		17 15 9
To receipts from Fellows for garden charges		42 1 0
To miscellaneous receipts		6 6 7
To Dividends on 3 per Cent. Consols		26 18 8
To Garden Exhibitions, 1849		3937 15 0
		7502 13 2
To Sale of £400. 6*s*. 7*d*. 3 per Cent. Consols		380 6 3
To Sir W. P. Call and Co. on loan, 30th Jan., 1850		1000 0 0
To Balance at Banker's, 1 April, 1849	£440 9 5	
ditto with Vice-Secretary, ditto	6 15 6	
		447 4 11
£		9330 4 4

PAYMENTS AND LIABILITIES.

PAYMENTS AND LIABILITIES		Payments. £. s. d.	Liabilities. £. s. d.
By interest on loan notes, &c.		279 7 4	
By rents, taxes, rates, &c. Regent Street and Chiswick		249 18 8	410 18 10
By repairs, furniture, &c., Regent Street		15 14 3	14 11 10
By housekeeping expenses ditto		33 14 7	
By salaries, collector's poundage, &c.		868 6 2	217 19 0
By cost of Quarterly Journal		159 2 10	211 12 6
By cost of Transactions and Fruit Catalogues		7 10 11	
By library charges		18 0 0	
By printing, stationery, &c.		55 7 1	12 15 0
By foreign missions and imports		11 9 3	3 16 0
By expenses of meetings, postage, carriage, &c.		132 5 6	
By garden labour		1010 15 0	
By implements, mats, seeds, &c.		77 17 3	35 18 2
By tan, dung, &c.		25 8 1	2 18 0
By coals and coke for garden		. .	147 16 1
By miscellaneous expenses at garden		120 10 1	63 3 1
By garden repairs		107 6 11	
By distribution expenses		129 4 5	85 9 3
By Exhibition expenses, 1849		1496 12 4	65 18 6
By new works at garden		97 18 1	134 0 0
By law expenses, 1846 to 1849		51 7 10	
By outstanding accounts, 1 April, 1849	£1444 11 8		
less difference in settlements	32 16 11		
	1411 14 9	1338 18 6	72 16 3
			1479 12 6
By medals' account :—			
Balance outstanding, 1 April, 1849	£690 5 0		
Awarded since	1038 1 6		
	£1728 6 6		
less deductions	30 4 6		
	£1698 2 0	1309 13 0	388 9 0
			1868 1 6
By Sir W. P. Call and Co., Loans, 1st April, 1849, repaid		1500 0 0	
By Balance at Banker's	£230 6 7		
ditto with Vice-Secretary	3 9 8		
		233 16 3	
		9330 4 4	

11 *April*, 1850.

This account has been examined, and, being compared with the Vouchers, found correct.

THOMAS HOBLYN,
SAMUEL F. GRAY,
CONRAD LODDIGES, } Auditors.

A. DUNCAN, Accountant,
10, Tokenhouse Yard.

	£. s. d.	£. s. d.
Amount of Debt 1st April, 1849	. .	8251 11 9
Amount of Debt 1st *April*, 1850, *viz*.,		
To Creditors on Loan Notes	5400 0 0	
To Sir W. P. Call and Co. on Loan	1000 0 0	
To Liabilities, as above	1868 1 6	
	8268 1 6	
Less Cash Balance	233 16 3	
		8034 5 3

Although, in considering the pecuniary position of the Society, the Council do not possess an exact knowledge of the value of the property existing in Regent-street and at the Garden, yet, assuming as correct some of the data of former years, and reducing the last valuation of other uncertain sums from 10 to 20 per cent., it appears that the fixed and floating property possessed by the Society at the date of the Auditors' report was as follows:—

	£.
Lease of the house in Regent-street	4,000
Library, &c., there	900
Furniture there	180
Effects at the Garden, and lease of the Garden . .	12,000
Estimated value of stock of Transactions, Journals, Fruit-catalogues, copper-plates, wood-blocks, &c. .	865
Amount of unpaid subscriptions due May 1, 1849, supposed to be good	505
Amount of unpaid subscriptions for the past year now due	2,730
Miscellaneous assets, consisting of rent due, unpaid dividends, and sums due for Journals, &c. sold . .	60
	£21,240

The debts then, amounting to 8034*l.* 5*s.* 3*d.*, and the property bearing the value of 21,240*l.*, the balance in favour of the Society is at least 13,205*l.* 14*s.* 9*d.*

When the By-laws of 1849 were agreed to by the Society, the Council was authorized to create a class of Associates with fewer privileges than Fellows, and subject to a smaller admission-fee and annual subscription. Upon full consideration, the Council have not thought it expedient to make use of this power; but they have arrived at the opinion that the present amount of the admission-fee is prejudicial to the interests of the Society, and they therefore intend to take the earliest opportunity of proposing to the Society that in future the admission-fee, for Fellows, shall be two guineas instead of six guineas.

The Garden.

The Garden is held of his Grace the Duke of Devonshire, upon a lease for sixty years, from September 29th, 1821, is dated March 21st, 1822, and was re-executed for the purpose of registration on the 14th April, 1823. The rent paid is 300*l.* a year, and the lease is renewable every thirty years, for ever, on a fine of 450*l.* It will be necessary to give notice before September 29th, 1851, of the Society's desire to renew the lease for a further term of sixty years, provided it should appear desirable to do so;

otherwise the Society's tenure of the Garden will cease in September, 1881; that is to say, about thirty-one years hence. A future Council will have to decide whether it is desirable to pay 450*l.* in order to secure the Society against this remote contingency. The subject is only introduced into the present Report for the purpose of pointing out to the Fellows in what position they stand with respect to their tenure.

No collector having been in the employment of the Society since the last anniversary, the new plants that have been acquired by the Garden, or to which attention has to be particularly directed, have been derived from the liberality of correspondents.

Among these, the Council would more particularly express their obligations to Dr. Hooker and Mr. H. H. Calvert. To the former gentleman they are indebted for seeds of fifteen kinds of Himalayan Rhododendrons, collected by him shortly before his detention by the Rajah of Sikhim—a present of great value to the Fellows of the Society. To Mr. Calvert, residing at Erzeroum, and now a Foreign Corresponding Member of the Society, they are indebted for various interesting seeds and roots from the districts adjoining that remote station.

They have also to acknowledge various contributions from Fellows of the Society, and others, of which the following are the most important:—

From Capt. Moody, Seeds from the Falkland Isles.
From G. U. Skinner, Esq., various Orchids from Central America.
From the Botanic Garden, Sydney, a case of New Holland Orchids, and other plants.
From M. Vilmorin, of Paris, Gesnera edulis, and various curious Seeds.
From the Royal Society of Van Diemen's Land, a collection of Indigenous Seeds.
From the Administration of the Garden of Plants at Paris, Angræcum virens.
From the Rev. J. Bransby, a collection of Seeds from the Havannah and Islands in the Pacific.
From Mons. L. Bouton, 7 kinds of Mauritius Seeds.
From the Honourable Court of Directors of the East India Company, various Seeds and Orchids; received by the overland mail.
From Mr. Johnstone, Royal Gardens, Hampton Court, plants of the Yellow Cabul Grape, and the Black Monukka Grape.
From J. B. Pentland, Esq., Seeds of the Calisaya plant.

The Society is also indebted for much assistance to various nurserymen, especially to—

Messrs. Standish and Noble, of Bagshot.
Mr. Glendinning, of Turnham Green.
Messrs. Veitch, of Exeter.
Mr. E. G. Henderson, of Pine-Apple Place.
Mr. J. A. Henderson, of the Wellington Nursery; and
Mr. Rinz, of Frankfort.

It is hoped that before another anniversary the Council may have to report the arrival of valuable coniferous seeds from California and Oregon, the Society having taken four shares in the expedition to those countries, now preparing in Edinburgh.

The lapse of another year also enables the Council to mention a few more interesting plants obtained from Mr. Hartweg's Californian collections, concerning which no sufficient information was before in the possession of the Society, viz.:—

Scutellaria splendens. A greenhouse or stove perennial.
Calboa globosa. A large, bright, orange-flowered stove-plant. From the eastern declivity of Orizaba.
Echeveria farinosa. On rocks near Carmel Bay.
Echeveria laxa. From woods near Monterey.
Quercus agrifolia. A new evergreen oak.
Rhododendron californicum. An evergreen, 5 feet high. In a shady dell in the woods near Monterey.
Arctostaphylos. A shrub, 6–8 feet high. In dry, rocky ground. Sacramento mountains and the Cuesta of San Antonio.
Fraxinus. A shrub, 12 feet high. On the flanks of hills near San Antonio.
Pæonia californica. Perennial. In dry places on the Cuesta of San Antonio; also in Bear-valley, Sacramento.
Azalea californica. A shrub, 5–8 feet high. In swampy places, Santa Cruz Mountains.

Concerning the Reading-room, the Council have again to report their entire satisfaction as to the advantages to the young men at the Garden. Their attendance is diligent, and their conduct praiseworthy. At the annual examination in August two of them, viz. William Baxter and Henry Williams, passed a satisfactory examination, and have since been recommended to places. Prizes have been given by the Vice-Secretary for plans of flower-gardens, for writing and spelling, and for questions in vegetable physiology in its relation to horticulture. The sum of 16*s.*, received from Mr. J. F. Wood, has been also given in prizes for an examination in arithmetic.

The following sums have been placed in Dr. Lindley's hands, to be applied by him to the purposes of the Reading-room, viz.:—By Mr. Wood of Nottingham, 16*s.*; by R. H. Solly, Esq. 1*l.*; by W. H. Pepys, Esq., 1*l.*

Seven lectures have been delivered by Dr. Lindley upon subjects relating to Horticulture and the Studies of Young Gardeners; and four by Mr. N. Lindley, of which three were upon the nature of Mechanical Forces, and one upon the Thermometer. Mr. Rauch also gave five lectures on the Art of making Ground Plans.

The books, &c., presented to the Reading-room have been—

From the VICE-SECRETARY:—

Sowerby's English Botany. Re-issue. Part I. Second Edition.

Patterson's Introduction to Zoology. Parts I. and II. 12mo. 1846.

Sur les Causes qui limitent les Espèces Végétales du Côté du Nord, en Europe et dans les régions analogues. Par M. Alph. de Candolle. 8vo. 1847.

Lee's Botany of the Malvern Hills. 12mo. 1843.

Dillwyn's Fauna and Flora of Swansea. 8vo. 1848.

Art de Construire et de Gouverner les Serres; par Neumann. Deuxième édition. 1846.

Marshall's Index Ready-Reckoner. 12mo. 1848.

Hooker's Journal of Botany and Kew Garden Miscellany. Parts I., II., III., and IV. 8vo. 1849.

Earp's Hand-book for Intending Emigrants to the Southern Settlements of New Zealand. 12mo. 1849.

Downing's Treatise on the Theory and Practice of Landscape Gardening. 8vo. 1849. Fourth edition.

Somerville's Physical Geography. Vols. I. and II. 12mo. 1849.

Thomason's Hints to Emigrants. 12mo. 1849.

Hodgson's Lectures on the Australian Settlements. 12mo. 1849.

Wilkinson's Working Man's Hand-book to South Australia. 12mo. 1849.

Harris's Guide to Port Stephens, in New South Wales. 12mo. 1849.

Baskerville's Affinities of Plants. 12mo. 1839.

Lindley's Appendix to the first 23 volumes of Edwards's Botanical Register. 8vo. 1839.

And Thirteen Pamphlets.

From Mr. FRANCIS RAUCH:—

Practical Observations on the Arrangement and Contrast of Colours; accompanied with coloured plates. Also 42 plans of Geometrical Flower Gardens, and 12 miscellaneous drawings.

From Mr. WILLIAM DUMBRILL:—

An Isometrical drawing of the Great Conservatory at Chatsworth.

The number of visitors to the Garden, exclusive of the days of exhibition, has been 7782, being an increase of 858 over 1848-9, and of 1458 over 1847-8.

The distribution of plants, packets of seeds, and parcels of cuttings from the Garden has been as follows:—

1849–50.	Plants.	Seeds.	Cuttings.
To Members	5,996	49,298	1,642
To Foreign Countries, Correspondents, &c.	472	554	138
To Her Majesty's Colonies	86	196	..
Total	6,554	50,048	1,780

The only other topic to which the Council find it necessary to allude is the Journal of the Society. This has continued to appear with perfect regularity, and will be seen to contain much interesting and highly important information. But the Council observe with regret that only about half the Fellows of the Society apply for it, or have given directions for its transmission to them. This is the more to be regretted, inasmuch as the present Post-office regulations offer great facility for its cheap conveyance to the most remote parts of the United Kingdom. The quarterly transmission to Regent-street of six penny postage stamps would enable all Fellows of the Society to receive the Journal within a few hours after its publication.

ORIGINAL COMMUNICATIONS.

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

(Communicated June 8, 1850.)

In the work whose title is at the foot of this page * we have the result of more than five-and-twenty years' continued observations on one of the most important and intricate subjects which can engage the attention of the botanist, that of the hybridization of vegetables. Whether we consider the subject matter itself, or its bearing on many interesting points in the history of plants, such as their sexuality, their vital energies, the distinctness and stability of species, their geographical distribution, their economic uses, and many other matters of more or less weight, it is scarcely possible to exaggerate its importance. Nearly one hundred years have passed since Kölreuter instituted a series of experiments on hybrid fecundation mainly with a view to controversies which had arisen respecting the sexuality of plants; and as these were numerous, conducted with great care and acuteness, and of long continuance, it was scarcely possible that he should not see its connection with other points of interest, though they had not been brought forward so prominently into notice as that to which his views were more especially turned: accordingly his work—which was long too much neglected—contains a storehouse of thought and investigation which is greatly to his credit as an original and careful observer; and it is surprising, after a lapse of so many years (a matter in itself of some moment as connected with certain theories as to the supposed instability of the vegetable world), that our author, whose experiments, be it observed, were made happily for the elucidation of the matter in hand at the very same place as those of Kölreuter, has found such a strict accordance, generally speaking, with the results produced by himself and those of his precursor.

Little had been added to the observations of Kölreuter, when the Academy of Berlin proposed in 1819 the subject of hybridi-

* Versuche und Beobachtungen über die Bastarderzeugung im Pflanzenreich, mit Hinweisung auf die ähnlichen Erscheinungen im Thierreiche, ganz umgearbeitete und sehr vermehrte Ausgabe der von der Königlich holländischen Academie der Wissenschaften gekrönten Preisschrift, von C. F. v. Gärtner. Stuttgart, 1849. 8vo. Pp. xvi. and 790.

zation in plants as a prize question. It remained some time without any answer; and it was not till 1828 that Wiegmann published his treatise—meeting, however, only a portion of the subject. A similar question was proposed, partly in consequence of the confessedly imperfect state of information on the matter, by the Dutch Academy in 1830; and after a like delay, our author's treatise, of which the present is an immensely enlarged edition, containing the additional experience of more than ten years, appeared in 1837. Meanwhile other labourers have been in the field, especially Mr. Knight and the late lamented Dean of Manchester, whose profound knowledge on the subject was the result of at least as long experience as that of Gärtner, though perhaps till lately but little appreciated on the Continent: and besides this, the practice of producing hybrids (in a more or less exact sense) is become so general, and indeed indispensable, amongst the raisers of new and rare forms of ornamental plants, for which there is every day an increased demand, that there exists a considerable stock of knowledge as to the laws which regulate their production, and few points, whether normal or exceptional, can have escaped the eye of the observer. The work before us, therefore, cannot be expected to contain much novelty, but, what is at present of great importance, it states in a simple, unpretending way, though perhaps with a little unnecessary repetition (a circumstance arising from the unhappy arrangement of the contents), the several lights in which the subject may be viewed, and that not in the way of theory, much less of the so-called philosophical style so usual with the author's countrymen, but as the result of more than nine thousand distinct experiments.

The volume is indeed a perfect monument of patience and industry. For, be it observed, the production of hybrids and the study of the laws by which they are regulated is quite a different matter, as was pointed out by our countryman, Mr. Herbert, from that of raising flowers or plants for show or general utility. The latter is comparatively one of far easier manipulation, and more encouraging from the splendid results to which it leads, as well as the immediate profit attendant on it, and the success far more certain, from the circumstance that varieties or forms are the principal subjects of trial, which cross with one another with the greatest ease, and yield an infinite variety of new forms, of which some are sure to repay the necessary labour. But the case is far otherwise with the investigation of true hybrids. The manipulation alone, especially when extended to plants of various genera, is often extremely difficult, the failures innumerable, the results in general far from splendid, and interesting chiefly as individual links in a complicated piece of chain-work; the labour immense and unceasing, and after all quite useless except accompanied by rare qualities of tact, order, neatness, perfect fairness and freedom from prejudice, unwearied watchfulness, and accurate judgment. The immense variety of objects which demand attention, not one of which, if any trustworthy inductions are to be made, must ever be lost sight of, the length of time which is required even for the simplest results, the careful labelling of every plant, and registering of the phænomena as they arise, the precision with which every capsule must be examined, and every seed numbered, the difficulty of preventing confusion amongst some thousands of seedlings, the necessity of growing every plant in a separate pot, and after all the labour of generalising so many observations, are enough to deter any ordinary person at a very early stage of the investigation. Our author exhibits all the qualities enumerated, as far as we can judge, in a very eminent degree; and the consequence is that he has produced a work which from first to last secures the faith of the reader.

As there is little probability from its size that it should be made accessible to the English student, except indeed the Ray Society or some other similarly constituted body should take it in hand, we think that it may be useful to give an analysis of the more interesting and important part of its contents; and though, as remarked above, we cannot look for much novelty, it may not be wholly useless to lay before our readers, in a connected series, the principal facts which it details, omitting for the most part all that is merely historical.

The author commences with some general observations on hybrid fecundation, confining the notion of a hybrid, whether in the animal or vegetable kingdom, to beings produced by heterogeneous fecundation, and by no means including mere casual degenerations or deviations, whether arising from grafting or other causes. That such fecundation is not the normal course of nature, but the effect of force and circumstance, is clear from the very rare occurrence of hybrids, generally speaking, in nature, and the small extent in which muling is practicable, even in cases where very close external resemblance would seem to make it probable; a fact which shows clearly that it depends upon peculiar inward constitution, and which may therefore become matter of experience, but, like so many other subtle mysteries of nature, can never be expected to be ascertained beforehand by direct observation. Not only must the pollen of the hybridizing plant be in perfection precisely at the moment when the tissue of the stigma is in a fit state for its reception and the proper success of its functions, but even where the access of its own pollen is perfectly debarred from the stigma of a plant, the success of hybrid fecundation seems from experiment to require a more delicate and precarious adjustment of every favourable condition—to be a longer process, and therefore subject to more impediments; while all ungenial influences in normal fecundation acquire a greater force. The results too, under precisely similar circumstances, are extremely different, whether as to the more or less complete setting of the fruit, or the number or perfection of the seeds produced; far more so than might be expected from the results of artificial impregnation of stigmas with their own pollen; and still more from the solitary instances in which experiments have succeeded between different plants, where numberless attempts have failed, as in the case of *Lychnis diurna* ♀ and *Flos Cuculi* ♂. The difficulty seems to exist to a greater degree in the matrix than in the strange pollen; for even though the protrusion of pollen tubes be caused by the moisture of the stigma, the necessary penetration does not take place. The same attraction does not exist which is consequent on the application of its own pollen.

In most cases the preference for its own pollen is so strong, that no hybridization will succeed unless it be completely excluded, even in the most minute quantity. But even where this condition is secured, much depends on propitious external influences. A certain degree of warmth is necessary, spring and autumn being far less eligible for hybrid fecundation than summer: the most favourable time at all seasons is usually the morning. Species, such as *Dianthus chinensis* and *Nicotiana rustica*, which readily set their fruit in autumn even in cold weather, and in which hybrid fecundation is easy in summer, when hybridized late in the year produce in general no fruit, the blossom falling off prematurely, or the fruit when present being imperfect and sterile, or yielding very few good seeds. Rain and moisture are prejudicial to natural, and much more to hybrid fecundation, because the former often takes place in closed flowers, but the latter in those only in which the female organs are exposed.

Hybrid fecundation is not only more difficult, but it is also when successful less productive than that which is natural. Mr. Herbert indeed assures us that he has obtained more plants from *Crinum capense*, fertilized with the pollen of *C. revolutum*, than from the pure seeds. This may merely be exceptional; but it is to be observed that Gärtner had very few opportunities of studying the laws of hybridization in monocotyledons; and we cannot subscribe to the probability of Mr. Herbert making such a mistake as confounding the fertility of a mule already produced with the original generation of the hybrid seeds from which it sprang. Hybrid *Daturæ* and many mule Pinks produce capsules far richer in seeds than the pure species from which they were produced.

The merely theoretic part of the subject as to the nature of fecundation, whether it be a chemical process or a sort of fermentation or engrafting, &c., is but lightly touched; and we the rather pass it by, as the author's strength seems to lie more in sound judgment and practical observation than in deep thought and minute analysis. As a proof of this, the name of Schleiden, which is of necessity involved in all theories of fructification, whatever may be the views entertained upon the subject, is mentioned but twice, as far as we have observed, during the course of the volume, and once indeed in reference to the possibility of metamorphosis in cellular plants.

The next subject which engages the author's attention is the modifications produced by hybrid fecundation. The phænomena exhibited by artificial impregnation with the proper pollen are precisely the same with those which occur in natural impregnation; but with strange pollen it is not exactly so. The fluid secreted by the stigma is collected in greater abundance on its surface, not as it should seem from increased excitability, but from difficulty of absorption, since in cases where no pollen is applied, or one entirely inoperative, the surface remains for a long time moist; and in hybrid fecundation, the duration of this condition is in exact proportion to the elective affinity between the mother plant and the particular species whose pollen is applied.

The process of complete cohesion of the pollen to the stigma takes place somewhat slower than under normal conditions, though its pure colour changes at the same period when impregnation is effected. Under the contrary circumstances, the grains may still be seen upon the stigma unaltered after the lapse of some days. A greater quantity of pollen also, applied at different times, is often necessary—a circumstance dependent clearly on the different condition of the stigma. In some rare cases the adventitious pollen produces disorganization of the stigmatic surface, without effecting fecundation, which is usually followed by the speedy disorganization of the stigma, and soon causes the blossom to fall. In general, however, the blossom lasts longer after hybrid fecundation, though sometimes it shrivels early, and contracts upon the stigma without falling off, which it would do in natural fecundation. The degree of sexual attraction between the species under observation is usually the inverse measure of its duration. The success of an experiment may often be anticipated from this law. A large portion of the ovules usually die, which is not surprising, inasmuch as the hybridizing process takes place with difficulty, and probably fewer pollen tubes penetrate into the cavity of the ovary. The author ascribes this to the impaired vital powers of the organs of the matrix, and a sort of necrosis caused by the strange pollen proceeding from the stigma to the ovules, for which we see little ground.

After the fall of the blossom, the capsule often remains stationary, though there was every reason to suppose that impregnation had taken place; and occasionally after the fruit is half grown no further progress is made. Those capsules which arrive at maturity acquire that condition in the same time as after natural impregnation, even though the periods of maturation be different in the two hybridizing species. The slow process of fecundation is, however, compensated afterwards, and the time of maturity proper to the matrix is preserved. In plants of warm climates, indeed, a supposed difference exists, which may depend upon depressed vital energies, as is certainly the case with the imperfect ripening of hybrid seeds late in autumn, when natural seeds arrive at perfection. The outer aspect of the hybrid seeds is indeed the same, and their embryo is more or less formed in many cases, but they do not germinate.

The time when impregnation will take place is comprised within certain limits, varying with the particular species. Very early experiments in hybrid fecundation before the expansion of the blossom seldom succeed, and no impregnation will take place with strange pollen when the stigma has arrived at such a state that its own pollen is not able to fecundate the whole ovary. In any case, however, there is no difference in the hybrid types resulting from the experiment.

When the stigma is dusted at the same time, or within certain limits, with its own pollen in sufficient quantity, and that of some other species, the latter is wholly inert, and the result is plants not differing in any respect from the matrix ; nor is the effect different if a division or portion of the stigma be dusted with either pollen separately, precaution being taken that there shall be no possibility of admixture. The elective affinity for the natural pollen makes the other completely negative.

The result is perfectly analogous when more than one kind of strange pollen is applied, the native pollen being completely excluded. One typical form alone results—the effect of the impregnation of that pollen for which the stigma has the greater elective affinity. Mr. Herbert produced from the admixture of twelve different kinds of pollen merely one hybrid. In such cases the number of perfect seeds is generally small, which is not surprising under circumstances so thoroughly unnatural. The author relates, however, a very curious exceptional instance. A plant of *Lychnis diurna* was dusted with the pollen of *Silene noctiflora*. Twelve capsules, of different degrees of perfection, were set, which yielded from 20 to 80 seeds. The plants produced by them were, with two exceptions, true *L. diurna;*

but these had smaller leaves, a more vigorous growth, and stronger but more finely divided branches. It is possible that the main crop was due to the presence of stamens in the *Lychnis*, which is not always strictly diœcious, the two abnormal forms being due to the hybrid fecundation. The experiment was repeated, but did not succeed. Mr. Herbert has occasionally observed, in the case of multilocular capsules, hybrid and natural seeds in the same plant. Such cases are, however, of extreme rarity.

The mode of experiment may be varied by dusting the stigma at different intervals with the different kinds of pollen. It is clear, however, that the strange pollen must be applied first to have in general any effect on the result. If impregnation has taken place, which in different genera requires very different periods, as in *Nicotiana* two hours, in *Malva* and *Hibiscus* three, in *Dianthus* five or six, &c., the application of the native pollen has no effect. The fruit is not more perfect, the seeds more numerous or different in their nature, nor is any superfetation effected, but the small number of seeds are precisely such as would have been generated by the simple hybrid fecundation. Two kinds of seeds were, however, produced in *Nicotiana rustica* impregnated with *N. paniculata*, by dusting half of the stigma with the strange pollen before the expansion of the corolla, and the remainder after a lapse of twenty hours; and the conditions of the experiment were varied till the pure type vanished entirely, and merely the usual bastard type made its appearance. The account of the experiments is very interesting, but too long for extraction.

A mixture of pure and hybrid seeds can only take place when the strange pollen is applied first, and the native pollen before the intrusive has affected the whole of the ovary, either by impregnating the ovules or destroying their vitality, or before the surface of the stigma has undergone such a change as to make impregnation impossible; or in the case where the native pollen is first applied, where the quantity is extremely small, and the intrusive pollen after a very short interval.

The occurrence, however, as said above, of the pure and bastard type from the seed of the same plant is extremely rare, and can only happen under very peculiar circumstances; but even a threefold produce is not absolutely without example, the successive impregnation of *Nicotiana paniculata* with *N. quadrivalvis* and *N. Langsdorfii* having given rise to three types; three plants proving the pure species, four the hybrid *paniculato-Langsdorfii*, and a single individual *paniculato-quadrivalvis*. A repetition of the experiment produced merely the latter hybrid form.

An important deduction arises from these exceptional cases. Even in this compound fecundation there is no confusion of types, but the hybrids are exactly such as would have arisen from a simple impregnation with the pollen of one allied species. In the course of a long series of experiments, seeds have occurred very rarely containing more than one embryo; and as it is possible that a pollen tube from either kind of pollen might have simultaneously entered the ovule, these seeds might have contained two embryos of a different nature: such, however, was never observed to be the case by Gärtner.* Nor, indeed, have two distinct varieties occurred under such circumstances.

Our author's observations contradict altogether the notions entertained by many, and amongst them by Mr. Herbert, of the possibility of varieties and half-hybrids arising from the admixture of different kinds of pollen. Gärtner has seen none, save typical hybrids, arise from the intermixture of pure species.

The stigma, when ready for the reception of the pollen, secretes in every case a greater or less quantity of moisture, which doubtless acts an important part in the process of fecundation. In certain cases it may be thought necessary to apply some fluid to the stigma for the better retention and development of the pollen grains. For this purpose the honey secreted by the flower, or that of some allied species, may be used without any modification of the produce. Oily fluids, such as various purer oils, also have been used with success, though not uniformly. Water, on the contrary, is generally unfavourable, though in some water-plants, in strict analogy with the observations of Spallanzani on the fecundation of the ova of certain aquatic reptiles, it has clearly no injurious if not a beneficial influence.

It is a general rule that the pollen of a species possessing a greater elective affinity neutralises the influence of that of one less closely allied in that respect, as also does that of the matrix the fertility of the pollen of another species. There are, however, two exceptions to this law:—

1. In fertile hybrids, where neither the pollen of the male nor female parent is effective, fecundation is produced by the pollen of some pure, nearly allied species: as in *Nicotiana rustico-paniculata*, on which the pollen of neither *N. rustica* nor *N. paniculata* has any effect, impregnation is readily produced by *N. Langsdorfii*.

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* Mr. Thwaites has found a compound embryo in the genus *Fuchsia*. Two forms were grafted together, one possessing the character of *F. fulgens*, the other of *F. coccinea*. It is clear, however, from his account, that they did not arise from a union of pure species. The seedlings were too varied to allow of such a supposition. See Ann. of Nat. Hist., 2nd series, vol. i. p. 163.

2. Again, it occasionally happens that where a plant cannot be fertilized with its own pollen, that of another individual of the same species, or even of some nearly allied species, is efficient. *Lobelia fulgens*, for instance, though impregnable to its own pollen, yields fruit with that of *L. cardinalis* and *L. syphilitica*, while the potency of the former pollen is proved by its impregnating either of the latter species. Mr. Herbert found similarly that *Zephyranthes carinata*, though inactive to its own pollen, was fecundated by that of *Z. tubispatha*.

The effect of strange pollen on the female organs of the matrix may be regarded in four points of view—as causing disorganization, as imparting vital energy, as procreative, and as giving form.

1. The first action of the pollen is a certain degree of disorganization of the stigma, and then of the blossom. This is the consequence of every efficient impregnation. Imperfect impregnation has also the same effect, but at a later period. Blossoms which began to fade in ten or twelve hours after natural impregnation, lasted more than eight days where the dust of *Lycopodium* had been applied instead of pollen. Pollen which will not fructify, sometimes however disorganizes the stigmatic tissue, as is the case with *Lychnis diurna* dusted with the pollen of *Saponaria officinalis*.

The more powerful the action of the pollen, the sooner the blossom fades. The contrary effect, however, is sometimes produced in absolutely sterile hybrids, such as *Nicotiana paniculato-Langsdorfii*, in which the blossoms fall very speedily; but when the pollen either of the male or female parent is applied, they last many days.

2. In the instance just mentioned the pollen appears rather the maintainer of life than the destroyer, though it has no quickening influence. In many cases the action of pollen, though not sufficient to quicken the ovules, affects in different degrees the outer envelopes of the seeds.

3. The grand effect of fecundation is the formation of the embryo. Without fecundation the capsule and external envelopes of the seeds may indeed exist, but there can be no embryo. Sometimes the influence of the male, sometimes that of the female parent predominates.

4. It remains, then, to consider the modifications of form produced by the pollen. In general, neither in form, size, nor colour, is there any difference in the seeds of the matrix, whatever difference there may be in those of the male and female parent. Variations in these points, indeed, do occur sometimes, but rather morphologic phenomena than the effect of fecundation. In a very few instances, as in *Dianthus superbus* ♀ and

deltoides ♂, and some others, there is a little difference in size, but whether absolutely dependent on impregnation does not appear very clearly.

Attempts to hybridize species of *Œnothera* with rough and angular seeds, with those possessing smooth and round seeds, did not succeed; there, however, seems to be little disposition amongst many species to hybridize. It has been supposed that hybrid impregnation has an effect upon the colour of the seeds of peas and other leguminous plants, and differences in colour certainly occur in peas which seem to be due to that cause, even taking into consideration the facility with which variations arise in plants of which so many mere forms exist. The case, however, is different as regards varieties of Indian corn. The white dwarf variety, when inoculated with the large red-striped form, produces seeds which exhibit no change of colour, though when sown they give rise to variegated spikes. The pea at present is almost the only exception to the law that the influence of strange pollen produces no immediate change in the peculiar form and outward properties of the fruit and seeds, but merely in the capacity of the embryo to produce, when developed, modifications of the respective species, and in the form of their parts.

The altered quality of the embryo does not appear outwardly, nor can it be discerned by the microscope. That this modifying power exists in the pollen does not admit of doubt, and the constancy of hybrid types produced between pure species shows that its tendency is in a great degree definite. It has, indeed, been supposed that variations and half-hybrids are produced in proportion to the degree of admixture of strange and native pollen, and that the paternal or maternal type prevails according to the prevalence of the paternal or maternal element; but the author's experiments do not encourage such notions, though they seem to rest upon good authority.* A certain quantity of pollen is necessary for perfect fecundation; and in cases of mixed fecundation the types are those of the pure matrix or of the normal hybrid. In some cases, too, of hybrid fecundation, the maternal type always predominates; in others the paternal; sometimes to such an extent, that the deviation of the typical hybrid from the pure parent on either side, as the case may be, is very slight.

The principal facts respecting imperfect fecundation have already been mentioned incidentally; we pass on, therefore, to

* Such is the theory of Mr. Thwaites in his paper on the conjugation of *Diatomaceæ* quoted above, which would be borne out were it certain that he had to deal with pure species. It is probably at the present day almost impossible to get pure individuals except of very recently introduced species of *Fuchsia.*

the next chapter, relating to the aptness of plants, whether as regards families and genera, or species, for hybrid fecundation.

The question then arises whether there are any outward signs by which this aptness may be discovered. Experience shows that a great, perhaps the greater portion of plants are not susceptible of hybridization. Out of 700 species submitted to nearly 10,000 distinct sets of experiments, only 250 true hybrids were raised. Allowing the possibility of repeated experiments proving that union is possible in some cases where it has not yet been obtained, the result is sufficiently striking, showing, especially when taken in conjunction with the large number of failures, where success has in some cases been obtained, not only that the least portion of the vegetable kingdom is capable of hybrid fecundation, but that as a general rule it is a forcing of nature.

In the larger portion of plants an harmonious concurrence of time and place favours the production of pure species, though this is sometimes disturbed, and in consequence hybridization becomes possible; and in any case a certain harmony of either sexual element must exist to consummate a real hybrid union. In this concurrence consists the fitness for union of two heterogeneous species. For this purpose a mutual attraction between the stigma and the pollen must exist, the attraction being greater for its own pollen, and in proportion to the degree of attraction for heterogeneous pollen will be the fitness for union. But there is no outer sign by which the degree of such attraction can be known—it can be ascertained only from experience. It appears probable, too, that this attraction does not exist in an equal degree in every flower. At least, the causes which prevent success are often perfectly inappreciable. It resides evidently in some peculiar constitution which very possibly may accompany peculiar organization. Unions of plants belonging to different natural orders may be pronounced impossible, alleged instances of such union being merely cases in which the pollen has been perfectly inactive, and the supposed hybrid fecundation simply an impregnation of the stigma with its own pollen. The author has attempted to produce hybrids in twenty-nine natural orders, and nine other orders are recorded as having given positive results. In ten families out of the twenty-nine no real hybrids were produced. Of these natural orders only a few genera were submitted to experiment; but of these a great part gave no hybrids, and even the number of species which did so was very limited. The most natural families, such as *Gramineæ*, *Umbellatæ*, &c., are precisely those which, whether in a wild state or under cultivation, seem least favourable to the production of hybrids. Many hybrids are supposed to exist amongst *Compo-*

sitæ, but artificial impregnation has failed to produce a true hybrid, and the so-called hybrids are probably mere crosses of varieties. Amongst cellular plants, as the sexual organs are for the most part unknown, or their nature very imperfectly ascertained, no direct experiments have been made; and it is doubtful whether the numerous forms which arise in the genus *Gymnogramma*, and which have very much the air of hybrids, are really so, or mere varieties. Since, however, even dichogamous plants are far less apt for hybridization than those which are hermaphrodite, it seems scarcely probable that true hybrids should exist in Ferns.

Hybrids are certainly more common in polyspermous genera, but this probably depends upon the greater chance of fecundation with strange pollen in capsules abounding with seeds than those which contain but a few. It might be supposed, too, that dichogamous plants would present a greater fitness, from the very circumstance of the access of the native pollen being more difficult; but precisely the contrary state of things obtains amongst these vegetables. Indeed, were they peculiarly susceptible, the original races must long since have perished.

With respect to genera, it is observable that nearly allied genera show a great difference in their aptness for producing hybrids. Most species, for instance, of *Aquilegia* admit of union, as far as opportunity of trial has occurred; whereas *Aconitum* and *Nigella* have shown no such mutual attraction; while in *Delphinium* a union took place only between *D. consolida* and *Ajacis*. *Pelargonium* is notoriously apt for producing hybrids, but not so *Geranium*, though it presents no appreciable impediments. And many equally strong examples might be adduced.

Much fallacy has arisen with regard to the supposed frequency of the union of different genera of the same family, in consequence of concluding that union had taken place because apparently perfect seeds had been produced, without waiting to examine whether they were really fertile, and in case of their germination, observing the produce. The author had himself been led into error in this respect during the earlier part of his studies, and a long series of experiments undertaken in consequence of the discovery of his error produced but a single successful result, namely, the union of *Lychnis diurna* with *Cucubalus viscosus*. He had, however, during the course of other experiments, effected a union between *Lychnis diurna* ♀ and *Silene noctiflora* ♂, as also with *Agrostemma coronaria*. The union of *Lychnis vespertina* ♀ with *Cucubalus viscosus* ♂ is much more difficult than that of *Lychnis diurna* ♀, and the hybrid type is entirely different, which gives the clearest proof of the really specific difference between the two. In the case of *Lychnis* and *Agrostemma*, though seeds were formed containing apparently perfect embryos, not a single one germinated, showing some weakness of constitution in the result of the union, of which many instances occur in these researches. Union had certainly taken place; for had the seeds been due to the access of homogeneous pollen, there could be no reason why they should not have germinated, assuming them to be perfectly developed. The union of *Rhododendron* and *Rhodora* with *Azalea*, and of Mr. Herbert's two divisions of *Nerine*, are instances of bigeneric fecundation. The constitutional weakness of the result of the former union of *Rhododendron* with the yellow or orange *Azalea* has a close analogy with that of *Lychnis* and *Agrostemma* just mentioned. These perhaps are the only well-authenticated instances of bigeneric union; those of *Cucumis* and *Melo*, *Cheiranthus* and *Matthiola*, *Brassica* and *Raphanus*, *Lychnis* and *Saponaria*, *Pisum* and *Vicia*, and some others, all seem to be more or less uncertain in some part of their history, into which we have not room to enter.

On the whole then it appears that the fitness for union depends not on the agreement of outward generic characters, but on the inward nature of the procreative elements of individuals; so that two kinds of affinity exist, not necessarily proportionate or concurrent—an outward systematic and an inward sexual affinity. At the same time we must remember that genera are confessedly artificial, and that in groups undoubtedly belonging to one common type, it does not follow that because one species will hybridize, another will. In some cases where union will not take place, the species belong to different natural groups, and have been separated as such under generic names. The rough-seeded *Œnotheræ* will not unite with those which have smooth seeds, the species of *Datura* with smooth fruit with those which have thorny fruit, the species of *Erica* with cylindrical blossoms with those which have bell-shaped corollæ; *Primulæ* with a valvular orifice, as *P. acaulis*, with those which, like *Auriculæ*, have the throat pervious; blue with yellow-flowered *Linum;* and so in many other cases.

The intimate agreement on which aptness for fecundation depends is indeed usually concurrent with external resemblance, but not necessarily so. This is what Mr. Herbert calls similarity of constitution, and which our author terms sexual affinity, or elective affinity (Wahlverwandschaft). The procreative fitness then of a species, which indeed sometimes is confined to individuals, is not to be determined from outward signs, but from direct and often repeated experiment.

It should be noticed that agreement in the time of flowering is no necessary element—or the contrary an hindrance, if by chance or artificial means the pollen of the one species can be procured when the stigma of the other is ready. In like manner the duration of the time of growth, or diversity of habit and persistence of foliage, is, to a certain extent, indifferent. The fruticose *Calceolariæ* unite with *C. plantaginea;* the evergreen *Rhododendron* with the deciduous *Azalea*, and *Hyoscyamus niger* with *agrestis.*

In some cases, especially in those where hybridization is rare, outward conditions, such as increased temperature, predispose plants for hybrid impregnation, and cultivation in general is favourable to this end, as it is to the production of deviations from a normal condition. Varieties are usually far more disposed to mix than the species from which they are derived, and hence the great difficulty of keeping our most valuable vegetables pure and genuine. Of all genera *Calceolaria* seems to present the greatest tendency to hybridize; the pure species unite with the utmost facility, and their hybrids are all fertile and disposed to fresh admixture.

As regards species, we know as little on what peculiarities the power of producing hybrids depends as in genera. No difference is perceptible in structure, and species which will not produce hybrids themselves, are sometimes capable of fecundating others; some will hybridize with but one species, whilst others show a greater extent of elective affinity. As, however, those which hybridize with one species usually are susceptible with regard to others, only in a different degree, it is possible that species which have hitherto united with one only will be found on further experiment to have a wider affinity.

In questions relative to species, it is of course requisite to have definite notions as to the terms species and variety, and the stability of the species themselves. It is impossible, however, to enter on the subject here. History is in favour of their stability, and of the existence of certain typical forms from which altered circumstances produce many deviations, all of which, indeed, have a tendency to revert to the original from whence they were derived. The facts which hybrid fecundation exhibits are decidedly in favour of such stability, and afford in doubtful cases the means of ascertaining specific distinctions. For nearly related species united with some particular species give rise to hybrids differing from one another more than the pure species from which they sprang; and in the case of such species as *Pentstemon gentianoides* and *coccineus* (Hoffm.), which differ principally in the colour of the flowers, their absolute specific difference is shown from the fact that all attempts to produce hybrids between them fail, which would not be the case were they mere varieties. The essence of a species consists in the definite relation of its sexual powers to other species, which relation, as well as the specific form, is in every species especial and constant. Form and essence are in this respect one. There are in fact two distinct kinds of affinity, an outer and an inner—one resting on agreement in habit, in stature, in the form of the leaves, in the harmony of the blossoms and organs of fructification ; the other in the greater or less disposition for the sexual union of species in the formation of hybrids ; the one morphological, the other physiological. And inasmuch as both frequently coexist, the more intimate relation is often regarded as identical with, or an immediate consequence of that which is external. And this error is strengthened by the observation of the ease with which closely allied forms, such as those of Melons, Cucumbers, &c., unite. In such cases, however, it is to be remembered that there is no new formation from two heterogeneous elements, as in the case of real hybrids, but merely the union of the original homogeneous elements of a single species.

Hitherto the capacity of plants for hybridization has been principally spoken of with reference to the female organs, but the male organs are no less necessary elements. The outer appearance of pollen, its form, size, and colour, seem to have no influence on its fitness for the production of hybrids, supposing always that there is no prejudicial operation. As regards size, the pollen of *Dianthus caryophyllus* fructifies *D. superbus*, the pollen of the latter being much smaller than that of the former. Difference of colour, as in *Nicotiana*, is unimportant, except indeed that it has been observed that the union of varieties of *Verbascum* with similarly coloured pollen is more fruitful. And with respect to the spermatic globules, it is most uncertain whether they perform the same office as those in animals, or whether they are really of the same nature. Dr. Brown's observation that at the time of penetration of the pollen tubes they are few in number, or altogether absent, makes it very doubtful whether they are so analogous as was once supposed ; and if not, difference of size, even if always readily appreciable, would give no certain indication.

It appears, therefore, that there is no external or structural character which can determine the aptitude of plants for hybrid union ; the outward agreement in habit is indeed a probable ground of success, but far from infallible, as it depends upon an invisible harmony of inward constitution. The aptitude amongst species even for union is scarcely ever present in an equal degree, nor is it necessarily reciprocal, but greater or less on one side than the other.

We have already spoken of the difference as to elective affinity between nearly allied species: the degree, however, of such affinity is not confined merely to the more speedy occurrence of the signs of fecundation, but extends to the whole process of fructification up to the maturation of the seeds. For instance, the union of *Aquilegia atropurpurea* ♀ with *Canadensis vulgaris* and *glandulosa*, as of *Dianthus barbatus* ♀ with *superbus*, *Japonicus*, *Armeria*, *Chinensis*, &c., produces fruit and seeds of very different degrees of perfection and number, which in point of fact are the very product which reveals especially the true degree of elective affinity amongst plants. In some cases, as in *Nicotiana macrophylla* and *suaveolens* with *N. paniculata*, union takes place very readily, and up to a certain point everything seems to tend to perfection ; but then a yellow ring is formed at the point where the capsule is fixed, and the seeds make no further progress. The pollen of one species may be capable of fructifying several, as that of *D. superbus* fructifies *barbatus*, *Armeria*, *Chinensis*, *caryophyllus*, *Caucasicus*, *arenarius ;* but it will not impregnate them in the same degree, but with greater perfection in the order in which the species are written down. The variation in the number of seeds is very great. Supposing the number of seeds in pure species of *Dianthus* to vary from eighty to one hundred and twenty, that in hybrids will vary as much as from two to fifty-four.

There is, however, another point of view in which this affinity must be considered. When two species, of which the first furnishes the matrix, the second the pollen, unite for the production of hybrid fecundation, judging from the reciprocity so general in the admixture of varieties, we might look for reciprocity of elective affinity, and expect as much success when the second affords the matrix and the first the pollen. Though this takes place in typical hybrids and in the crossing of varieties, the case is very different with pure species. The degree of elective affinity, therefore, is quite altered, and sometimes reduced to nothing, the species remaining the same, the sexes and the proportion of their energy being changed. Sexual affinity does not observe systematic or morphological laws. One of the most striking examples is that of *Nicotiana Langsdorfii*, which fructifies in a decreasing ratio *N. paniculata*, *vincæflora*, *suaveolens*, *glauca*, and *rustica*, though not susceptible of impregnation from these species, or *Chinensis*, *macrophylla*, *quadrivalvis*, and *glutinosa*. It is to be observed that in all those cases in which entire absence of elective affinity exists on the one side, the produce on the other is mostly very small, or fails in the majority of numerous experiments.

The want of perfect reciprocity of sexual force even in the most nearly allied species of the same genus shows that the male and female procreative energy do not keep an equal pace with each other, though this difference has no influence on the typical form of the hybrids which arise from the union. Still the shorter or longer period necessary for the transformation of one pure species into another by hybrid fecundation seems to depend in some measure on this difference.

When two species, such as *Nicotiana rustica* and *glutinosa*, do not admit of union with one another, or, as *N. paniculata* and *Tabacum*, only of imperfect union, the union may be accomplished sometimes by a third species which stands in close elective affinity with either of the first. Thus *Nicotiana rustico-paniculata* is completely fructified by the pollen of *glutinosa*, as also *paniculato-rustica* with that of *Tabacum*. This affinity is called by the author compensating or mediate affinity (Vermittelnden Verwandschaft). The peculiarity in these unions is, that the consequent hybrids are generally so like the type of the compensating species that they can be considered merely as varieties of this latter which furnished the fecundating pollen, and are for the most part perfectly barren.

Another example may be given from the genus Dianthus, in which *D. barbatus* and *caryophyllus* unite imperfectly, whereas *D. barbato-chinensis* easily hybridizes with *caryophyllus* ♂, *D. chinensis* being in this case the intermediate member.

It was observed before that the difference of the number of seeds is proportionate to the degree of elective affinity. Our author avails himself of this as a means of estimating this degree in the several species. It may not be uninteresting to give a table of the affinities of a single species, though we cannot enter upon various questions which arise as to the propriety of this mode of estimation. Taking therefore normal impregnation as unity, we have—

♀Dianthus barbatus♂	proprio polline	1,0000
	superbus	0,8111
	Japonicus	0,6666
	Armeria	0,5333
	barbato-Carthusianorum	0,3111
	Chinensis	0,2600
	collinus	0,2333
	deltoides	0,2222
	Chinensis latif. Schr.	0,1354
	Carthusianorum	0,1111
	prolifer	0,0333
	virgineus	0,0111
	pulchellus	0,0096
	arenarius	0,0084
	diutinus	0,0033

XXI.—*On the Introduction of New Coniferous Trees into Park Scenery.* By R. Glendinning, F.H.S.

(Communicated Dec. 10, 1849.)

Few persons will be inclined to dispute the beautiful appearance and remarkable pictorial effect produced by the Cedars of Lebanon. When rightly disposed in the grounds of any gentleman, they constitute a feature that it can scarcely be possible to appreciate too highly; nor can we praise too much those who so liberally in the past age conferred upon us the delightful pleasure of beholding them. The Oak every one admits to be a beautiful tree; this would not be diminished in the smallest degree, but the contrary, if contrasted with the Cedar: striking effect is produced by contrast, and interest is increased by variety. How much of both would be destroyed were the noble Cedars of Goodwood, Sion, Wilton, Claremont, and other places, cut down! Look at any park planted entirely with deciduous trees: when denuded of their foliage, how dreary and inhospitable is the effect they produce, especially to those who are accustomed to observe a more varied and refreshing landscape! We therefore have some examples of what the Cedar has effected in converting the cheerless, wintry aspect of some of our baronial residences by its noble bearing and verdant foliation. It is a question worth asking, whether the landed proprietors of the present age are availing themselves of the opportunities so abundantly and reasonably afforded them of introducing a vast variety of trees equally interesting, both as regards pictorial effect and individual beauty, which the Cedar of Lebanon exemplifies.

Take, for example, the Pinuses of California, and we find sufficient in them alone to work out an entirely new feature in the landscape. What in a park can give expressions of dignity and grandeur surpassing the Abies Douglasii? The rapidity of its growth is quite marvellous. It is only a few years since it was introduced into this country, and in some places it is now actually vying in loftiness with the Cedar of Lebanon itself: when we also consider the enormous altitude it, as well as numerous other species from the same country, attains in its native regions, what we are accustomed to call trees will comparatively dwindle in our estimation to mere stunted bushes. Among these may be mentioned Pinus insignis, Lambertiana, ponderosa, Coulteri, Sabiniana, and others. Nor is the height which these attain their only recommendation. They not unfrequently make a growth of three feet and upwards in one season, and this is not uncommon even in exposed situations. Their variety of foliation, which is so decided and expressive, together with their picturesque character as trees, claim our especial interest as decorative objects in park scenery. Although North-West America has contributed largely in supplying us with material for this purpose, the more southern parts of the same continent have also afforded us numerous subjects of great interest, inasmuch as they place at our disposal objects with a totally distinct character, which, if properly grouped and contrasted with the Pines of other countries, must create an entirely new feature. Take, for example, the long grass-like foliage of P. Devoniana, Russelliana, Lindleyana, Montezumæ, &c., and imagine huge specimens of these scattered over the parks of England, which, however tardily it may occur, will eventually be the case. These are but a few of the contributions to the arboriculture of the country which the Horticultural Society have effected: others of more recent date are likely to be equally interesting and important, such as P. Benthamiana, a tree of enormous dimensions, P. Fremontiana, tuberculata, muricata, &c., together with Cupressus Goveniana and macrocarpa, the latter not a shrub, but a huge timber tree, with a beautiful green aspect. Where avenues are introduced, this plant must take a leading position. The beautiful light-green colour it retains at all seasons of the year strongly recommends its abundant introduction in all suitable situations.

Cryptomeria japonica, a comparatively new plant to our gardens, is likely soon to be quite as common as the Cedar of Lebanon. Its graceful manner of growth, and its rapidity of expansion, together with its hardiness, are strong inducements to its plentiful introduction. The character which the Japan Cedar may exhibit in the climate of this country, as an ornamental or picturesque tree, may be fairly assumed from the beauty and elegance which numerous specimens, already 8 feet high, in this country present: besides, we are informed that it is a tree extremely ornamental in its appearance where discovered in the north of China.

The North Indian mountains have also contributed numerous trees of great beauty and interest. The Cedrus Deodara alone is a host in the hands of an ornamental planter. These are now plentiful, chiefly through the instrumentality, and, I may add, liberality, of the East India Company. This also is a tree of rapid expansion. The habit it assumes being that of great gracefulness, its drooping branches and albescent hue are extremely desirable in themselves to give peculiar expression in pictorial delineation: in groups, in avenues, or as single objects, it may with great propriety be liberally employed. We have also from the same country the lovely Abies dumosa, a tree of much gracefulness and beauty. Pinus excelsa, Abies Smithiana, and Picea Webbiana are handsome Pines when their characters are sufficiently developed. Abies Pinsapo, from Malaga, is a very attractive and desirable Fir, and in every respect superior to the Cephalonian Fir, which it so much resembles in its manner of growth, being perfectly hardy, distinct, and rigid in appearance; it will be found a tree valuable for its effectiveness in contrasting with trees of different outline, independently of its beauty individually.

The Araucaria imbricata can scarcely be overlooked by any improver. The striking singularity of its aspect readily distinguishes it from all known hardy Conifers—its frond-like branches have given it the name of the Palm of the Indians who inhabit the Chilian Andes. In this country there are many large specimens which afford the opportunity of appreciating its value as a highly ornamental tree. Its adaptation in relieving any sameness produced by other Pines renders it extremely desirable.

Besides the Conifers here alluded to, there are many others in every respect equally desirable. My object has not been to produce a catalogue, but rather to draw the attention of those who have little idea of the great beauty of this family of trees, which in itself possesses the material by which the aspect of our parks and gardens may be more effectually embellished than by all others besides. A moment's reflection must surely point out how desirable in all places it would be to substitute these noble and gigantic Pines for the worthless Beech, Birch, Sycamores, &c., which predominate by the acre in hundreds of instances. Their cheerless expression over the face of the country must eventually seal their doom, and give place to others of much higher pictorial pretensions. A future generation demands thus much at our hands. The interest and pleasure which such improvement suggests to landed proprietors will, doubtless, ultimately lead to the realization of so desirable a result.

XXII.—*On the Effects of the Winter in Devonshire.* By James Barnes, Gardener to the Lady Rolle, at Bicton, Sidmouth.

(Communicated June 1, 1850.)

In consequence of the injury the supposed hardy trees and shrubs have sustained everywhere during the late severe winter and spring, I have been induced to forward a few remarks respecting their condition in this locality. At this date, when the ash, walnut, &c., are unfolding their foliage, we can surely form a correct idea of the injury committed: and by considering the kind of weather we have experienced, and comparing notes from different places, we may possibly arrive at some pretty certain conclusion as to what trees and shrubs will in future be likely to stand our climate.

The summer of 1849 was very favourable for stimulating a kindly growth, and the mild autumn ripened it well. During the winter there were 8° and 14° of frost on several nights in January, an amount of cold which well tried everything subjected to it; and the spring of the present year being one of the most severe and ungenial ever remembered, has proved what really would or would not pass the whole year uninjured. Notwithstanding the rigour of the winter, however, all seemed to go on well until March, when we had repeated severe cutting winds, with from 4° to 10° of frost at night, and the soil frozen several inches in depth—so much so, that the ploughs were stopped, and even trenching on one or two occasions. During this time we had clear, hot, sunny days. The soil, too, was cold and saturated with rains which had fallen before the setting-in of the frost. Under these conditions many old and previously well-tried plants gave way, and the two first weeks in May were very ungenial for any plant to recover itself which had received much injury. To some extent, therefore, a gloomy aspect has been given to many a worthy favourite.

If the following remarks are considered useful, I contemplate adding something more to them as the summer advances.

Clematis florida, Grahamii, integrifolia, Leeana, cylindrica, and cirrhosa have been all killed down to the ground. Some kinds from New Zealand and New Holland—C. calycina, japonica, and cærulea are some of the newest—appear to be quite hardy.

Illicium floridanum, anisatum, and religiosum were slightly protected, and are not injured.

Tasmannia aromatica has stood out three years with a slight protection.

Magnolia grandiflora has been killed this year; M. glauca, macrophylla, and cordata have all withstood the severity of the weather well.

Schizandra coccinea, Kadsura japonica, and Menispermum canadense have all survived without protection.

Berberis sp., from Peru, and B. aurahuacensis, have been killed down to the ground; B. petiolaris, elegans, cornuta, macrophylla, and Knightii have wintered well; B. trifoliata and tenuifolia have been killed down; B. fascicularis hybrida (one of the best) and nervosa and magnifica have all withstood the frost. Cistuses have wintered well; ladaniferus, laurifolius, laxus, and cyprius will be fine soon.

Helianthemum algarvense and scabrum are uninjured.

Pittosporum eriocarpum and Bidwellianum are killed down.

Stuartia virginica and marylandica, Gordonia Lasianthus, and G. pubescens have survived without protection.

Thea viridis, T. Bohea, and T. oleifera have been protected.

Coriaria nepalensis and Euonymus fimbriatus are killed down; E. japonicus, and its gold and silver varieties, have all wintered without protection.

Celastrus buxifolius has been killed to within a few inches of the ground.

Ilex majestica, magnifica, and gigantea are killed; Cassine and vomitoria, dipyrena, latissima, latifolia, and balearica have stood well.

Colletia spinosa is one mass of flowers; C. Bictonensis has wintered well, and is making fine growth, after being finely in flower all the winter.

Ceanothus americanus, azureus, azureus intermedius and divaricatus have had their last year's shoots killed.

Aristotelia Maqui and its variety variegata are uninjured.

Pistacia vera and Lentiscus ditto. Duvaua ovata, latifolia, longifolia, have had their young wood killed.

Edwardsia microphylla uninjured.

Genista tinctoria, florida, germanica, anglica, triquetra, prostrata, hispanica, have all had their young wood killed; G. procumbens, purgans, and scorpius have flowered finely.

Cytisus filipes, greatly protected, has been killed; hirsutus, falcatus, incarnatus, minor and major, purpureus and purpureus pendulus, spinosus, and nigricans, are all uninjured.

Ononis fruticosa, protected, ditto.

Adenocarpus intermedius, quite exposed, is unhurt.

Acacia armata, unprotected in an exposed situation, is killed; Brownii uninjured.

Astragalus Tragacantha is beautifully in flower.

Coronilla glauca, protected, has not suffered.

Medicago arborea has proved quite hardy, and has been in flower all the winter.

Indigofera nepalensis is unhurt.

Cercis siliquastrum is beautifully in flower.

Prunus Mume has been wintered without protection.

Spiræa decumbens, sinensis, canadensis, Reevesiana (a species from China), ovata, pubescens, and capitata, have stood uninjured.

Photinia dubia and glauca have survived without protection.

Eriobotrya japonica, uncovered, is uninjured.

Calycanthus lævigatus, ditto.

Philadelphus mexicanus and gracilis, ditto.

Eucalyptus montana and oppositifolia, ditto; E. pulverulenta, protected, is killed.

Passiflora cærulea, Colvillii, and racemosa are uninjured.

XXIII.—*On the Mode of Action of Heat on Plants, and especially on the Effect of the Sun's direct Rays.* By M. Alphonse de Candolle.

(From the Bibliothèque Universelle de Genève, March, 1850.)

Whenever it is endeavoured to explain facts in vegetation by means of temperature, thermometrical data are made use of, such as are supplied to us by the observations of meteorologists. At first everything was referred to mean annual temperatures, but as these could not be brought into harmony with the greater number of facts, the means of seasons were afterwards taken into consideration, and then monthly means. Finally, M. Boussingault has introduced the most logical course: that which consists in reckoning the time during which any phenomenon of vegetation continues, and the mean temperature during that time. Thus, supposing a plant has taken 20 days to ripen its seeds from the period of flowering, and that the mean temperature during those 20 days has been 10°,* it will be said that the heat received by the plant has been 200°; the number of days may have been 10, and the mean temperature 20°, to produce the same heat of 200°, which figure will express the aggregate heat necessary in the species to produce a certain effect in the plant.

But, on applying this calculation to different phenomena of vegetable life and to different climates, it is soon evident that it can only be approximative. In some instances, indeed, results are obtained so discordant that one is led to doubt altogether the value of the process.

The causes of error are really numerous; and if we do not succeed in ascertaining them, if we cannot determine the corrections required at least by the most important of them, it is to be feared that our comparison of facts in vegetation with facts in temperature will remain very vague and unsatisfactory. I do not pretend to enumerate the whole of the causes of error which may be imagined; it will suffice to indicate the following.

1. The time which should be taken into account is in many cases very difficult to fix. Thus, the moment when germination commences, when buds begin to swell, the period of maturity of several seeds, are points much more difficult to ascertain than is generally supposed. M. Boussingault ('Economie Rurale,' vol.

* The degrees of temperature given in this paper are those of the Centigrade thermometer, which are retained in the translation on account of the facility of calculation and the advantage of representing the freezing point by 0°, more especially as the temperatures given are merely by way of illustration.

ii. p. 659), in his calculations of the aggregate heat necessary for annual plants in cultivation, has given a table in which the days of sowing wheat, maize, &c., in different countries are given approximatively from a mean estimate of years and customs. That they have been thus obtained is evident from the circumstance that the dates are almost always the 1st or the 15th of a month; whereas direct observation would have often given some intermediate days. It is, moreover, impossible that germination should everywhere commence within the same period after sowing. When frosts or droughts come on, the seeds do not germinate. If, therefore, M. Boussingault has sometimes arrived at different figures for the aggregate heat required for the same plant, it can be no matter of surprise; and if he has more frequently obtained figures very near to one another, it may be supposed that different causes of error have compensated each other. I have made experiments of the same nature, to which I shall presently refer. The aggregate heat from the time of sowing to the maturity of the seeds in the same species has never been strictly the same; it has, indeed, often been very different, and I shall presently state the reason. I do not say this to detract from the merits of the method proposed by M. Boussingault—a method which I constantly make use of—but in order to show the improvements of which it is susceptible in order to enable us to reap the full benefit of it.

2. The temperature of the soil must influence the progress of vegetation; and it is well known that, with relation to the temperature of the atmosphere, it follows a curve, diverging more or less according to country, and even according to soil.

3. All temperatures below 0° (the freezing point) are totally useless to plants, as congelation stops the absorption and circulation of liquids. It is also certain that low temperatures, such as +1°, +2°, and +3°, or thereabouts, are not sufficient to excite many of the phenomena of vegetable life. Thus wheat, sown in autumn, will rest stationary during the winter, although the temperature may frequently remain for several days above 0°. Thus, the date-tree in the north of Spain, the Ginkgo in many parts of the centre of Europe, will never flower, although the temperature is sufficient for them to develop their leaves and to grow. Many seeds, in certain degrees of temperature, will rot, instead of germinating. The temperature to be taken into account must therefore be only that which is above a certain degree, varying according to the species and to the vegetative phenomenon considered, for that only is the *useful* temperature. But how shall we ascertain this starting point, so variable according to species and phenomena, and so obscure when we are considering, for instance, the commencement of germination or of flowering?

4. Temperatures below 0°, we repeat, are certainly useless for all species of plants and for all their functions; they produce no effect whatever. But in thermometrical calculations we take them for negative quantities, to be deducted from temperatures above 0°. That is not considering them as nothing; it gives them a real importance. We argue as if the plant receded when temperature falls below 0°. It does not, however, recede. The plant does not diminish like the column of mercury in the thermometer; it remains stationary. Thus all mean temperatures in the data for which negative quantities are taken into account are ill applied to facts in vegetation. We should calculate them by substituting noughts for negative numbers; whereas we have not in general before us meteorological tables containing sufficient details to enable us to make the correction.

5. Plants are almost always exposed to the direct rays of the sun, and thermometrical observations, from whence the temperatures of countries are deduced, are made in the shade. It is well known that the heat of the sun's rays varies according to season, geographical situation, height above the level of the sea, and sundry local causes. Consequently, 10° of mean temperature in the shade during 10 days will correspond in one place with one certain effect produced on plants exposed to the sun; in another place, or in another season, with some other greater or lesser effect.

My present object is to treat of the last of the above-mentioned circumstances, as being that which is the chief cause of error resulting from the use of thermometrical means. The question is not new; but in the calculation of the direct action of the sun's rays methods have been made use of which appear to me but little applicable to plants, and I have endeavoured to adopt a different one. It will, I trust, be admitted to be well founded; and if it presents some little difficulty in practice, if it is merely sketched out in the trials I have made, it will at least oblige one to reflect on the mode of action of heat on plants.

Philosophers, who have wished to determine the solar action, have always made use of thermometers exposed simultaneously or successively to the sun and the shade. The differences have been always considerable, and have borne relation to season and geographical position; but these differences have depended also much upon the kind of thermometer, and the manner in which the bulb receives the sun's rays and radiates during the night. Sometimes the bulb has been covered with black wool, a substance which absorbs and radiates in a high degree; sometimes the thermometer has been left bare. Some have withdrawn it from the influence of rain and dews, others have left it exposed to these causes of cooling. The series of observations made in the garden of the Horticultural Society of London * has been with thermometers covered with black wool: the one in the sun, the other in the shade, compared with ordinary thermometers in the shade. M. de Gasparin,† wishing to place the thermometers more in the situation in which plants themselves are, or at least the upper roots of plants, covered the bulbs with a millimeter (about $\frac{1}{30}$ of an inch) of earth. By all these processes the monthly mean temperatures have been greater in the sun than in the shade by 4° at the most near London, by 15° at the most at Orange: these figures, however, depend much upon the methods employed in each case.

It appears to me useless to discuss which of the above two apparatus is the best. I consider them both as bad when applied to vegetable life. Nobody, indeed, can imagine that the surfaces of branches and leaves are warmed in the sun or radiate in the shade like this or that thermometer. They are solid bodies, into which heat penetrates slowly, and we compare them with liquid mercury in which the heated molecules are set in motion! The surfaces are green, with a mixture sometimes of brown, yellow, or other colours, and we compare them with uniform surfaces, sometimes very different from green! Shining leaves often reflect a portion of the light, and we compare them with the round bulb of a glass thermometer, or to black wool, which reflects no light at all! In the plant the cold of the night does not cause it to withdraw within itself the leaves and flowers which have been formed during the day; alternations destroy nothing; yet we compare it with a thermometer where the fall of the mercury is calculated in reduction of its rise! Lastly, all physiologists know that the chemical properties of solar rays have an immense effect on vegetable tissue; for it is their chemical action (independently of heat) which causes the carbonic acid gas to decompose, and a great deal of water to evaporate by the opening of the stomates. A ray of light, almost without heat, certainly has its influence. It is, therefore, very useful to have some measure at once of the calorific and of the chemical effects of the sun's rays.

I conclude that *the only logical method of measuring the effect of the sun's rays upon plants is by the observation of the vegetables themselves: that is to say, the comparison of their development, firstly, in the shade and in the sun; and, secondly, under*

* Published in the Transactions of the Society. Mr. Dove has calculated the means from 1826 to 1840 monthly, converting the degrees of Fahrenheit into the Centigrade scale. See Dove, *Ueber den Zusammenhang der Atmosphäre mit der Entwickelung der Wärmeveränderungen der Pflanzen*, Berlin, 1846.

† Cours d'Agriculture, vol. ii. p. 72.

different intensities of sunshine, according to seasons and geographical positions. For this purpose I have proceeded as follows, by way of trial, hoping in future to do better, or that others may do better.

I have chosen some annual plants, of which the periods of flowering and ripening appeared well marked, and which seemed to be capable of vegetation at temperatures very little above 0°. I have sown them simultaneously in the sun and in the shade. I have sown the same species, in the sun, at different periods, from spring onwards. I have noted precisely the periods of flowering and ripening; I have compared them with thermometrical means obtained in the ordinary manner by observations in the shade, and the result has been an exact estimate of the surplus heat received by certain plants under the direct influence of the sun—an estimate given in the form of a certain number of days having a certain mean temperature in the shade. An example will better explain the process.

Some *Cress* (Lepidium sativum) was sown on the same day, the 24th May, 1847, in a bed in the shade, and in another exposed to the sun, in the Botanical Garden of Geneva. The seeds germinated rapidly, as is usual with this little species. The plants in the shade flowered on the 13th July, and ripened the 17th August. Let us adhere to the latter date, in order to consider the aggregate life of the plant. From the 24th May to the 17th August are 85 days. The mean temperature of Geneva, according to the usual observations taken at the Observatory with a thermometer in the shade, was 17° 24. The product of 85 by 17° 24=1465, expresses, according to M. Boussingault's method, the aggregate heat required by the plant to germinate and ripen its seeds. There is no error here: for the plant, like the thermometer, was in the shade, and no negative quantities were taken into account in the means. The plants exposed to the sun flowered the 12th July, and ripened the 9th August; total, from the period of sowing to ripening, 77 days. The mean temperature during those days, measured by a thermometer in the shade, was 17° 06. The multiplication of 77 by 17° 06 gives only 1313: thus, a heat *apparently* of 1313° has produced the same effect as 1465° in the former case. Yet the same aggregate heat on the same species cannot produce two such different effects. It is clear that the plants in the sunshine have received 1313°, measured by the thermometer in the shade, plus an additional quantity resulting from the action of the sun's rays—an additional quantity not recorded by the thermometer of the Observatory, and represented by the difference between 1313 and 1465=152°. In other terms, the effect, calorific or chemical, of the direct rays of the sun was equal to 152° of an ordinary thermometer in the shade. This effect was distributed over 77 days, and was therefore equivalent to 1° 97 (very near 2°) per day.

I might, in order to simplify the calculation of the mean temperatures, have considered only the eight additional days required by the plants in the shade to ripen their seeds. During these eight days the mean temperature, multiplied by 8, would have given 152°; thus expressing, in degrees of a thermometer in the shade, the value of that which the plants in the shade have received the less, or those in the sun the more. I have preferred calculating the figures for the whole life of the plant, in order the better to estimate the gradual effect of solar action and of general temperature.

Seeds of *Iberis amara* were sown on the 23rd April, 1847, in the shade and in sunshine. The plants in the shade flowered the 28th June, and ripened the 9th September. Those in the sun flowered the 20th June, and ripened the 11th August. Considering the whole period, the first required 139 days and the second 110 days to complete the cycle of their vegetation as annual plants. The plants in the shade received, in degrees of thermometer observed in the shade, an aggregate of 2219° (the product of 139 days by their mean temperature); the plants in the sun appeared to receive only 1754°, calculating the temperature of their 110 days in degrees of a thermometer in the shade. The difference, 465, expresses the effect of the solar rays, calculated in degrees of a thermometer in the shade. This amount gives a mean of 4° 2 per day.

Other species were sown at the same time and their progress observed simultaneously, viz., Sinapis dissecta, Nigella sativa, Iberis umbellata, and Linum usitatissimum. One of these, however, the Iberis umbellata, did not sufficiently show its period of maturity for the results to be complete in its case. Without entering into details, these several species gave the following results as the effect of solar rays calculated per day, and expressed in degrees of a thermometer in the shade:—

	From Sowing to Flowering.	From Flowering to Ripening.	From Sowing to Ripening.
Sown on the 22nd of April:—			
Iberis amara	2°·2 per day	6°·5 per day	4°·2 per day
Sinapis dissecta	3·8 ,,	1·8 ,,	2·5 ,,
Nigella sativa	..	..	4·6 ,,
Sown on the 24th of May:—			
Lepidium sativum	0·4 ,,	4·7 ,,	2 ,,
Iberis umbellata	0·8 ,,	..	..
Linum usitatissimum	..	..	4·1 ,,

The diversity in these figures is not occasioned by any defect in the method of obtaining them, but by the constant variations in the solar action from one day to another according to the season and the nebulosity of the atmosphere. It is owing also to the plants having been sown at two different periods, and to their having each finished its life on a different day. Those which lived chiefly in summer felt so much the more the effects of a season when the sun has more force than in any other.

The following is an instance of the increasing and afterwards decreasing action of the sun on vegetables from spring to autumn. It is taken from two species which unfortunately both proved ill-adapted to fixing precisely the day of maturity. Nevertheless the experiment is not useless.

Flax (Linum usitatissimum) and *Iberis amara* were sown in the Botanic Garden of Geneva in the sun. The sowings of Flax marked A, B, C, and those of Iberis A, B, C, were in a border which, besides the direct rays of the sun, received also the reverberation from a wall situated at the distance of a yard. The sowings of Flax D and E were beyond the influence of the wall, but still in the sun. The two latter were made in 1848, the others in 1847.

	Date of Sowing.	Date of Maturity.	Duration in days.	Mean Temperature.	Product.
Flax A . . .	April 23 .	August 2 .	101	15°·89	1605
Flax B . . .	May 24 . .	August 7 .	75	16·96	1272
Flax C . . .	June 24 . .	Sept. 3 . .	71	17·70	1257
Flax D . . .	April 29 .	August 12 .	105	16·37	1719
Flax E . . .	June 9 . .	Sept. 7 . .	90	17·82	1604
Iberis A . .	April 23 .	August 11 .	110	15·95	1754
Iberis B . .	May 24 . .	Sept. 10 . .	109	16·70	1821
Iberis C . .	June 24 . .	October 26	124	14·99	1858

It will be seen that the later the Flax was sown the smaller was the product of the temperature by the number of days, because this species, ripening in summer, received an increasing amount of additional solar heat—a heat not indicated by the thermometer in the shade. The Iberis, on the contrary, showed products increasing as the period of sowing was delayed, because its vegetation only terminated in September or October, when the solar heat diminishes.

In the result of my experiments of 1847, I was at first puzzled by an anomaly, which however was very well explained by the state of nebulosity of the sky, of which fortunately our observations at Geneva give us an exact measure. The species sown on the 24th May were less affected by the sun up to their period of flowering than those sown on the 23rd April (0° 4, or 0° 8 per day, and the latter 2° 2 and 3° 8). But it happened that the month of June, 1847, was more cloudy than the month of May. The plants sown the 23rd April made their chief progress towards flowering during May. In this month the sky was covered with clouds by 0·41 of its extent at twelve o'clock,* and from the 17th to the 20th June, the most important period for the plants, it was covered by 0·47 of its extent. The plants sown the 24th May made their chief progress towards flowering during June and the first week of July, a period in which the sky was clouded at twelve o'clock by 0·52 of its extent. To determine the effects of nebulosity with precision, it would be necessary to take it into account every day with relation to the temperature of the day. We should also know the effect of watery vapours, which intercept heat although the air may retain its transparence. We cannot enter into all these details, but it is evident that, in order to estimate the solar action in different countries, or in different months in the same country, we must, as much as possible, take into account either the mean extent of clouds, or at any rate the number of clouded days. According to observations made at Geneva, the mean nebulosity varies but little from one year to another. Thus this element, carefully observed, might serve to characterise climates with facility and regularity.

I tried fresh experiments in 1849, making use of *Rape* (Colza). This species, however, did not answer my expectations in regard to precision in the time of flowering and ripening. Besides which I was not satisfied with the situation afforded by the Botanical Garden of Geneva.† The latter motive, as well as the hope of establishing a comparison between the solar action at Geneva and in a more southern climate, induced me to request my friend, M. Moquin-Taudon, professor of botany at Toulouse, to try in the latter town a series of experiments. He very kindly acceded to my request. He even extended his sphere of observations to several species. Knowing well his habitual exactness, and also that he had very favourable localities at Toulouse, I hoped to have obtained interesting results from his labours. Unfortu-

* The observations made at Geneva indicate the proportion of the firmament occupied by clouds. Estimated in decimals, this proportion gives means easy of calculation. This practice is far preferable to the terms *cloudy, slightly clouded*, &c., ordinarily used in meteorological tables.

† The shade was not perfect. It is difficult to procure good shade so as to leave at the same time to the plants full daylight, which they cannot do without.

nately insects, and a rather high flood, destroyed the greater part of the plants raised in the shade. Perhaps I may be enabled hereafter to publish some of the observations of M. Moquin, when I give the whole of my own, in a work on botanical geography, upon which I have for some time been engaged.

The advantage of the proposed method is the obtaining a measure of the solar action on plants, by means of the plants themselves, and the recording the effect observed in ordinary degrees of the thermometer. The plants raised in the shade form the connecting link, the means of reduction, as it were, between the plants raised in the sun and the ordinary thermometer kept in the shade. This is certainly much better than exposing the thermometer to the sun, for in the latter case, notwithstanding all the different processes imagined, no one can say that the thermometer receives the influence of the sun in the same way as the plants.

It would appear desirable that experiments analogous to my own should be made in countries differing from each other in elevation and in latitude, as well as in nebulosity or clearness of atmosphere. We should then obtain a knowledge of how much should be added in each locality to the monthly means for the solar heat, which is neglected in the ordinary observations made in the shade. I am persuaded that a comparison made, for instance, between England* and Eastern Europe, would show that the thermometrical mean temperatures, observed in the shade, do not fairly express the comparative nature of the climates in an agricultural point of view. As essays of this kind are multiplied, it will be ascertained which species of plants are best adapted to the showing clearly the effects of temperature. It may also be found that thermometers covered with wool, or with sand, or those exposed in some other manner to the sun's rays, will give results the nearest to those obtained from the plants themselves. In that case such thermometers may be used without scruple, which would be more convenient for observations on vegetables.

I will not conclude without stating that these experiments have considerably modified my views of the mode of action of external circumstances, of heat more especially, upon plants. I have sometimes, with many physiologists, committed the error of regarding the plant as a species of thermometer. It is a faulty comparison, which leads into error. I repeat it, the lowering of the temperature does not destroy in the plant the effect which a rise had

* In any observations made in England or in the United States it is evident that 32 degrees must be deducted from all quantities noted in degrees of Fahrenheit. The use of this thermometer is a great bar to the ready comprehension of facts in vegetation observed by persons not well instructed.

previously produced. In the thermometer the mercury falls and rises; the plant, on the contrary, only advances. The mean variations of the thermometer, to which vegetable phenomena are always referred, have nothing corresponding to them in vegetable life; for the young plants do not withdraw into the seed, nor the leaves into the bud, if cold succeeds heat. To keep within reality, the plant must be compared to a machine which does its work in proportion to the impulse given by heat and by the chemical action of light. If the impulsive force is insufficient to set the machine in motion, all is stopped, but the produce of its previous work is so much gained, and when the impulse recommences, a new produce is added to the former. Thence the necessity I have alluded to of registering only temperatures above 0°, for we are certain that below that point the vegetable machine is stopped. Thence also the need of ascertaining whether certain plants do not cease their functions at + 1°, + 2°, &c., as the limits of plants towards the north,* and the daily observation of various facts, seem to indicate. In following up this idea, the action of several agents, such as humidity, of which the effect is immense on plants, may be compared to the numerous causes which influence the working of a machine. Let us take the steam-engine for instance. It is without doubt set in motion by caloric, but also it is necessary that there be no deficiency of water, that all its parts be in a good state, that friction be diminished by oil, &c. The definitive amount of work is in proportion to all these causes. Organised beings are not less complicated. Calculations which are applied to them are always approximative, like those of the powers of a machine; and the same process must be followed in making them, that is to say, we must take into account the impulsive forces, time and all accessory circumstances, not to fall into serious errors, or to come to numerical products without any useful results.

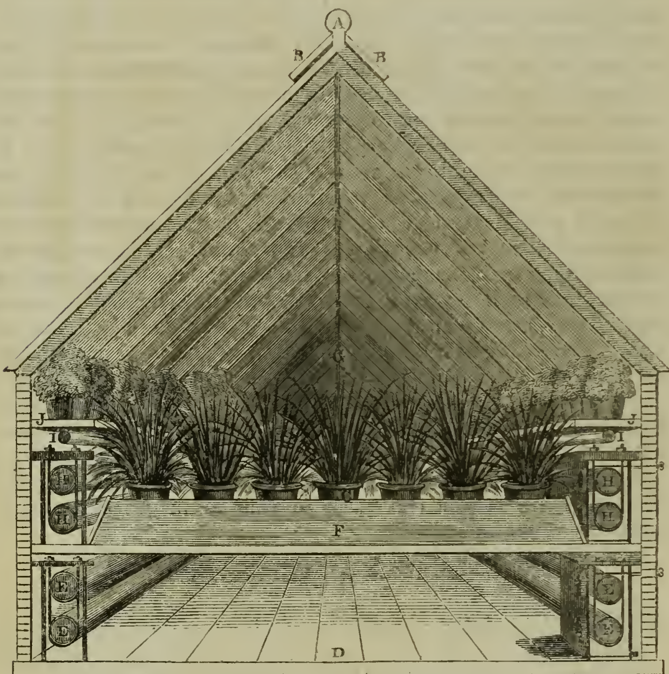
XXIV.—*Description and Plans of a Range of New Pine-Stoves, lately put up in the Gardens at Bicton.* By James Barnes, Gardener to Lady Rolle, Bicton, Sidmouth, Devonshire.

(Communicated June 6, 1850.)

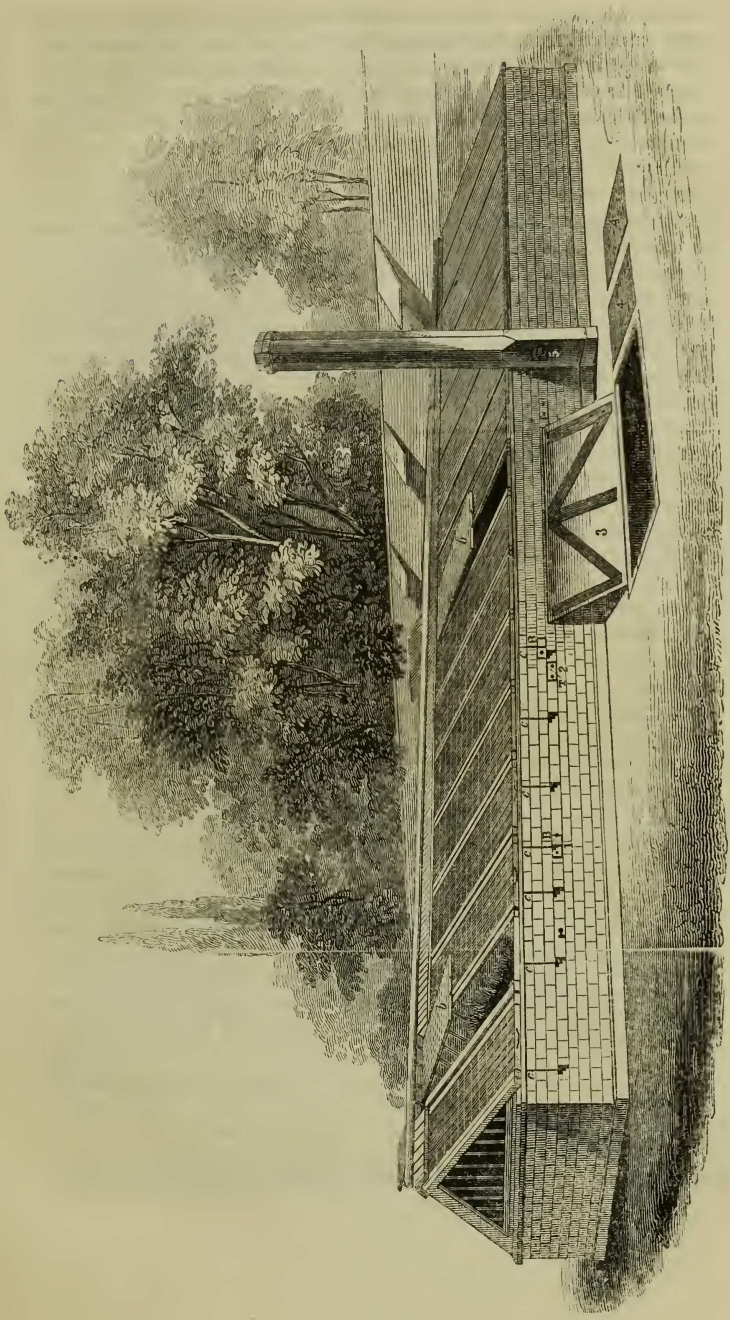
The following is some account of a new Pine structure which was erected here about a twelvemonth ago, and, having had both a winter's and summer's experience of it, I am now able to

* See my memoir on the Polar Limits of Species in the Bibliothèque Universelle, 1848; Archives des Sciences, vol. vii., p. 5; or in the Annales des Sciences Naturelles de Paris, 3rd series, vol. ix.

offer a correct opinion as to its capabilities and efficiency of working, which I am happy to state have been in every way most satisfactory, fully answering my expectations. The house was put up by Mr. Ware, of Exeter; and the heating apparatus, which answers admirably, was fixed by Mr. Kerstahl, of the same town. The boiler and apparatus have been newly registered, and are capable of furnishing either bottom or top heat, with a small consumption of fuel. In this respect it has a decided advantage over any heating apparatus I have ever seen constructed or had the working of.



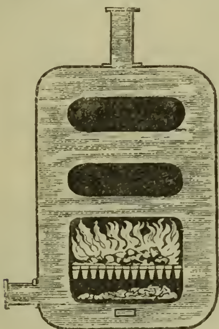
The house is about 77 feet in length, by 16 feet 8 inches in width, outside measure. It is divided both at bottom and top into seven divisions, by means of 4-inch brickwork, sufficiently high to allow pines to be cultivated in pots, or to give depth enough of earth, if at any time it should be contemplated to turn the plants out into the bed. To make the partition complete to the roof, a sheet-glass sash rests on the brickwork, making each division about 15

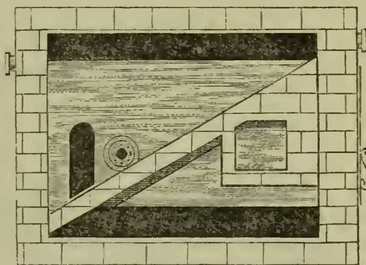


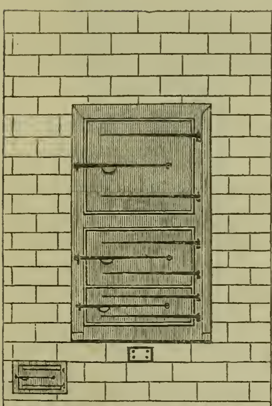
feet in length, by 10 feet 6 inches in width, being room enough to accommodate from thirty-six to forty-two of the largest or full-grown plants. It is an equal span-roofed erection, just high enough to allow the plants to enjoy both sun and air; and in order to keep the foliage from being injured by the moving up or down of the sashes, and for the purposes of giving air and water, the ridge-piece (A) has an excellent convenience, in the shape of a small shutter or lap (B), which is fixed to the top, and hinged. These shutters act in connection with the lights: thus as soon as the latter are in their places, the shutters fall into theirs, and they are readily raised with the lights. Air may also be administered by means of tilts, which are fixed to the wall-plate by small chains (C). By these means facilities are afforded for supplying any amount of air at all times and seasons throughout the year; a great desideratum; and the supply can be so regulated as to suit either growing plants, ripening fruit, or plants swelling fruit. The hot-air chamber (D) in each division is warmed by 4-inch pipes (E), and covered in with 2-inch slate, resting on iron bars, placed on brick piers. This slate bottom supports the plunging-bed (F), which consists of half-decayed leaves, famous material for retaining heat and moisture; (G) the end of the structure; (H) the 4-inch pipes for furnishing the top heat; and (I) a perforated 1-inch copper pipe for contributing the required humidity. In each division the latter has a union joint, worked outside, by a small handle, the turning of which waters the whole of the plunging material, or part of it, as may be desirable; and the water may also be made to splash up against the slate-shelf (J), which runs round the house, just over the pipes. On this shelf French beans are cultivated during the autumn, winter, and spring months; and from these a constant and good supply of beans is obtained.

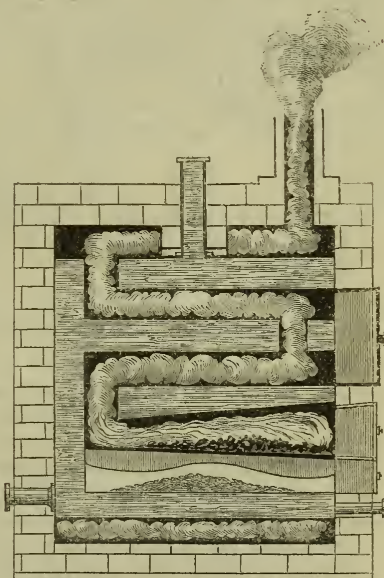
No. 1 shows the handles of four valves outside the wall, for regulating the bottom heat, and close to it are two more for regulating the top heat: 2, in the next division, is for the same purpose: 3 is a trap-door (open) for entering the stoking-room and coal-cellar, which are under ground, quite out of sight, and commodiously arched in: 4 shows two neat cast-iron square ventilators, for admitting air and light to the cellar and stoking-room: 5 is the chimney-shaft, at whose base is a small iron door to afford access for clearing out the flue about that part where soot is liable to collect: *b* shows the simple way in which the lights are opened. On each side of the house, and running its whole length, is a neat pavement 10 ft. 6 in. broad. The whole is thoroughly drained, and has a neat appearance. It will be observed that the fire has great command of the boiler, and the apparatus is so constructed that the whole range may be heated at once, either at top or bottom, or both together; or half of the range, or only its middle divisions, may be worked separately—a very economical and good arrangement.

The following sections explain the construction of the boiler and its apparatus.*









* N.B.—This boiler seems to be identical with that of Mr. Hill.—Ed.

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

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22. Audibertia polystachya. *Bentham, Labiatæ*, p. 414.

Raised from Californian seeds collected by Hartweg.

A white, sage-like, herbaceous plant, growing about 2 feet high. Leaves on long stalks, oblong, blunt, crenate, having a strong and by no means agreeable odour, proceeding apparently from numerous point-like dark brown glittering glands, with which they are covered, especially on the under side. Stem erect, producing a great number of white labiate flowers, on short, lateral, one-sided racemes. Stamens long and prominent.

This seems to be unable to bear an English winter without protection; for it has perished among rockwork in that of 1849–50. The flowers have no beauty; but the snow-white leaves and stems produce an appearance sufficiently remarkable to give it a claim to cultivation where the climate agrees with it.

Oct. 10, 1849.

23. Arbutus xalapensis. *Humboldt, Bonpland, and Kunth, Nov. Gen. et Sp. Plant.*, iii. 281. *Bentham, Plant. Hartweg.*, No. 485.

Raised from Mexican seed, received from Hartweg in February, 1846, from the mountain of Anganguco.

A low, dull brownish green evergreen bush. Branches, petioles, and underside of leaves covered with a short soft down, without any trace of setæ. Leaves oblong, flat, long-stalked, rounded at the base, perfectly entire, or very slightly serrate, with a hard, firm, reddish edge; somewhat downy on the upper side. Flowers dirty reddish-white, in close downy terminal short pyramidal panicles. Peduncles glandular and woolly. Calyx nearly smooth. Corolla ovate, at the base almost flat and unequally gibbous, with a contraction below the middle, and a very small limb. Ovary with a granular surface.

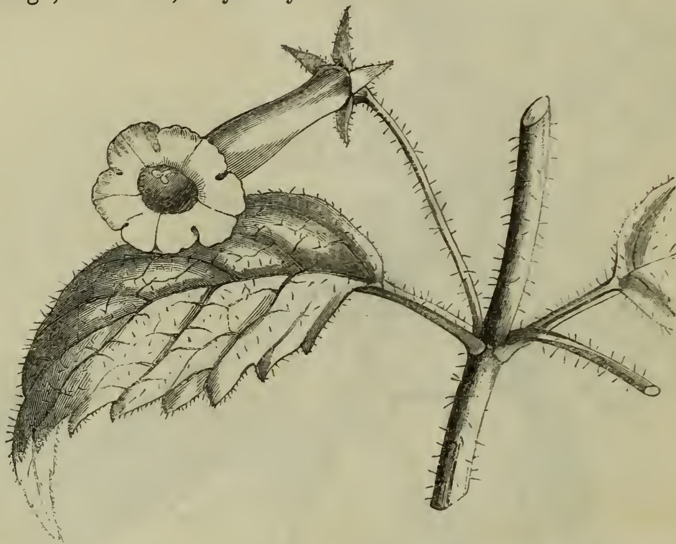
This little bush is by no means ornamental. It grows slowly, requires protection in winter, has dull spotted leaves, and remains in flower only for a week or two in April. Although a true Arbutus, it seems to have none of the beauty of its race, and must be consigned to the collectors of mere botanical curiosities.

24. Achimenes Ghiesbreghtii of the Gardens.

Presented to the Society by Mr. Andrew Henderson, of the Wellington Nursery, St. John's Wood Road, in 1849.

Stems erect, deep purple brown, with a few scattered hairs. Leaves opposite, stalked, oblong-lanceolate, rugose, convex, coarsely serrated, not unlike those of the larger stinging-nettle. Flowers solitary, axillary, with a slender hairy peduncle, twice as long as the leafstalks. Calyx smooth, equally 5-parted.

Corolla deflexed, nearly cylindrical, gibbous at the base on the upper side, $1\frac{1}{2}$ inch long, bright scarlet, with an oblique regular limb, and a circular throat. Disk, a lobed fleshy ring. Stigma large, two-lobed, very hairy.



This is a neat, distinct, and rather slender kind, requiring the same treatment as the old A. coccinea, and easily increased by the small scaly rhizomes. It grows about 8 or 10 inches in height, and flowers from June to August. It is very handsome.

25. Parsonsia heterophylla. *Allan Cunningham, in Annals of Natural History*, vol. ii. p. 46. (P. albiflora, *Raoul.*)

Raised in 1847 from New Zealand seeds, presented by J. R. Gowen, Esq.

A twining evergreen greenhouse plant, flowering abundantly in May and June. Stem covered with fine down, pale yellow; leaves leathery, dull green, slightly downy, wavy, very variable in form; linear, lanceolate, ovate-lanceolate, obovate, or even spathulate, often repand, varying in length from 2 to 3 or 4 inches. These singular diversities in the form of the leaves do not seem to be confined to any particular parts of the plant, but appear on any of the branches, and all intermingled; the short spathulate leaves are, however, most usual on short lateral shoots. Flowers pale cream-colour, in close one-sided naked panicles, rather sweet-

[Parsonsia heterophylla.]

scented. Calyx three times as short as the corolla. Corolla urceolate, with a revolute 5-cleft border, not more than a quarter as long as the tube. Anthers without any tails, but simply sagittate.

According to Cunningham, this plant is common in the northern island of New Zealand, at Hokianga and Wangaroa, in shady woods. M. Raoul, whose P. albiflora can scarcely be different, found it on the outskirts of woods at Akaroa. It is rather a nice addition to our greenhouse climbers, and will probably prove hardy in thé south of England. For purposes of cultivation it is much superior to P. variabilis.

26. Parsonsia variabilis.*

Received from J. R. Gowen, Esq., from New Zealand, in 1847.

A small twining greenhouse plant, very much like P. heterophylla, from which it differs in its leaves being shining and much more variable in form, the linear ones being far narrower, and often expanded at the very end into a circular blade. The flowers are not more than half the size, and instead of being contracted at the mouth or urceolate, are exactly campanulate; they are also far less hairy, by no means so numerous or densely arranged, and usually intermingled with long narrow leaves.

It is a very curious thing, but possesses little claim to beauty. Its flowers are, however, much sweeter than in P. heterophylla.

27. Dodecatheon integrifolium. *Michaux, Flora Boreali-Americana*, i. 123. *Bot. Mag.*, t. 3622.

Raised from Californian seed sent home by Hartweg.

A dwarf stemless plant, with a few long narrow, almost spathulate, undivided leaves, and a slender scape, bearing a single nodding flower, very like that of the common species, and of the same purple colour, with a yellow eye and dark purple anthers.

Such was the plant from which the annexed drawing was made. Upon looking, however, to the wild specimens, we find that it becomes much more vigorous when older, bearing as many as three flowers on a scape, or, according to Sir Wm. Hooker,

* P. *variabilis;* caule volubili pubescente, foliis nitidis acutissimis nunc linearibus angustissimis basi rotundatis subundulatis, nunc ovalibus utrinque acutissimis, nunc obovatis, nunc linearibus apice dilatatis circularibus, paniculis brevibus raris secundis subfoliosis, sepalis corolla triplo brevioribus, corollâ campanulatâ (nec urceolatâ ut in P. heterophylla) limbo revoluto tubo quadruplo breviore, antheris ecaudatis.

eleven or twelve; in which case it becomes as interesting as the old and well-known species, so common in gardens. A damp, rich, shaded American border suits it best; and there it may be expected to grow without difficulty.

28. CEANOTHUS RIGIDUS. *Nuttall, in Torrey and Gray's Flora of North America*, vol. i. p. 268. *Bentham, Plantæ Hartwegianæ*, p. 302.

Raised from Californian seed, collected by Hartweg in open places in woods near Monterey.

A stiff branching dark green evergreen bush; said to grow 4 feet high when wild. Young branches downy. Leaves small, truncate, spiny-toothed, subsessile, very shining and smooth on the upper side; on the under pale and netted. This network is produced by numerous short branching veins, in the interspaces between which are deep pits, reaching half through the parenchym, and each closed up by a dense ring of white converging hairs. Such pits are placed pretty generally in a double row between each of the principal lateral veins. The flowers appear in small clusters or umbels at the end of very short spurs. They are deep purplish violet, not blue, and less showy than those of C. dentatus or C. papillosus.

The species seems to be even more hardy than the two last-named sorts, for it has borne the winter uninjured and unprotected both in sunny and in northern aspects; and, in fact, the specimens left unprotected are quite as healthy as those left under glass all the winter.

The only flowers that have yet appeared were in a greenhouse. It seems as if, in the open air, the shrub would prove an autumnal flowerer.

ORIGINAL COMMUNICATIONS.

XXV.—*A Catalogue of Coniferous Plants, with their Synonyms.*

The number of persons interested in the cultivation of Coniferous plants is very great. The traffic in them has become a considerable branch of retail trade. The present year has witnessed the despatch of a young collector to Oregon, chiefly for the sake of the Conifers that abound there. The nurserymen's lists are full of errors, from which, indeed, books of science are far from being exempt; for they both contain repetitions of the self-same plant, or of trifling varieties of it, under different names; so that buyers are much in want of a guide on which they may rely with reasonable confidence, both for the completion of their collections and in making their purchases.

Under these circumstances, it has been thought desirable to prepare a catalogue, into which all known species may be introduced, whether actually growing in this country or not. Fortunately one of the most talented of Continental botanists had already carried out the task so far as to render it comparatively easy,* and to leave to the present compilers little more labour than that of abstracting the main facts, introducing newly discovered species, and making corrections in the list of old ones.

The only abbreviations employed are [h], which signifies hardy, and † for species not yet introduced. Those which have no mark connected with their names are understood to be too delicate for the neighbourhood of London.—[J. L. and G. G.]

Order I.—CUPRESSINEÆ.——The CYPRESS RACE.

1. Juniperus, *Linn.*—Junipers.

†1. J. drupacea, *Labill.* . . . J. *oxycedrus* γ, Lam.	A bush; fruit blackish.	Levant.
2. J. macrocarpa,[h] *Sibth.* . . J. *oblongata*, Gussone. J. *Lobelii*, Gussone. ? J. *Biassoletii*, Link.	A large bush; fruit glaucous, purplish black.	Greece, Sicily, &c., in sandy places.

* Synopsis Coniferarum, auctore Stephano Endlicher. Sangalli, 1847. 8vo., p. 368.

3. J. Oxycedrus,[h] *Linn.* . . . J. *macrocarpa*, Tenore. J. *Wittmanniana*, Fisch. J. *oxycedrus taurica*, Hort.	A large bush; fruit brown.	All the basin of the Mediterranean, in sandy districts.
†4. J. rufescens, *Link* . . .	A bush; fruit red and shining.	Most parts of the South of Europe; Western Islands.
†5. J. hemisphærica, *Presl.* .	A low shrub; fruit red and shining.	Mountains of Sicily, Calabria, &c.
6. J. nana,[h] *Willd.* . . . . J. *dealbata*, Douglas. J. *saxatilis*, Hort. J. *montana*, ditto. J. *sibirica*, Pin. Wob. J. *canadensis*, Loddiges. J. *davurica*, Hort.	Prostrate; fruit dark, covered with bloom.	Mountains of Europe, Northern Asia, and North America.
7. J. communis,[h] *Linn.* . . .	A bush; fruit dark, covered with bloom.	Europe, from Lapland to Portugal, & Northern Asia.
(A) vulgaris[h] . . . . . J. *cracovia*, Loddiges. J. *taurica*, Hort.	A spreading bush; fruit round.	
(B) hispanica,[h] *Booth* . .	A spreading bush; fruit ovate.	
(C) caucasica[h] . . . . . J. *oblonga*, Bieberst. J. *interrupta*, Windl. *Thuiæcarpus juniperinus*, Trautv.	A straggling or trailing bush; fruit ovate.	
(D) arborescens[h] . . . . J. *stricta*, Hort. J. *suecica*, Miller. J. *hibernica*, Loddiges.	An upright pyramidal bush.	
(E) echiniformis, *Rinz.*		
†8. J. rigida, *Sieb. and Zucc.* .	A tree, 15–25 ft. high.	Mountains of Japan.
†9. J. taxifolia, *Hook.* . . .	A bush?	Japan.
10. J. prostrata,[h] *Pers.* . . . . J. *repens*, Nuttall. J. *hudsonica*, Loddiges.	Prostrate; fruit round, glaucous.	N. America, especially Newfoundland.

11. J. recurva,[h] Hamilt. J. *incurva*, Herb. Hamilt.	An ascending bush; fruit dark, thin-pointed.	Alps of Nepal and Cashmere.
12. J. squamata,[h] *Don* ? J. *religiosa*, Royle. J. *squamosa*, Herb. Hamil. J. *Lambertiana*, Wallich. J. *rigida*, ditto. J. *dumosa*, Hort.	A low trailing bush; fruit ovate, umbilicate, dark purple.	Alps of Bootan and Nepal, at the elevation of 9-11,500 feet.
†13. J. davurica, *Pall.*	A small tree; fruit roundish, smooth, blue.	Highest mountains of Siberia.
14. J. chinensis,[h] *Linn.* J. *Thunbergii*, Hook. J. *nepalensis*, Gardens. J. *procumbens*, Siebold. (A) The male. (B) The female. J. *Reevesiana*, Hort. J. *flagelliformis*, Hort.	A bush; fruit glaucous, pale, emarginate.	China, Japan, and adjacent islands.
15. J. sphærica,[h] *Lindl.*	A large tree; fruit globular, pale.	N. China.
†16. J. pseudo-Sabina, *Fisch.*	A spreading bush; fruit ovate, black.	Mountains of Tarbagatai and Altai.
17. J. Sabina,[h] *Linn.* J. *horizontalis*, Mönch.	A spreading bush; fruit globose, glaucous.	Mountains and northern parts of Europe, Siberia, and N. America.
18. J. Sabinoides,[h] *Griseb.* J. *Sabina tamariscifolia*, Aiton. J. *turbinata*, Gussone.	A spreading bush; fruit obovate, narrowed at the base, glaucous.	Mountains of the South of Europe.
†19. J. oophora, *Kunze*	An erect bush; fruit ovate, wrinkled, brown.	Spain, in the neighbourhood of Bonanza.
20. J. fœtidissima,[h] *Willd.* J. *hispanica*, Miller. J. *thurifera*, Hort. J. *excelsa*, Pin. Wob.	A tree; fruit globose, smooth.	
21. J. excelsa,[h] *Bieberst.*	A shrub or tall tree; fruit roundish, tuberculated.	Levant; Asia Minor; Arabia; Western Himalayas.

(B) nana	A dwarf bush.	Himalayas, at great elevations.
†22. J. procera, *Hochst.* . .	A huge tree, producing fine timber.	Abyssinia.
23. J. occidentalis,[h] Hooker . ? J. *Hermanni*, Persoon. ? J. *dealbata* of some gardens. J. *excelsa*, Lewis & Clark.	A very large tree.	N. W. America.
24. J. Virginiana,[h] *Linn.* . . J. *barbadensis*, Linn. J. *caroliniana*, Gardens. J. *arborescens*, Mönch. (B) pendula, *Gardens.* (C) glauca, *Gardens.*	A tree.	N. America and West Indies.
25. J. mexicana, *Schlecht.* . . J. *Deppeana*, Steudel. J. *Sabinoides*, Humboldt.	A tree.	Mountains of Mexico.
26. J. flaccida, *Schlecht.* . .	A tree.	Mountains of Mexico.
27. J. bermudiana, *Linn.* . .. J. *oppositifolia*, Mönch.	A tree.	Bermuda.
28. J. tetragona, *Schlecht.* . .	A shrub, with round glaucous fruit.	Mexico, at low elevations.
29. J. phœnicea,[h] *Linn.* . .	A small tree.	Mediterranean and Levant.
(A) sclerocarpa . . . . J. *tetragona*, Mönch.	Fruit shining, hard.	
(B) malacocarpa . . . J. *Lycia*, Linn.	Fruit glaucous, soft.	

Doubtful Species.

30. J. gracilis, *Endl.* A shrub. Mexico.
31. J. cernua, *Roxb.* A shrub. China.
32. J. dimorpha, *Roxb.* A shrub. China.
33. J. aquatica, *Roxb.* A shrub. China.
34. J. glauca, *Willd.*
35. J. Cedro, *Webb and Berth.* A tree. Canaries.
36. J. racemosa, *Risso.* N. of Europe.
37. J. gossainthanea, *Loddiges* (J. *Bedfordiana*, Knight); very like a Red Cedar, but tender.
38. J. pubescens, *Gardens.* N. of India.

2. Widdringtonia, *Endl.*

1. W. juniperoides, *Endl.* . *Cupressus juniperoides*, Linn. *Cupressus africana*, Mill. ?*Juniperus capensis*, Lam. *Taxodium juniperoides*, *T. capense*, Hort. *Schubertia capensis*, Spreng. *Callitris arborea*, Schrad. *Pachylepis juniperoides*, Brongn.	A large tree ; fruit depressed, globose.	Cape of Good Hope, on Mount Blauwberg in the ridge called the Cedarberg, at the height of 3-4000 feet.
2. W. cupressoides, *Endl.* . *Thuia cupressoides*, Linn. *Callitris cupressoides*, Schrader. *Callitris stricta*, Schrader. *Pachylepis cupressoides*, Brongn.	A bush.	Cape of Good Hope, at small elevations.
†3. W. Commersonii, *Endl.* . *Thuia quadrangularis*, Venten. *Pachylepis Commersonii*, Brongn.	? ?	Madagascar ; formerly in the Garden of the Mauritius.

Doubtful Species.

4. W. Natalensis, *Endl.* Port Natal. | 5. W. Wallichii, *Endl.* Cape of Good Hope.

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3. Frenela, *Mirbel.*

1. F. fruticosa, *Endl.* . . . *Callitris fruticosa*, R. Brown. *Callitris oblonga*, Rich.	A shrub.	East Coast of N. Holland.
2. F. rhomboidea, *Endl.* . . . *Callitris rhomboidea*, R. Brown.	A bush?	East Coast of N. Holland.
†3. F. Roeï, *Endl.*	A bush?	S.W. Coast of N. Holland.

4. F. triquetra, *Spach* . . *Cupressus australis*, Desf. *Callitris cupressiformis*, Vent. *Frenela Ventenatii*, Mirb. *Cupressus triquetra*, Lod. ? *Cupressus articulata*, Pin. Wob. *Juniperus Cunninghamii*, Hort.	A tree?	East Coast of N. Holland.
5. F. australis, *Mirb.* . . *Thuia australis*, Desfont. *Cupressus australis*, Per. *Callitris australis*, R.Br.	A tree.	East Coast of N. Holland and Van Diemen's Island.
†6. F. verrucosa, *Cuningh.* . *Callitris verrucosa*, R.Br.	A tree?	Eastern interior of N. Holland.
†7. F. robusta, *Cuningh.* . *Callitris robusta*, R. Br. *Callitris Preissii*, Miquel	A large tree.	S. & S.W. of New Holland.
†8. F. Gunnii, *Endl.* . . . *Callitris Gunnii*, Hook.	A tree.	Van Diemen's Island.

Doubtful Species.

9. F. glauca, *Mirb.* (*Callitris glauca*, R. Brown). N. Holl.
10. F. calcarata, *Cunning.* (*C. calcarata*, R. Brown). N. Holl.
11. F. propinqua, *Cunning.* (*C. propinqua*, R. Brown). N. Holl.
12. F. tuberculata, *Mirb.* (*C. tuberculata*, R. Brown). N. Holl.
13. F. arenosa, *Hort.* (*C. arenosa*, Sweet). N. Holl.
14. F. pyramidalis, *Hort.* (*C. pyramidalis*, Sweet). N. Holl.
15. F. Fothergilli, *Hort.* (*C. Fothergilli*, Loudon; *Cupressus Fothergilli*, Pin. Wob.) N. Holl.
16. F. macrostachya, *Hort.* (*C. macrostachya*, Hort.) N. Holl.
17. F. rigida, *Hort.* (*Juniperus rigida*, Noisette). N. Holl.
18. F. ericoides, *Hort.* (*Juniperus ericoides*, Noisette). N. Holl.

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4. Actinostrobus, *Miquel.*

†1. A. pyramidalis, *Miq.* . . .	A tall bush.	Coast of Swan Riv.

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5. Callitris, *Vent.*

1. C. quadrivalvis, *Vent.* . . . *Thuia articulata*, Vahl. *Frenela Fontanesii*, Mirb.	A very large tree, with fine fragrant wood.	Mountains of Barbary.

6. Libocedrus, *Endlicher.*—Libocedars.

†1. L. Doniana, *Endl.* . . . *Dacrydium plumosum*, Don. *Thuia Doniana*, Hooker.	A tree 30–70 feet high.	N. Island of New Zealand.
2. L. tetragona, *Endl.*[h ?] . . *Pinus cupressoides*, Mol. *Juniperus uvifera*, Don. *Thuia tetragona*, Hooker.	A large tree, with good timber; a bush at the Straits of Magellan.	Mountains of S. Chili.
3. L. chilensis,[h ?] *Endl.* . . *Thuia chilensis*, Don. *Thuia andina*, Pöppig.	A large tree.	Mountains of S. Chili.

7. Biota, *Don.*

1. B. orientalis, *Endl.*[h] . . *Thuia orientalis*, Linn. *Thuia acuta*, Mönch. *Cupressus Thuia*, Targioni-Tozzetti. *Platycladus stricta*, Spac.	A large tree, with hard red wood.	China and Japan.
2. B. tatarica . . . . . . *Thuia nepalensis*, Hort. *Thuia tatarica*, Hort.	A tree.	N. of Asia and Nepal.
3. B. stricta . . . . . . *Thuia stricta*, Hort.	A tree.	N. of Asia.
4. B. pendula, *Endl.*[h] . . . *Cupressus pendula*, Thun. *Cupressus patula*, Pers. *Thuia pendula*, Lambert. *Cupressus filiformis*, Hort. *Thuia filiformis*, Lodd.	A large bush, weeping like a Casuarina.	China and Japan. Cultivated everywhere. Reported to be a cross between a Juniper and a Thuja.

8. Thuia, *Linnæus.*—Arbor Vitæ.

1. T. plicata, *Don* . . . . . T. *Wareana*, Booth.	A large tree.	N. W. America.

2. T. occidentalis, *Linn.*[h] . . *T. obtusa*, Mönch. *Cupressus arbor-vitæ*, Targioni-Tozzetti.	A tree.	North America.
†3. T. gigantea, *Nutt.* . . . *T. Menziesii*, Douglas.	An immense tree.	N.W. America.

Doubtful Species.

4. T. inæqualis, *Desfont.* Native country unknown.

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9. Thuiopsis, *Siebold and Zuccarini.*

†1. T. dolabrata, *Sieb. and Zucc.* *Thuia dolabrata*, Thunbg. *Platycladus dolabrata*, Spach.	A large tree, with hard red wood.	Japan.

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10. Cupressus, *Tournefort.*—Cypresses.

1. C. horizontalis, *Mill.*[h] . . C. *expansa*, Hort. C. *orientalis*, Hort. C. *Tournefortii*, Audibert	A small tree.	Mediterranean and Levant.
2. C. sempervirens, *Miller* . . C. *fastigiata*, D. C. C. *pyramidalis*, Targioni-Tozzetti.	A small tree.	Greece and Asia Minor.
3. C. torulosa,[h] *Don* . . .	A fine tree.	Bootan and Nepal.
4. C. glauca, *Lam.* . . . . . C. *lusitanica*, Miller. C. *pendula*, L'Heritier.	A fine tree.	Hindostan, near Goa.
5. C. funebris, *Endl.*[h] . . . C. *pendula*, Staunton.	A beautiful weeping tree.	N. of China.
6. C. thurifera, *Lindley* . . C. *Benthami*, Endl. C. *Coulteri*, Pin. Wob. C. *Lindleyi*, Klotzsch.	A tree.	Mounts. of Mexico.
7. C. Uhdeana, *Gordon*. . .	A tree.	Mexico.
8. C. Goveniana,[h] *Gordon* . .	A bush.	California.
9. C. macrocarpa,[h] *Hartweg* . C. *Lambertiana*, Hort.	A large tree.	California.

11. Chamæcyparis, *Spach.*—White Cedars.

1. C. sphæroidea,[h] *Spach* . . *Cupressus thyoides*, Linn. *Thuia sphæroidalis*, Rich. *Thuia sphæroidea*, Hort.	A small tree.	N.W. America and S. Canada.
†2. C. nutkäensis, *Spach* . . *Cupressus nutkäensis*, Lambert. *Thuia excelsa*, Bongard. *Cupressus americana*, Trautvetter.	A large tree.	N.W. America, as far as Nootka Sound.
†3. C. thurifera, *Endl.* . . . *Cupressus thurifera*, Humb. *Juniperus thurifera*, Bonpl.	A lofty tree.	Woods of Mexico.
†4. C. obtusa, *Sieb. and Zucc.* . *Retinispora obtusa*, Sieb. and Zucc.	A tree 60 to 80 feet high.	Forms forests in Japan.
5. C. pisifera, *Sieb. and Zucc.* . *Retinispora pisifera*, Sieb.	A small tree.	Woods in the island of Nipon.
†6. C. squarrosa, *Sieb. and Zucc.* *Retin. squarrosa*, Sieb.	A bush.	Japan.

12. Taxodium, *Richard.*—Deciduous Cypresses.

1. T. distichum,[h] *Rich.* . . . *Cupressus disticha*, Linn. *Schubertia disticha*, Mirb. (B) T. pinnatum,[h] *Gardens.*	A very large tree.	U. States; Mexico, in swamps.
†2. T. microphyllum, *Brongn.* .	?	N. America.
†3. T. adscendens, *Brongn.*[h] .	A small tree.	Florida and Carolina swamps.

13. Glyptostrobus, *Endlicher.*

1. G. heterophyllus,[h] *Endl.* . ? *Thuia lineata*, Poiret. ? *Thuia pensilis*, Staunton. *Taxus nucifera*, Gardens. *Cupressus nucifera*, Hort. *Schubertia nucifera*, Denhardt. *Taxodium heterophyllum*, Brongn. *Taxodium japonicum*, Id. *Schubertia japonica*, Sph. *Cupressus sinensis*, Hort.	A bush.	China.
2. G. pendulus, *Endl.* . . . *Taxodium sinense pendulum*, Poiret. *Taxodium sinense*, Pin. Wob.	A bush, with long weeping branches.	China.

14. Cryptomeria, *Don.*

1. C. japonica,[h] *Don* . . . *Cupressus japonica*, Linn. *Taxodium japonicum*, Br.	A very large tree, 60 to 100 feet high.	Northern districts of China, in damp situations.
? 2. C. nana,[h] *Hort.* . . .	A bush.	North of China.

Order II.—ABIETINEÆ.——The PINE RACE.

15. Abies, *Linnæus.*

* Firs.

†1. A. Tsuga, *Sieb. and Zucc.* . *P. Araragi*, Sieb. (B) nana, *Endl.*	A tree resembling the Hemlock Spruce.	N. of Japan.

2. A. Brunoniana,[h] *Lindley* . *Pinus decidua*, Wall. *P. dumosa*, Lamb. *P. Brunoniana*, Wallich. *Abies dumosa*, Loudon. *A. cedroides*, Griffith.	A tree 70 to 80 feet high.	Nepal, Bootan, Gossainthan.
3. A. canadensis,[h] *Michaux* . *Abies americana*, Marsh. *Pinus canadensis*, Linn. *Picea canadensis*, Link.	A tree 70 to 100 feet high. (The Hemlock Spruce.)	N. America, from Hudson's Bay to N. Carolina.
4. A. Douglasii,[h] *Lindley* . . *Pinus taxifolia*, Lamb. *P. Douglasii*, Sabine. *Abies californica*, Gardens *Picea Douglasii*, Link.	A tree 150 to 200 feet high.	N. W. America, California, Mexico.
†5. A. bracteata . . . . *Pinus venusta*, Douglas. *Picea bracteata*, Loudon. *Pinus bracteata*, Don.	A slender tree, 120 feet high.	From the River Columbia to the mountains of California.
6. A. nobilis,[h] *Lindley* . . *Pinus nobilis*, Douglas. *Picea nobilis*, Loudon.	A very large tree.	Columbia River.
7. A. Fraseri,[h] Lindley . . *Pinus Fraseri*, Pursh. *Picea Fraseri*, Loudon. (B) nana. *Pinus hudsonica*, Gardens.	A low scrubby tree.	Mountains of Carolina and Pennsylvania.
8. A. religiosa, *Lindley* . . *Pinus religiosa*, Humb. *Picea religiosa*, Loudon. *A. hirtella*, Lindley. *Pinus hirtella*, Humb. *Picea hirtella*, Loudon.	A tree 150 feet high.	Mountains of Mexico to the height of 9000 feet.
9. A. Nordmanniana,[h] *Spach* . *P. Nordmanniana*, Stev. *Picea Nordmanniana*, Loudon.	A tree 80 feet and more high.	Mountains of the Crimea.
10. A. Picea,[h] *Lindley* . . . *Pinus picea*, Linn. *P. pectinata*, Lamarck. *Abies alba*, Mill. *Abies taxifolia*, Desfont. *Abies pectinata*, D. C.	A tree sometimes as much as 160 feet high. (The Silver Fir.)	Mountains of Central and Southern Europe from the Pyrenees to the Caucasus.

Abies vulgaris, Poiret. *Abies excelsa*, Link. *Abies candicans*, Fisch. *Picea pectinata*, Loud.		
(B) Apollinis,[h] *Link* . . *Pinus Apollinis*, Antoine. *P. orientalis*, Frivaldsky.	A small tree or shrub.	Mountains of Greece.
†(C) leioclada, *Endlicher* . *Pinus leioclada*, Steven.	. .	Damp places, near the Black Sea.
11. A. cephalonica,[h] *Loudon* . *Ab. Lucombeana*, Gardens. *Picea cephalonica*, Loud. *Pinus cephalonica*, Endl.	A tree 60 feet high.	Mount Enos in Cephalonia to the height of 5000 feet.
†12. A. firma, *Sieb. and Zucc.*. *Abies Momi*, Siebold. *Pinus firma*, Antoine.	A tall tree.	Mountains of Japan.
†13. A. homolepis, *Sieb. & Zuc.* *Pinus homolepis*, Ant.	A tree 20 to 30 feet high.	Mountains of Japan.
14. A. balsamea,[h] *Miller* . . *Pinus balsamea*, Linn. *Abies balsamifera*, Mich. *Picea balsamea*, Loudon.	A tree 40 to 50 feet high. (The Balm of Gilead.)	Canada and Northern States of N. America; on the mountains down to N. Carolina.
†15. A. concolor . . . . . *Pinus concolor*, Engelm.	A tree.	Mountains of New Mexico.
16. A. amabilis,[h] *Lindley* . . *Picea amabilis*, Loudon. *Pinus amabilis*, Douglas.	A tree 170 to 200 feet high.	N. W. America.
17. A. grandis,[h] *Lindley* . . *Pinus grandis*, Douglas. *Picea grandis*, Loudon.	A tree 170 to 200 feet high.	Valleys of N. California.
†18. A. lasiocarpa, *Hooker* . .	? ?	N. W. America.
19. A. Pindrow,[h] *Spach* . . *Taxus Lambertiana*, Wal. *Picea Pindrow*, Loudon. *Pinus Pindrow*, Royle. *Picea Herbertiana*, Madd.	A tree 80 to 100 feet high.	Himalayan Mountains as far as Cashmeer.

20. A. Webbiana,[h] *Lindley* . *Pinus striata*, Hamilton. *Pinus spectabilis*, Lamb. *Pinus tinctoria*, Wallich. *Pinus Webbiana*, Wall. *Abies spectabilis*, Spach. *Picea Webbiana*, Loud. *A. bifida*, Siebold. *Pinus bifida*, Antoine. *Abies densa*, Griffith.	A tree 80 to 90 feet high.	Western Himalayas to 10,000 feet; also Japan.
21. A. Pichta[h] . . . . . . *Pinus Pichta*, Fisch. *Abies sibirica*, Ledebour. *Picea Pichta*, Loudon. *Pinus sibirica*, Steudel.	A lofty tree.	Mountains of Siberia and the Altai.
22. A. Pinsapo,[h] *Boissier* . . *Pinus Pinsapo*, Boissier. *Picea Pinsapo*, Loudon.	A branching tree 60 to 70 feet high.	Mountains of Grenada.
†23. A. Mertensiana. . . . *Pinus Mertensiana*, Bongard.	A branching shrub, (like A. canadensis, *F. Rauch.*)	Island of Sitcha.
24. A. Menziesii,[h] *Lindley* . . *Pinus Menziesii*, Dougl.	A tall tree.	N. W. America.
25. A. alba,[h] *Michaux* . . . *Pinus laxa*, Ehrhart. *Pinus glauca*, Mönch. *Pinus tetragona*, Mönch. *Pinus alba*, Aiton. *Abies curvifolia*, Gardens. *Picea alba*, Link. (B) nana,[h] *Loudon.*	A tree seldom above 50 feet high. (The White Spruce.)	N. America, from 48° to 70° N. lat.
26. A. rubra,[h] *Poiret* . . . *Pinus americana*, Gärt. *Pinus rubra*, Lambert. *Picea rubra*, Link. (B) violacea,[h] *Loudon.* *Picea cærulea*, Link. (C) arctica,[h] *Cunningh.*	A tree seldom above 30 feet high. (The Red Spruce.)	Nova Scotia and Newfoundland.
27. A. nigra,[h] *Michaux* . . . *Abies mariana*, Miller. *Pinus mariana*, Duroi. *Pinus nigra*, Aiton. *P. marylandica*, Gardens	A tree 80 feet high. (The Black Spruce.)	N. America, between 44° and 53° N. lat.

Abies denticulata, Poiret. *Picea nigra*, Link.		
28. A. orientalis,[h] Poiret . . *Pinus orientalis*, Linn.	A tall tree.	Coast of the Black Sea and to the Eastward.
29. A. ajonensis[h] . . . . *Picea ajonensis*, Fisch.	A large tree.	Coast of S.E. point of Siberia.
30. A. excelsa,[h] *De Candolle* . *Pinus excelsa*, Lambert. *Pinus cinerea*, Röhling. *Picea vulgaris*, Link. *Picea excelsa*, Link. (B) viminalis, *Wahlenberg*. (C) carpatica, *Loudon*. (D) variegata, *Loudon*. (E) Clanbrasiliana, *Loudon*. (F) nana, *Gardens*. *A. pygmæa*, Loudon. (G) tenuifolia, *Loudon*. (H) gigantea, *Loudon*. (I) monstrosa, *Loudon*. (K) mucronata, *French Gardens*.	A tree sometimes 150 feet high. (The Common Spruce.)	Alps of Central Europe, and as high as 67° N. lat.
†31. A. obovata, Loudon . . *Picea obovata*, Ledebour. *Pinus obovata*, Ledebour.	A tall tree, resembling the Silver Fir.	Siberia and the Altai Mountains.
†32. A. Schrenkiana, *Fischer* . *Pic. Schrenkiana*, Fisch. *Pin. Schrenkiana*, id.	A tree?	Siberia.
33. A. Jezoënsis,[h ?] *Sieb. and Zucc.*	A large tree.	Japan.
†34. A. polita, *Sieb. and Zucc.* *Abies Torano*, Siebold. *Pinus polita*, Antoine.	A fine tree, perhaps the same as the next.	Mounts. of Japan.
35. A. Khutrow,[h] *Royle* . . *Pinus Smithiana*, Lamb. *Abies Smithiana*, Pinetum Woburnense. *A. spinulosa*, Griffith.	A tree 50 feet high.	Western Himalayas, to the height of 10,000 feet.
36. A. Morinda,[h] *Gardens* . . *Pinus Morinda*, Gardens. *Picea Morinda*, Link.	A smaller tree than the last.	Mounts. of N. India.
†37. A. sitchensis . . . . *Pinus sitchensis*, Bongard.	(Very near A. Menziesii, *F. Rauch*.)	Island of Sitcha.

Doubtful Species.

Abies trigona, *Rafinesque.*	300 feet high.	Oregon.
Abies heterophylla, *Raf.*	180 feet high.	Ditto.
Abies aromatica, *Raf.*	100 feet high.	Ditto.
Abies microphylla, *Raf.*	180 feet high.	Ditto.
Abies mucronata, *Raf.*	180 feet high.	Ditto.
Abies falcata, *Raf.*	35 feet high.	Ditto.

* * Larches.

38. A. Gmelini,[h] *Rupprecht* . *Larix dahurica*, Turcz. *Pinus dahurica*, Fischer.	A low shrub.	Arctic Siberia.
†39. A. leptolepis, *Sieb. and Zucc.* *Larix japonica*, Gardens.	A tree like the Larch.	N. of Japan.
40. A. Ledebourii,[h] *Rupprecht.* *Larix sibirica*, Ledebour. *Pinus pseudolarix*, Steud. *Pinus Ledebourii*, Endl.	A tree like the Larch.	Altai Mountains.
41. A. pendula[h] . . . . . . *P. Larix nigra*, Marsh. *Pinus laricina*, Duroi. *Larix pendula*, Salisbury *Larix intermedia*, Lodd. *Pinus pendula*, Solander	A tree like the Larch, but weeping.	N. America.
42. A. microcarpa[h] . . . . *P. Larix rubra*, Marsh. *Pinus intermedia*, Duroi. *Larix microcarpa*, Poiret. *Larix americana*, Michaux. *Larix tenuifolia*, Salisb. *Pinus microcarpa*, Lamb.	A tree 100 feet high.	N. America, from 45° to 50° N. lat., forming vast forests.
43. A. Larix,[h] *Lamarck* . . *Larix decidua*, Miller. *Larix pyramidalis*, Salisb. *Larix europæa*, De C. *Larix excelsa*, Link. *Larix vulgaris*, Fischer. *Pinus Larix*, Linn. ?*Larix archangelica*, Gardens. (B) repens, *Gardens.* (C) pendula, *Gardens.*	A tree 100 feet high.	Alps of Central Europe.
44. A. sibirica,[h] *Fisch.* . . . *Larix sibirica*, Gardens.	Russian Larch.	Siberia.

45. A. Griffithiana,[h] *J. Hooker* .	A tree 40 to 60 feet high. (The Sikkim Larch.)	Eastern Nepal, Sikkim.

Doubtful Species.

A. Kamtchatika, *Rupprecht*. (*Pinus Kamtchatika*, Endlicher.) A dwarf bush. Kamtchatka.

* * * Cedars.

46. A. Deodara,[h] *Lindley* . . *Cedrus Deodara*, Loudon. *Pinus Deodara*, Roxb.	A tree 150 feet high. (The Deodar.)	Western Himalayas.
47. A. Cedrus,[h] *Poiret* . . . *Cedrus Libani*, Barrelier. *Larix Cedrus*, Miller. *Larix patula*, Salisbury. *Pinus Cedrus*, Linn. (B) argentea, *Gardens*.	A flat-headed tree 80 feet high. (The Cedar of Lebanon.)	Mountains of Lebanon and Taurus.
48. A. atlantica[h] . . . . *Cedrus atlantica*, Manetti. *Pinus atlantica*, Endl. *Cedr. argentea*, Gardens. *Cedr. africana*, Gardens. *Cedr. elegans*, Gardens.	A huge tree. (The Silver Cedar.)	Mounts. of Atlas.

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16. Pinus, *Linnæus*.—Pines.

* Leaves in fives.

†1. P. Koraiensis, *Sieb. and Zucc.*	A bush 10 to 12 feet high.	Corea and Kamtchatka.
†1*. P. parviflora, *Siebold* . .	A shrub.	Japan.
2. P. Cembra,[h] *Linn.* . . .	A tree 50 feet high	Mounts. of Europe and N. Asia.
(B) pumila,[h] *Endlicher* . . *P. pygmæa*, Fischer. *P. Cembra pygmæa*, Loud.	A shrub.	Siberia beyond the Lena, Kamtchatka, Kurile Islands.
†3. P. Peuce, *Grisebach* . . *Pinus Cembra, var. fruticosa*, Griseb.	A shrub or low tree.	Mountains of Rumelia.

4. P. excelsa,[h] *Wallich* . . *Pinus Strobus*, Hamilt. *Pinus Chylla*, Loddig. *P. Dicksonii*, Gardens. *P. pendula*, Griffith.	A tree 50 to 150 feet high.	Southern and Western Himalayas.
5. P. Strobus,[h] *Linn.* . . . (B) alba *of Gardens.* (C) brevifolia, *Loudon.* *P. compressa* } Gardens. *P. nivea* }	A tree 200 feet high. (The Weymouth Pine.)	N. America, from 43° to 48° N. lat.
6. P. monticola,[h] *Douglas* .	A large tree.	N. W. America.
7. P. Ayacahuite,[h] *C. Ehrenb.*	A tree 100 feet high.	Mountains of Mexico.
8. P. Lambertiana,[h] *Douglas* . (B) brevifolia, *Hooker.*	A tree 200 feet high and more.	N. W. America.
†9. P. Ehrenbergii, *Endl.* . .	A tree 100 feet high.	Mounts. of Mexico.
10. P. rudis, *Endl.*	. .	Mounts. of Mexico.
11. P. Hartwegii,[h] *Lindley* .	. .	Mounts. of Mexico.
12. P. oocarpa, *Schiede* . . (B) oocarpoides, *Bentham.*	. .	Mounts. of Mexico.
13. P. Russelliana,[h] *Lindl.* .	. .	Mounts. of Mexico.
14. P. Devoniana,[h] *Lindl.* . .	A tree 80 feet high	Mounts. of Mexico.
15. P. macrophylla,[h] *Lindl.* .	A low tree.	Mounts. of Mexico.
16. P. apulcensis,[h] *Lindl.* . . *P. acapulcensis*, Gardens.	A tree 50 feet high	Mounts. of Mexico.
17. P. Montezumæ,[h] *Lambert* .	A tree 40 feet high	Mounts. of Mexico.
18. P. Lindleyana,[h] *Loudon* .	A large tree.	Mounts. of Mexico.
19. P. Grenvilleæ, *Gordon* .	A tree 60 to 80 feet high.	Mounts. of Mexico.
20. P. Gordoniana, *Hartweg* .	A tree 60 to 80 feet high.	Mounts. of Mexico.
†21. P. occidentalis, *Swartz.* .	. .	St. Domingo and W. Indian Islands.
22. P. Wincesteriana, *Gordon* .	A tree 60 to 80 feet high.	Mounts. of Mexico.
23. P. tenuifolia, *Benth.* . .	. .	Mounts. of Guatemala.
24. P. leiophylla, *Schiede and Depp.*	. .	Mounts. of Mexico.

25. P. filifolia, *Lindley* . .	. .	Guatemala.
26. P. pseudostrobus, *Lindl.* .	. .	Mounts. of Mexico.
27. P. Orizabæ,[h] *Gordon* . .	A small tree.	Mounts. of Mexico.

* * Leaves in threes.

28. P. Teocote,[h] *Cham. and Schlecht.*	A tree 100 feet high.	Mounts. of Mexico.
29. P. patula, *Schiede* . . (A) stricta, *Bentham.* (B) macrocarpa, *Schiede.*	. .	Mounts. of Mexico.
†30. P. insularis, *Endlicher* . ?*Pinus timoriensis*, Loud.	. .	Philippines.
31. P. persica,[h] *Strangways* .	. .	S. of Persia.
32. P. sinensis, *Lamb.* . . *Pinus Kaseya*, Royle. *P. nepalensis*, Pinet. Wob. *P. Cavendishiana*, Gardens.	. .	China.
33. P. longifolia, *Roxburgh* .	A tree 50 to 80 feet high.	Nepal and Cashmere.
34. P. Gerardiana,[h] *Wallich* . *Pinus Neosa*, Govan.	A tree 50 feet high	Himalayan Mountains.
35. P. Sabiniana,[h] *Douglas* .	A tree 120 feet high.	N. W. America.
36. P. macrocarpa,[h] *Lindl.* . *P. Coulteri*, Don. *P. Sinclairii*, Kew Garden	A tree 120 feet high.	N. W. America.
37. P. radiata,[h] *Don* . . .	A tree 100 feet high	California.
38. P. tuberculata,[h] *Don* . . *P. californica*, Hort. Soc.	A tree 100 feet high	California.
39. P. Benthamiana,[h] *Hartweg* *P. brachyptera*, Engelm. *Pinus Sinclairii*, Hook.	A tree 200 feet high	California.
40. P. cembroides,[h] *Zuccarini* .	A tree 30 ft. high.	Mounts. of Mexico.
†41. ? P. edulis, *Wisliz.* . .	A bush.	New Mexico.
42. ? P. osteosperma, *Wisliz.* .	A bush.	New Mexico.
43. P. Llaveana,[h] *Schiede* . .	A dwarf tree.	Mounts. of Mexico.
44. P. Fremontiana,[h] *Endlicher* *P. monophylla*, Torrey.	A tree 20 ft. high.	California.

45. P. insignis,[h] *Douglas* . . *P. californica*, Loisl. *P. monteragensis*, Godefr. *P. adunca*, Bosc.	. .	California.
46. P. ponderosa,[h] *Douglas* . .	A large tree.	N. W. America.
47. P. serotina,[h] *Michaux* . . *P. Tæda alopecuroidea*, Aiton.	A tree 40 ft. high.	Pennsylvania and Carolina.
48. P. rigida,[h] *Miller* . . . *Pinus Tæda rigida*, Aiton. *P. Loddigesii*, Loudon.	A small tree.	United States.
49. P. Tæda,[h] *Linn.* . . .	A tree 80 ft. high.	Florida and Virginia.
50. P. australis,[h] *Michaux* . . *P. palustris*, Miller.	A tree 70 ft. high.	Florida and Virginia.
51. P. canariensis, *Chr. Smith* .	. .	Teneriffe and the Great Canary.
52. P. Bungeana,[h] *Zuccarini* . *P. excorticata*, Gardens.	? ?	N. of China.

* * * Leaves in pairs.

53. P. pungens,[h] *Michaux* . .	. .	Virginia and Carolina.
54. P. muricata,[h] *Don* . . *P. Edgariana*, Gardens.	A tree 40 feet high (Bishop Pine.)	California.
55. P. inops,[h] *Solander*. . . *P. virginiana*, Miller.	A tree 30–40 feet high.	N. America.
56. P. mitis,[h] *Michaux* . . .	A tree 50–60 feet high.	N. America.
57. P. variabilis,[h] *Lambert* . . *P. echinata*, Miller.	. .	Sandy coast of N. America.
58. P. Pinaster,[h] *Solander* . . *P. Massoniana*, Lamb. *P. Hamiltoniana*, Tenore. *P. maritima*, D. C. *P. japonica*, Gardens. *P. nepalensis*, Royle. ? *P. Latteri*, Madden. *P. syrtica*, Thore. (B) Escarena, *Risso*. (C) Lemoniana, *Bentham*.	A tree 50–60 feet high.	Mountains and sea-coast of Continental Europe, India, China, and Japan.

(D) minor, *Loisleur.* (E) variegata.		
59. P. pumilio,[h] *Hænke* . . *P. tatarica*, Miller. *P. pungens*, Scopoli. *P. sylvestris montana*, Aiton.	A small bush.	Alps of Europe, to the height of 7500 feet.
60. P. Mugho,[h] *Bauhin* . . *P. uncinata*, Ramond. *P. montana*, Baumann. *P. rotundata*, Link.	A lofty tree.	Pyrenees; Alps of South - Western and Central Europe.
(B) humilis, *Link* . . . *P. pumilio*, Lambert.	A low tree.	
(C) obliqua, *Sauter.* *P. uliginosa*, Wimmer. *P. pyramidalis*, Reuss. ? *P. Fischeri*, Gardens.		
61. P. sylvestris,[h] *Linn.* . . *P. altaica*, Ledeb.	A middle-sized tree. (The Scotch Fir.)	Central and Northern Europe, up to 70° N. lat.; and N.W. Asia, as high as 63° N. lat.
(A) communis . . . . . *P. genevensis* } of Gar- *P. rigensis* } dens.	White-wooded.	
(B) rubra . . . . . . *P. rubra*, Miller. *P. scotica*, Willd. *P. scariosa*, Loddiges. *P. squamosa*, Bosc. *P. tortuosa* } *P. monophylla* } Gar- *P. horizontalis* } dens. *P. hagenoviensis* }	Red-wooded.	Scotland.
(C) latifolia. *P. Erzeroum.*		
†62. P. Merkusii, *de Vriese* . *P. sumatrana*, Jungh.	A tree 100 ft. high.	Sumatra, at 3000 to 4000 feet above the sea.
63. P. Banksiana,[h] *Lambert* . *P. Hudsonica*, Lamarck. *P. rupestris*, Michaux. *P. contorta*, Douglas.	A branching tree 40 ft. high. (The Scrub-Pine.)	N. America, as high as 64° N. lat.

64. P. resinosa,[h] *Solander*. . *P. rubra*, Michaux. *P. canadensis bifolia*, Gardens.	A tree 80 ft. high. (The Red Pine.)	N. America, between 41° and 48° N. lat.
65. P. Laricio,[h] *Poiret* . . *P. magellensis*, Schouw. *P. altissima*, *P. caramanica*, *P. calabrica*, *P. romana* } of Gardens.	A lofty tree. (The Corsican Pine.)	Spain, Corsica, and coasts of the Mediterranean.
66. P. austriaca,[h] *Hoess* . . *P. nigricans*, Host. *P. nigra*, Link.	A lofty tree.	Carinthia, Styria, Lower Austria, Transylvania, the Banat.
67. P. Pallasiana,[h] *Lambert* . *P. taurica*, *P. tatarica* } of Gardens.	A lofty tree.	Limestone Mountains in the Western Crimea.
68. P. pyrenaica,[h] *Lapeyrouse* *P. penicillus*, Lap. *P. hispanica*, Cook. *P. halepensis major*, Gard. *P. monspeliensis*, Vilm.	A lofty tree.	Pyrenees.
69. P. halepensis,[h] *Mill.* . . *P. hierosolymitana*, Duham. *P. genuensis*, Cook. *P. cairica*, Don.	A middle-sized tree.	South coast of Europe.
(B) maritima,[h] *Lambert* . *P. Pithyusa*, Fox Strangways.	. .	Coasts of Greece.
70. P. Brutia,[h] *Tenore* . . . *P. conglomerata*, Gräff.	. .	Mountains of Calabria, to the height of 3600 feet.
71. P. Pinea,[h] *Linn.* . . . *P. densiflora*, Siebold. *P. aracanensis*, Gardens. (B) fragilis, *Nouv. Duham.* (C) cretica, *Gardens.*	A large flat-headed tree. (The Stone Pine.)	The coasts of the Mediterranean, not growing more than 1500 feet above the sea.

Doubtful Species.

P. arabica, *Sieber*, (*P. australis*, Hort.) Palestine and Arabia.

P. Finlaysoniana, *Wall.* Cochin China.

P. flexilis, *Engelmann.* New Mexico.

P. strobiformis, *Wisliz.*	A tree 100 to 130 ft.	North of Mexico.
P. Chihuahuana, *Wisliz.*	A tree 30 to 50 ft.	North of Mexico.
P. macrophylla, *Wisliz.*	A large tree.	North of Mexico.

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17. Araucaria, *Juss.*

1. A. brasiliensis, *A. Richard* *Columbea angustifolia*, Bertoloni. *A. Ridolfiana*, Savi.* *A. de Bibbiani*, Italian Gardens.*	A lofty tree. * This is said by the Marquis di Ridolfi to be much more hardy than the common A. brasiliensis.	Mountains of Brazil, between 15° and 25° S. lat.
2. A. imbricata,[h] *Pavon* *Dombeya chilensis*, Lam. *Abies columbaria*, Desf. *Colymbia quadrifaria*, Salisbury. *Ar. chilensis*, Mirb. *Ar. Dombeyi*, Rich.	A lofty tree.	Mountains of S. Chili.
3. A. Bidwilli, *Hooker*	A large tree.	Moreton Bay.
4. A. Cunninghamii, *Aiton* *Altingia Cunninghamii*, G. Don. *Eutacta Cunninghamii*, Link. *Eutassa Cunninghamii*, Spach. (B) longifolia, *Antoine.* (C) glauca, *Antoine.*	A large tree.	Moreton Bay.
5. A. excelsa, *R. Br.* *Dombeya excelsa*, Lamb. *Eutassa heterophylla*, Salisbury. *Altingia excelsa*, Loudon. *Colymbea excelsa*, Spreng. *Eutacta excelsa*, Link.	A tree 200 feet high. (Norfolk Island Pine.)	Norfolk Island.

Undescribed Species.

A. Cookii, *R. Br.* (*Cupressus columnaris*, Forst.) New Caledonia.

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18. Dammara, *Rumphius.*

1. D. orientalis, *Lambert* . . *D. alba*, Rumph. *Pinus Dammara*, Lamb. *Pinus sumatrana* } of Gar- *Abies sumatrana* } dens. *Abies Dammara*, Poiret. *Agathis loranthifolia*, Salisbury. *Agathis Dammara*, Rich.	A lofty tree.	Malay Archipelago.
2. D. australis, *Lambert* . . *Agathis australis*, Salisb. *Podocarpus zamiæfolius*, A. Richard.	A tree 140 ft. high. (The Kaurie Pine.)	N. Zealand.

19. Cunninghamia, *R. Brown.*

1. C. sinensis,[h] *R. Br.* . . *Pinus lanceolata*, Lamb. *Abies lanceolata*, Desf. *Belis jaculifolia*, Salisb. *Belis lanceolata*, Sweet. *Araucaria lanceolata* of Gardens.	A small tree.	Southern China.

20. Pherosphæra, *Archer.*

†1. P. Hookeriana, *Archer* . .	A low shrub.	Van Diemen's Land.

21. Microcachrys, *Jos. Hooker.*

1. M. tetragona, *J. Hooker* . *Arthrotaxis tetragona*, Hooker.	A tree 25 ft. high.	V. Diemen's Land.

22. Arthrotaxis, *Don.*

†1. A. selaginoides, *Don* . . *Cunninghamia selaginoides*, Zucc.	A low bush.	V. Diemen's Land.
†2. A. cupressoides, *Don* . . *Cunninghamia cupressoides*, Zucc.	A tree 30 ft. high.	V. Diemen's Land.
†3. A. laxifolia, *Hook.* . . .	? ?	V. Diemen's Land.

23. Sequoia, *Endlicher.*

†1. S. sempervirens, *Endl.* . *Taxodium sempervirens*, Lamb. *Taxodium nutkaense*, Lamb.	? ?	N.W. America and Nootka Sound.
2. S. gigantea,[h] *Endl.* . . . *Taxod. sempervirens*, Gard.	A tree 300 ft. high.	California.

24. Sciadopitys, *Siebold.*

†1. S. verticillata, *Sieb. & Zucc.* *Taxus verticillata*, Thunberg. *Pinus verticillata*, Sieb.	? ?	Japan.

Order III.—PODOCARPEÆ.——The PODOCARP RACE

25. Podocarpus, *L'Herit.*

†1. P. Nageia, *R. Br.* . . . *Myrica nagi*, Thunberg. *Nageia japonica*, Gärtner	A tree 30–60 feet high.	Japan.
2. P. cuspidata, *Endl.* . .	. .	Japan.
3. P. grandifolia, *Endl.* . .	. .	Japan.
4. P. latifolia, *Wallich* . .	. .	Mounts. of India.

†5. P. Blumei, *Endl.* . . . *P. latifolia*, Blume.	A lofty tree.	Java.
†6. P. Sellowii, *Klotzsch* . .	. .	Brazil.
†7. P. oleifolia, *Don* . . .	A leafy tree.	Chili.
†8. P. salicifolia, *Klotzsch* . .	. .	Columbia.
9. P. coriacea, *Richard* . . *P. antillarum*, R. Br. *P. yacca*, Don. ? *Taxus lancifolia*, Wikström.	A tree 50 ft. high.	W. Indies.
10. P. Purdieana, *Hooker* . .	A tree 120 ft. high.	Jamaica, at the height of 3500 ft.
†11. P. Lamberti, *Klotzsch* .	A large tree.	Brazil.
†12. P. rigida, *Klotzsch* . . *Juniperus rigida*, Pavon. *Podocarpus glomerata*, Don.	A large tree.	Peru.
†13. P. chilina, *Richard* . . *P. saligna*, Don.	A tree 40 ft. high.	Chili.
14. P. Totara, *Don* . . .	A tree 90 ft. high.	N. Zealand.
†15. P. elata, *R. Br.* . . .	. .	E. Coast of N. Holland.
16. P. spinulosa, *R. Br.* . . *Taxus spinulosa*, Smith. *P. pungens*, Caley. *P. excelsa*, Loddiges.	. .	E. Coast of N. Holland.
†17. P. Bidwilli, *Hoibrenk* .	. .	E. Coast of N. Holland.
†18. P. læta, *Id.*	. .	E. Coast of N. Holland.
†19. P. nivalis, *Hook.* . . .	A low shrub.	Mountains of N. Zealand.
†20. P. Lawrencii, *Hook. fil.* .	. .	V. D. Land.
†21. P. alpina, *R. Br.* . .	. .	V. D. Land, at the height of 3000 to 4000 ft.
†22. P. ensifolia, *R. Br.* . .	. .	N. E. Coast of N. Holland.
23. P. chinensis, *Wallich* . . *Taxus chinensis*, Roxb. *Juniperus chinensis*, Roxb.	. .	China.

24. P. nereifolia, *R. Br.* . .	Fruit eatable.	Nepal.
†25. P. polystachya, *R. Br.* . *P. nereifolia*, Don.	A large tree.	Sincapore.
†26. P. bracteata, *Blume* . .	A tree 80 ft. high.	Amboyna and Java.
27. P. macrophylla, *Don* . . *Taxus macrophylla*, Banks *P. verticillata*, } Gardens. *P. longifolia*, }	A tree 40 ft. high.	Japan, as high as 40° N. L.
(B) Maki, *Siebold* . . . *P. Makayi*, Gardens. *Taxus Makayi*, Pin. Woburn.	A bush.	Japan.
†28. P. japonica, *Siebold* . .	. .	Japan.
†29. P. Koraiana, *Siebold* . .	. .	Corea.
†30. P. amara, *Blume* . . .	A vast tree, with whorled branches.	Java.
31. P. Thunbergii, *Hooker* . *Taxus latifolia*, Thunb. *P. nobilis*, Gardens.	A tree.	C. of Good Hope.
32. P. elongata, *Herit.* . . *Taxus elongata*, Soland. *Taxus capensis*, Lamarck. *P. pruinosa*, E. Meyer.	. .	C. of Good Hope.
†33. P. Meyeriana, *Endl.* . .	. .	C. of Good Hope.
†34. P. falcata, *R. Br.* . . *Taxus falcata*, Thunberg.	. .	C. of Good Hope.
35. P. taxifolia, *Humboldt* . *Taxus montana*, Willd. *Podocarpus montana*, Loddiges. *Dacrydium distichum*, Don.	A tree 60 ft. high.	Peru.
(A) communis, *Kunth.*		
(B) densifolia, *Kunth.*		
†36. P. andina, *Pöpp.* . . . ? *Taxus spicata*, Dombey. *P. spicata*, Pöppig.	A tree 10 to 20 feet high.	S. Chili.
†37. P. ferruginea, *Don* . .	A tree 40 to 60 feet high.	N. Zealand.

†38. P. spicata, *R. Br.* . . *Dacrydium taxifolium*, Solander. *Dacrydium Mai*, A. Cunningham.	A lofty tree.	N. Zealand.
†39. P. cupressina, *R. Br.* . . *P. Horsfieldii*, Wall. *P. imbricata*, Blume.	A tree 180 ft. high.	Java, Philippines, &c.
40. P. dacryoides, *A. Richard* *Dacrydium thuioides*, Solander. *Dacrydium excelsum*, Don. *Podocarpus thuioides*, R. Br.	A tree 200 ft. high.	N. Zealand.
†41. P. biformis, *Hooker* . .	. .	N. Zealand, southern Island.

26. Dacrydium, *Solander*.

1. D. cupressinum, *Solander* . *Thalamia cupressina*, Sprengel.	A tree 200 ft. high.	New Zealand.
†2. D. laxifolium, *J. Hook.* .	A very small shrub.	New Zealand, on mountains.
†3. D. elatum, *Wall.* . . . *Juniperus rigida*, Wall. *J. Phillippsiana*, Id. *J. elata*, Roxburgh.	A vast tree.	Malay Archipelago.
†4. D. Colensoi, *Hooker* . . *Alania*, Colenso.	A tree 50 ft. high.	New Zealand.
5. D. Franklinii, *J. Hooker* . *D. huonense*, A. Cunningham.	A tree 100 ft. high. (The Huon Pine.)	VanDiemen'sLand.

Order IV.—TAXINEÆ.——The YEW RACE.

27. Phyllocladus, *L. C. Richard.*

1. P. trichomanoides, *Don* . .	A tree 60 ft. high.	N. Zealand, northern island.
2. P. rhomboid~~alis~~, *Rich.* . . . *Podocarpus asplenifolia*, Labill. *P. Billardierii*, Mirbel. *Phyllocladus asplenifolia*, Hook.	A tree 40 to 50 feet high.	Mountains of Van Diemen's Land.

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28. Salisburia, *Smith.*—The Ginkgo.

1. S. adiantifolia,[h] *Smith* . .	A lofty tree. (The Maidenhair tree.)	China and Japan.

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29. Cephalotaxus, *Sieb. and Zucc.*

1. C. pedunculata,[h] *Sieb. & Zucc.* *Taxus Harringtonia*, Gardens.	. .	Japan.
2. C. Fortuni,[h] *Hooker* . .	probably the same as 1 or 3.	Japan.
3. C. drupacea, *Sieb. and Zuc.* ? *Taxus Inukaja*, Gardens.		

Doubtful Species.

C. umbraculifera, *Siebold.* Japan.

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30. Torreya, *Arnott.*

†1. T. nucifera, *Sieb. and Zucc.* *Taxus nucifera*, Linn. *Podocarpus ? nucifer*, Persoon. *Caryotaxus nucifera*, Zuc.	A small tree.	Japan.
2. T. taxifolia, *Arnott* . . . *Taxus montana*, Nuttall.	A small tree.	S. States of N. America.
? 3. T. Humboldtii, *Kew.*		

31. Taxus, *Tournefort*.—Yews.

1. T. baccata,[h] *Linn.* . . .	A low tree.	Europe; Caucasus; mountains of India.
(B) sparsifolia, *Loudon.*		
(C) variegata, *Loudon.*		
(D) Dovaston, *Gardens.*		
(E) stricta, *Gardens.*		
(F) lutea, *Endlicher.*	Yellow berried.	
2. T. fastigiata,[h] *Lindl.* . . *T. hibernica*, Mackay.	An erect bush.	Ireland.
3. T. canadensis,[h] *Willd.* . . *T. procumbens*, Lodd.	A bush.	N. America.
†4. T. cuspidata, *Sieb. and Zucc.*	A tree 15 to 20 feet high.	Japan.
†5. T. Wallichiana, *Zuccar.* . *T. nucifera*, Wall.	. .	Nepal.
†6. T. globosa, *Schlechtend.* .	. .	Mexico.
7. T. adpressa,[h] *Gardens* . . *Cephalotaxus tardiva*, Sieb. *Ceph. brevifolia*, Gardens.	. .	Japan.

Doubtful Species.

T. tomentosa, *Ehrenb.* A branching erect small tree. Cape of Good Hope.
Podocarpus, or Taxus, or Abies, Brunonis, *Griffith*; a large solitary tree with pendulous branches; Bhotan, at the height of 6-9000 ft.

The compilers of this Catalogue wish to observe that they have not considered it necessary to include in it all the trifling varieties of Conifers to be found in Gardens, nor indeed would it be possible, for in every batch of seedlings variations of form or colour may be found, and employed to swell the nursery catalogues.

They also perceive that information obtained since the appearance of the first part of the Catalogue enables them to correct some errors, attributable either to themselves or others; as is stated in the following list.

p. 201. Juniperus *religiosa*, Royle (No. 12), appears, from Major Madden's valuable account of Indian Conifers, not to be J. squamata, but something distinct. A slender plant, having much the appearance of

Cupressus torulosa, is raised under this name from E. Indian seeds.

p. 201. Juniperus *procumbens*, Siebold (No. 14), is J. squamata, and not J. chinensis.

p. 201. Juniperus *fœtidissima*, Willd. (No. 20), is a native of Armenia, between Tiflis and Erivan, and of dry slopes on the west side of Karabagh.

p. 202. Juniperus *gracilis*, Endlicher (No. 30), is the same as J. flaccida.

Juniperus *japonica* of Gardens appears to be a distinct species, near J. oxycedrus, and not enumerated in the preceding list.

p. 206. Cupressus *pendula* of Gardens is Cupr. torulosa.

Cupressus *Corneyana*, Knight, is the female of Juniperus sinensis.

Cupressus *Knightiana* is not determinable at present.

p. 225. Podocarpus *Dieffenbachii* of Gardens is said to be some New Zealand Veronica !

XXVI.—*On Himalayan Conifers.* By Major E. Madden, Bengal Artillery.

(Reprinted from the Journal of the Agricultural and Horticultural Society of India, Vol. VII. Part I. p. 75.)

[The following excellent paper upon a subject of much interest is so little likely to be seen by European readers that it appears advisable to reprint it in the words of the learned author, without curtailment.]

I. Pinus longifolia.—The common hill name, *Cheer*, appeared to be simply the Sanscrit word denoting " bark," " rind," so conspicuous in this species : but further examination of Wilson's Dictionary proves its true origin to be " *Ksheerahvu* :" i. e. " named from its milk," or turpentine ; an involved method of nomenclature, which is further exemplified in *Cupressus torulosa*, "*Soorahvu*," " named divine," abbreviated, in like manner, in the vernacular of Kumaoon and Gurhwal, to *Soorüi*. *Cheer* is still used in Sindh to signify *gum*. *Sulla*, another well known mountain appellation of *P. longifolia*, from Nepal to Busehur, is apparently a corruption of the Sanscrit " *Surul*," " straight," " erect ;" but not without reference to the root, *sri*, " to spread fragrance," which this tree does to a remarkable* extent.

* Both ideas are involved in the stanza of Calidasa, "Birth of *Uma*," translated by Dr. Mill, J. A. S., July 1833, p. 338 :—

" His

" *Kolon*," " *Kolan*," " *Kolain*," variations of a common Gurhwal name, are undoubtedly from the same root as " *Kelon*," the Cedar. *P. longifolia* is universally distinguished on the hither side of the N.W. Himalaya as " *Sulla*," " *Sullee*," wherever the term " *Cheel*" is appropriated to *Pinus excelsa*. In Koonawur, however, *P. longifolia* preserves its name " *Cheer*," " *Cheel*," with the addition of the indigenous term " *Sthee*" or " *Shthee*." In Kumaoon it is known indifferently as *Cheer* and *Sulla*, but the latter is considered the proper Khusiya name. " *Siyahee-ka-Sulla*, *Binsur-ka-Banj*," the pines of Siyahee, the oaks of Binsur, is an Almorah proverb, of which the point lies rather in the alliteration than in the nature of things. The tree occurs in the greatest perfection and abundance on both mountains, and, indeed, seen from any commanding elevation, outer and central Kumaoon and Gurhwal, north to the Pindur, from 2,500 to 7,000 or 7,200 feet elevation, appear little else than one great forest of *Cheer* pine, succeeded at that level by oaks. Like our Anglo-Saxon race, it is jealous of the presence of rival colonists; and these, like so many Celts or Red Indians, are driven to a distance, or to shady ravines, where the pine does not thrive.

In a synopsis of the Indian *Coniferæ*, at the end of his Himalayan Travels, Dr. Hoffmeister gives the limits of *P. longifolia* at 5,000 and 8,000 feet: but so far as the general line of forest is in question, this is certainly too high; though a few stunted trees may here and there even exceed that limit by a few hundred feet. As to the error in the lower limit there can be no doubt. Dr. Griffith has already been quoted as fixing it in Bhotan to 1,800—2,000 feet; in Sikhim, where it only occurs in one place, Dr. Hooker informs me that its upper limit is 2,000 to 2,500 feet: the Lepcha name is " *Gniet-koong*." At Ramesur bridge, on the Surjoo, in eastern Kumaoon, 1,500 feet above the sea, it descends within 100 feet of the river; and in following the course of the Ganges from Hurdwar to Sreenugur, we first meet it on the floor of the valley at about 1,600 feet, near Seetakotee, 8 miles above Deopryag.* Now, though this may be

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"His beauteous tall pines, when the elephants heal
By friction on them, the sharp twitching they feel
Athwart their big foreheads—a liquor distil
Of milky-white hue o'er each fir-covered hill:
Whose well-diffused fragrance makes every dark height
And table-land pregnant with od'rous delight."

* Continuing our examination of the Uluknunda and its affluents northward, we find *Pinus longifolia* disappearing between Josheemuth and Pundkesur at about 6,500 feet: on the Mundakinee, it ceases at about the same elevation a little below Goureekoond: a limit of fully 500 feet less

nearly as much an extreme in one direction as 8,000 is in the other, there can be no doubt of the tree being well established at 2,500 feet. It appears spontaneously at that elevation, or probably less, on the low range, corresponding to the Siwalik, which separates the Kotah Doon from the plains of Rohilkhund.

From Mr. Winterbottom I find, that though common outside on the Rujawur hills, *Pinus longifolia* has not penetrated into the valley of Kashmeer: knowing therefore the limit set by Nature to its upward extension, one is surprised in the Personal Narrative, and in the abstract of the flora of Dr. Hoffmeister's Travels (pp. 360, 366, 405, 474, 510, 511, 512, of the English translation), to find *Pinus longifolia* entered at the very limit of forest on the Lamakaga, Harung, Nagkunda, and other passes, associated with *Abies Smithiana* and *Webbiana*, *Corylus Jacquemontii*, *Syringa Emodi*, the shrubby *Rhododendrons*, and other sure indices of great elevation. The mistake perhaps originated in too implicit a reliance on the vernacular names, and in the travellers not being aware that the same term *Cheel* is used, in different districts, both for *P. longifolia* and *P. excelsa*. But that the latter is the tree intended would be manifest from the "Journal" alone, to any one conversant in the Koonawur nomenclature: for (p. 363) he observes at Chitkool, "the *Cheel* pines, here called *Limm*," *Leem* being *P. excelsa* amongst the Mongolian tribes of Koonawur, and in use down to Tibet, and *Byans* of Kumaoon. The oversight is duly corrected in Appendix I., addressed to Baron Humboldt, from Simlah, a few weeks prior to the author's premature and lamented death on the field of Feerozshuhur.

At page 495 of the same work we read—"In the valley of the Dudegaon (beyond Dhunpoor in Gurhwal), at an elevation of 6,800 feet, again met with a tolerable thick forest of *Pinus longifolia;* and it is very remarkable, that the *Chamærops Martiana* (Wallich) is here in immediate contact with it, some tall stems of that palm being even scattered in among the pines."

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than it attains on the central and outer mountains, and clearly indicating the severer climate of the interior, consequent on the vicinity and heavier fall of snow.

When Mr. Vigne (Travels in Kashmeer, ii. 215) mentions *Pinus longifolia* associated with juniper and black currant, near Suti Syn, in Baltistan, we must suppose him to mean *Pinus Gerardiana*. I shall have occasion in the sequel to remark on the frequent inaccuracy of this traveller in matters botanical. Either he or Baron Hügel, or both, speak of the lime tree as a native of Kashmeer, probably alluding either to *Grewia* or to *Celtis*.

Captain Hutton (Journal of a Trip through Koonawur, J. A. S., Nov., 1839, p. 908) mentions "*Pinus excelsa* or *Cheel*" on the ascent to Gourakotee; but the tree here is *P. longifolia*, as correctly stated by Hoffmeister, pp. 472-501.

This requires confirmation. Dr. Hoffmeister very kindly furnished me with some memoranda of his observations on the Himalayan *Coniferæ*, in which the palm appears to be mentioned as *Phœnix humilis;* and, as far as I have observed, it is much more likely to be this ascending to its utmost limit, than *Chamærops Martiana* descending to its lowest. Each is known as the "*Thakil*" in Kumaoon, on the N.W. frontier of which *Chamærops* becomes rare; but on the Thakil mountain near Pithoragurh, in Shor, or S.E. Kumaoon, *Chamærops Khasiyana* of Griffith, which seems a mere variety of *Ch. Martiana*, grows in abundance at 8,000 feet above the sea level, attaining a height of 50 feet, associated with yew, maple, holly, oak, hornbeam, far above the forests of *Pinus longifolia* which clothe the inferior slopes of the mountain. The locality indicated by Dr. Hoffmeister merits, however, further examination.* Colonel Kirkpatrick has "*Jugur*" as "a species of *Tal*" in Nepal: and *Chamærops Khasiyana* bears this name as well as "*Thakil*" in Kumaoon.

A curious phenomenon, yet unaccounted for, is observable in perhaps one-half the whole number of *Pinus longifolia* in Kumaoon. This consists in the spiral arrangement of the bark and woody fibre, the coils being sometimes as much compressed as those of an ordinary corkscrew, and in some instances the stem itself is thus contorted. This is attributed by the people to the action of the wind: but the phenomenon is apparently unknown in Gurhwal, &c., where the winds are equally violent; while in Kumaoon we find specimens with straight and with spiral fibres mixed up in the same forest, and trees of other genera, in company with these, are never so affected, nor does the peculiarity extend to the *Coniferæ* of the upper ranges. A careful dissection under the microscope would perhaps show it to be already present in the embryo. There is a strong prejudice against the use of the twisted timber, which may be well founded where it is required for planks; but when applied unsquared for roof-trees it appears to stand well, bearing great weights for many years; nor in Kumaoon does the practice or the experience of the people at all bear out the very inferior estimate of the timber formed by some of our officers in Gurhwal. From the facility of obtaining it little other wood is used in a great part of the province, where, with ordinary care, it is calculated to last a couple of generations. It is also employed to a consider-

* A careful search in October, 1849, authorizes me to assert, that *Chamærops* of any kind does not grow in the pine woods indicated: *Phœnix sylvestris* (var. *humilis*) reaches up to 5,500 feet, and I doubt not is the palm seen by Dr. Hoffmeister.

able extent at Lodihana, Feerozpoor, and other towns on the Sutluj, and other rivers of the Punjab, down which it is floated from the mountains, but often of bad quality, and so extremely knotty as to possess little strength: but better materials are not procurable. In Kumaoon extremely fine clean planks may be purchased to any extent, and at a very moderate rate.

On his journey to Manusarawur, Captain H. Strachey observed the importation of pine timber across the Himalayan Passes into Tibet,* naturally destitute of all arborescent vegetation; a fact which must be admitted to modify the justness of the observation, that nature has distributed her most inflammable materials to the coldest regions of our globe. The fuel of Tibet, brushwood only, is not derived from the *Coniferous* trees, but from *Astragalus* and *Caragana* of the *Leguminosæ*, and from *Myricariæ* of the *Tamariscineæ.*

Pinus longifolia, with *straight* fibre, is distinguished in Kumaoon by the term *Sapin*, which is equivalent to the Sanscrit *Surul*, *straight*, a singular coincidence with the French *Sapin*, as *Kosee*, a legume, with *ecosse*. Such odd affinities in sound and sense are, however, more numerous than many imagine; thus our *Birch* seems identical with the Russian *Bereza*, and the Sanscrit *Bhoorjja*: the last form still vernacular in Chumba, &c.; but the etymology—"firm in the earth,"—is less probable than the allusion to its *bark*, perhaps conveyed in the German *Birke*. The coincidence of the Tibetan *Tan*shing, with the German *Tanne*, must be accidental: the latter being allied to *tenuis*, and thus to the modern "needle trees" of the same people.

The cones of *Pinus longifolia* open spontaneously in April and May; the tree is deciduous (nearly) in May and June, and has then a shabby appearance, assuming a rusty colour, which, as well as the reddish-brown matting of the *pirol* or fallen leaves, may be recognized at a great distance. The turpentine is called *leesha* in Kumaoon. Ink is made in Sikhim from the charcoal of the burnt leaves, mixed with rice-water.—(*Dr. Hooker.*) The *Cheer* pine flourishes at Meerutt, Kurnal, Seharunpoor, &c., but the leaves droop considerably; and hence it is that Dr. Roxburgh, describing the tree from Calcutta-grown specimens, represents them with this position: but in the more bracing air of their native mountains they are certainly rather erect than pendulous.

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* From the same traveller I learn, that chips of *Pinus* (*excelsa*?) are imported from Poldar to Zanskar of Ludakh, where they are used for candles, and called *Lashi* or *Chanshing*, *i. e.*, night-wood. So in Nepal, the knots of this, or *P. longifolia*, are cut into slips for torches, called *Diyaloo.*

II. Pinus excelsa.—Under the temporary name of *P. pendula*, Dr. Griffith (*Journals of Travels*, pp. 211, 237, 239, 264, 265, 287, 293, compared with Journal of Asiatic Society, March 1839, pp. 217, 218) describes this species as being common in Bhotan, forming large and beautiful woods on southern aspects, next above *P. longifolia*, and below *Abies Smithiana*, or from 6,000 to 10,000 feet, but becoming stunted at this last elevation. This is the species, No. 398, p. 123 of Dr. Griffith's Itinerary Notes. In Nepal it is stated to occur at Narainhetty and Bunipa (probably planted), and wild on Sheopoor and Gosainthan; but Dr. Hooker has not met with it in the eastern part of that country or in Sikhim. We next find the tree in Byans, on the Upper Kalee, where Kumaoon borders on the Nepal province of Dotee; here it is common, and was found by Captain H. Strachey, under the Khusiya name *Raisulla*, and the Bhotiya *Lumshing*, identical with those given by Loudon, *Lamshing* and *Raesulla*, the former being the *Leem* of Koonawur; and *Raisulla* (applied in Lower Kumaoon to the black fir and cypress), denoting "king of the pines," as *Raibanj*, *Reeanj*, king of the oaks (*Quercus lanata*), may possibly have led to the specific name *excelsa;* which Dr. Hoffmeister misunderstands of the stature instead of the site of the tree. This, he says, "is most unworthy of its name, for specimens of more than 40 to 50 feet in height are great rarities." Large woods no doubt occur in which many of the trees are about this height; but Don mentions 90 to 120 feet as the stature; between the Shatool Pass and Panwee, as well as below Chansoo in Koonawur, there are magnificent forests, containing many trees certainly not under 150 feet.

P. excelsa appears to be wholly wanting in central and N.W. Kumaoon. In Gurhwal, native report places it on the great mountain Rikholee Goodree (a spur from Trisool), and about Kunol, near Ramree; but it has not been observed so far to the S.E. by Europeans. Lt. R. Strachey and myself first came on it below *Abies Smithiana* and *Picea Pindrow*, on the descent from the Pilgwenta Pass to Josheemuth, between Toongasee and Mirg, whence it occurs on the mountains on the south side of the Uluknunda, as far down as the Patal Gunga, behind Lungsee Ghat. Dr. Jameson, Lt. R. Strachey, and Mr. Commissioner Batten, inform me that it continues thence up the course of the Dhoulee, and is the uppermost and only pine met in the ascent of the Neetee Pass; the latter observer fixing its upper limit near Bumpa at 11,800 feet, and stating that it is not unlike the *Cheer at a distance* (*J. A. Society*, April, 1838, p. 312). In Dr. Hoffmeister's Travels, the first mention of it in Gurhwal is on the Kaleekhal, a spur of Toongnath, associated with *Abies*

Smithiana, and below *Picea Pindrow*. The same traveller states it to be the uppermost pine on both the north and south face of the Lamakaga Pass, leading from the Ganges to the Buspa, reaching up to 11,500 feet on the former, and 8,500 feet on the latter side. On the Harung Pass, behind Sungla, he describes it as occurring 600 feet above *Picea Webbiana*, growing with *Rhododendron campanvlatum*. Between Jaka and the Roopin Pass I observed it associated with the lowermost specimens of *Picea Webbiana;* and while the authorities just cited for Gurhwal are sufficient to justify the epithet *excelsa*, the mass of the species in Busehur is certainly below the silver fir. Captain A. Gerard fixes the limits near Simlah at 7,006 and 8,425 feet, and this estimate was adopted generally in the Journal for January 1845, but he himself gives 12,140 feet as the superior limit on the snowy range of the Leem, which is the same tree. On Muhasoo, near Simlah, it reaches nearly 9,000 feet, and on Kumuloree, behind Nagkunda, 9,500—10,000. At Kotkhaee it abounds at 5,500; and along the Beeskool stream, below Deorah, in Joobul, it may be traced, mixed with alder, nearly down to the Pubur, opposite Raeengurh, probably its lowest site, being little more than 5,000 feet above the sea; and here only on the shaded side of the mountains. Dr. Griffith (p. 239) once observed it in Bhotan, mixed with *P. longifolia*, as low as 5,400 feet. We may therefore fix on 5,000 and 12,140 feet above the sea-line as the extreme limits of this species. We have no accounts of its presence beyond Busehur till we reach Kashmeer, whence Mr. Winterbottom traced it to the mountains of Gilgit in latitude 35½, its most northern habitat hitherto ascertained, as Bhotan, in 27°, is the most southern. Dr. Griffith (*Itinerary Notes*, p. 329) states it to be common on the mountains of Kafiristan, north of Julalabad; west of which meridian it has not been traced. The Kafir name is *Piunee*.

Pinus excelsa seems to prefer the more cheerful aspects of the mountains, provided they do not face due south. It flowers from the end of April to the middle of June, according to the elevation and exposure: the cones are erect while young, and are about an inch long in October; by April following they are 3 to 4 inches in length, and altogether require 18 months to mature. In the allied American species, *Pinus strobus*, Lord Weymouth's pine, the seeds fall in October of the second year. The cotyledons of *P. excelsa* average about nine, *P. longifolia* about twelve.

On the northern side of the Roopin Pass many specimens may be noticed of *P. excelsa* with bright green leaves, which, on others, are mingled with foliage of the glaucous green, proper to the tree on the lower mountains. Dr. Griffith, also, observed some variation; for at 9,500 feet he mentions (p. 259), mixed with *Abies Smithiana*, a "species *very like Abies pendula*;" the difference consisting in the *erect* leaves (*Itinerary Notes*, p. 149). And in Nepal, Dr. Wallich observed a variety which he thought to come nearer *P. strobus* than the usual one (*Royle's Illustrations*).

I have already remarked, that in Busehur, wherever *P. longifolia* is known as "*Sulla*," *P. excelsa* takes the name of "*Cheel*," which in Joobul, &c. is variously modified to *Cheeltoo*, *Cheetoo*, *Cheeoo*. In Gurhwal it is called *Cheela*. Baron Hügel mentions that in Kashmeer the *Kair* fir is preferred for burning lime; this is probably the local form of *Kael*, *P. excelsa*, which in Busehur is equally esteemed in the preparation of charcoal for the smelting of iron ore. At Almorah, the bark of *P. longifolia* is employed for this purpose.

Dr. Hoffmeister states, that "*Kel*" is used on the Sutluj above Rampoor for *P. longifolia*, and quotes Professor Wilson as authority for the signification "a sort of pine;" a definition not to be found in the Sanscrit Dictionary of 1832. The vernacular term was perhaps "*Kael*," *P. excelsa*.

III. Pinus Gerardiana.—"*Rhee*" and "*Shungtee*" are the names by which this pine is known in Busehur and Lower Koonawur: further down the Sutluj, where, however, the tree is not found, it appears to be called "*Newr*," perhaps a corruption of *Neoza*, but properly *Juniperus excelsa*. The Tibetan race of Hungrung and Shipkee know it as the "*Kuminche*" and "*Koneeunchee*," cognate with "*Konecha*," "*Kolecha*" of the Joohar (Juwahir) Bhotiyas, who only know the tree by report, and occasionally receive the seeds from the west. No allusion is made to *P. Gerardiana* in Dr. Griffith's journey to Bhotan, nor has Dr. Hooker found it in Sikhim or eastern Nepal; the most southern habitat appears to be the forest between Mularee and Bumpa, on the route to the Neetee Pass, in which Dr. Jameson observed several specimens, truly wild, in 1846. The climate and flora of that locality are similar to Koonawur. Dr. Falconer informs me, that it is abundant between Astore and Iskardo, in Little Tibet. Mr. Winterbottom found it as far north as Gilgit, in $35\frac{1}{2}°$, a fact which forms a strong link in the chain of evidence to identify the *Neoza* with the *Chulghozeh* or *Julghozeh* of Kabul. Dr. Griffith (*Journals of Travels*, 457, 461) mentions the latter at Tezeen, in Afghanistan, and says it exists, but rare, in the Siyah-posh Kafir mountains above Chugur Serai, north of Julalabad, where its occurrence on the *outer* ranges indicates their exemption from the periodical rains. Masson (i. 222) informs us that the mountains near Nijrow, in the Kohistan of Kabul, are covered with *Chulghozeh* pine, and beyond this point I know no record of its having been observed. Enough is shown to prove that Dr. Hoffmeister's limitation, "grows on the Sutluj only," is to be understood solely of the British Himalaya; and even then with the reservation of the Neetee examples. He fixes its vegetational limits at 5,800 and 9,400 feet, the last apparently from a single observation near Mebur, on the north side of the Harung Pass. Capt. A. Gerard states its highest limit on a southern exposure of the inner Himalaya (near Murung) to be 10,849 feet, but (*Tours of Lloyd and the Gerards*, p. 264) in another place he expressly fixes it as high as 12,300. This locality, near Soongnum, is no doubt its extreme limit; the usual range he states (p. 273) to lie between 5,500 and 10,800 feet. It is very generally associated with *Cedrus Deodara*.

Pinus Gerardiana, on the right or north bank of the Sutluj, does not extend to the west of Meeroo; on the south it is first met with a few miles above Wangtoo bridge, occurring abundantly on the rocks and cliffs from Melum (Melung of the map) upwards, and along the course of the Buspa, nearly to Sungla; the inferior limit agreeing with that assigned by Dr. Hoffmeister. When young, and on a tolerable soil, the *Rhee* grows in a conical form, pretty much with the habit of *P. longifolia*, to the height of about 50 feet, furnished with numerous horizontal branches nearly to the ground: but in the situations which it best loves, rocks and bleak-riven crags, the boughs become excessively crooked, and are twisted in every direction. The exterior bark is of a silvery grey, falling off in large flakes, and never, as Dr. H. observes, transforms itself into the rough outer coating of the other pines; the inner layers, thus disclosed, are at first green and smooth like the epidermis. The foliage is of a blackish-green; the leaves, in bundles of three, with deciduous sheaths, are acute, flattened, from 4 to 6 inches long. The scales of the cone have the ends thickened, are broader than those of *P. longifolia*, with a less abrupt beak, and are without the boss at its top which marks that species. In the warmer sites, the seed ripens by the end of September, but higher up, not till October; the cones of last season still hanging on the branches. It arrives at Simlah for sale in the latter half of November.

"*Sunoubur Sukkur*," supposed (p. 43) to be equivalent to "*Pistacio Pine*," is correctly written *Sunoubur Sughar*, and signifies "*Lesser Pine*," an apt name enough for *P. Gerardiana*, the stature of which probably never much exceeds 50 feet.

Pinus Cembra, p. 45. Erman (*Travels in Siberia*, ii. 512) remarks the curious fact, that this native of Switzerland re-appears in Siberia from the eastern slope of the Ural to the Lena; near Okhotsk he found the *Kedrovoi Slanetz* or *P. Cembra*, var. *humistrata*, the elastic stone-pine or spreading cedar of eastern Siberia, which has several stems 12 feet high and 3 inches in diameter, erect in summer, but completely prostrated by the snow in winter. The cones are but half the size of *P. Cembra*, with nuts of equally good flavour.

The name *Cembra* is vernacular in Dauphiné; the German is *Zirbel;* the Swiss *Arve*, *Arbe*, *Alvies*, and *Arth;* the Russian *Kedr*, *Kedrovoi*, has probably been applied under the idea that it was the cedar: the tree is nowhere indigenous to Russia, and cannot have had an original Sclavonic designation.

There is a fourth species of *Pinus*, hitherto unnamed, on the Khusiya hills and on the mountains of Upper Assam, which, from the form of the cone and the locality, seems to be the *P. Nepalensis* of Dr. Royle (*Illustrations*, 353), and of the Arboretum Brit., iv. p. 2236, f. 2117. It resembles *P. sinensis*, and is thus described by Dr. Griffith (*Itinerary Notes*, p. 58, No. 901): "Pinus Icon. 46, 47. Circa Moflong. Arbuscula, juniores tantum formosi, seniores always scraggy. Circa Nungklow, præcipue in descensum. Arbor 50–60 pedalis trunco stricto, ramulis asperis foliorum cicatricibus, basi novellorum squamatis, squamis reflexis, foliis ternatis, (vaginis membranaceis,) acerosis supra planis, infra convexis, spithamæis; infimis sub-pendulis, summis sub-ascendentibus; intermediis nutante cernuis. Conis sessilibus, ovatis, curvatis. Amentis masculis brevibus, vix uncialibus, ascendenti, curvatis; fœminæis pedunculos, bracteato-squamatos, terminantibus.

"Intermedia inter *P. longifolia* et *P. sylvestris* cum habitu accedis."

Through the kindness of Dr. McClelland, I have seen the figures and specimens referred to; the former, however, represent the leaves as binate, which may be a proof of the identity of the plant with *P. sinensis*, which, according to Loudon's Supplement, has leaves in threes, sometimes in twos. Dr. Falconer, Superintendent H. C. Botanic Garden, has excellent specimens from the mountains of Upper Assam, sent by Major Jenkins. The leaves are filiform, in threes from 5 to 7 inches long, with rather long sheaths. The cones are often in whorls of four, sometimes five; of a broad ovate form, and with short stalk: they are from 1½ to 2½ inches long, the squamæ oblong, obtuse, thickened at the end, but without beak.

Along with the above, among Dr. G.'s specimens, is one with binate leaves, 4 or 5 inches long, the sheath short: it is without fruit. In the Residency Garden, Kathmandoo, Mr. Winterbottom observed a scrubby looking pine, about 30 feet high, with leaves in pairs, of the length of *P. sylvestris* (i. e. 1½ to 2 inches), and very persistent ovate cones, about 1¾ inches long, the scales furnished with a straightish or somewhat upcurved prickly beak. Mr. W. could not learn whence it came, but it would appear to be *P. pinaster*, var. *Nepalensis*. The cones, however, were not in whorls.

On the mountains between Moulmein and Zimmay, N.N.E. of the former place, in lat. 18½°, long. 98½, Dr. Richardson (*J. A. S.*, October, 1836, pp. 612, 621) mentions a species of pine forming fine open forests, and, like *P. longifolia*, allowing no other tree in its neighbourhood. Some of the specimens measured 8 or 9 feet in circumference, and were "much taller and straighter than the same trees in Europe." Though no clue is afforded for its identification, there is every reason to believe it to be the species at present known as *Pinus Latteri*, of which a short notice appeared in the J. A. S. for January, 1849, from a specimen obtained on the Thoungyeen river on the Mergui frontier, in lat. 17°, at an elevation above the sea of 1,000 to 1,500 feet. Drs. Falconer and McClelland possess specimens from the same district; Dr. McClelland's being supposed by Mr. O'Reilly, who transmitted them, to come from an elevation of between 3,000 and 4,000 feet. It apparently belongs to the *Pinaster* section: and the striated leaf, described by Mr. Masson, may be observed on *P. pinaster*, and still more prominently in *P. Lambertiana*, as figured in Loudon's Supplement. *P. Latteri* has the leaves in pairs, from 5 to 7 or 8 inches long, with sheaths of half an inch. The cones are short-stalked, oblong-ovate, 3 to 3½ inches long; the scales thickened and rhomboidal at the end; beakless.

Dr. Falconer informs me that the timber has been pronounced by Mr. Seppings to be equal to the best Norway spars for light yards.

IV. Abies Smithiana.—Under the name of *A. spinulosa* (*Journals of Travels*, pp. 259, 265, 275, with Journal of Asiatic Society, March, 1839, p. 223), Dr. Griffith describes this spruce as growing abundantly on the northern ranges of Bhotan, from 7,800 to 11,600 feet above the sea (*J. A. S.*, but only to 10,500 in the Journals);—preferring north faces, and in mass occurring next below *A. Webbiana* (*densa*). Dr. Griffith's specific name is a translation of "*Kundrou*," a common vernacular term about Simlah. It is rare in Sikhim; and confined to valleys of the inner range at 8,000 to 9,000 feet, mixed with *Abies Brunoniana*, and seldom exceeding 50 feet in height. In the Lachen valley alone did Dr. Hooker find it abundantly, but never large. The Bhotiya name is *Téé*. Loudon (*Supplement to Encyclopædia of Plants*) gives Kumaoon as its habitat, but I have been unable to detect a trace of it in the province; it occurs nowhere in

Danpoor and Joohar, along the snowy groups of Nunda Devee and Nunda Kot; nor were Bhotiyas of Milum, accustomed to traverse the mountains, able to recognise the cones or dried specimens. Natives of Budhan have assured me that, with *Pinus excelsa*, it is indigenous on Rikholee Goodree, and about Kunol, near Ramree, but the nearest point to Kumaoon, where credible (European) testimony vouches its presence, is the descent from the Pilgwenta Pass, Pilcoonta hill of the map, to Josheemuth, where Lieut. R. Strachey and myself found it at 8,000 to 9,500 feet, mixed with *Picea Pindrow*. Capt. Raper (*As. Res.*, xi. 518, 547) found it abundantly in the same district, under the name *Realla;* as did Dr. Jameson and Lieut. Strachey in the valley of the Dhoulee, between Mularee and Bumpa.

Below Josheemuth, I observed it on the mountains above Helung and Punkheemuth, on the south side of the Uluknunda; and above Josheemuth it is common on the heights and crags which form the tremendous defile of the Vishnoo Gunga, descending to the level of that river, near Lambugur, at about 7,000 feet. The people of all this part of Gurhwal confound it with *Abies Pindrow* under the common term "*Ragha:*" this name is given by Dr. Wallich, Plantæ Asiat. Rar. iii. 24.

Dr. Hoffmeister first met it under the names *Rai*, *Raisulla*, on the spurs of Toongnath (where, however, I did not observe any); and onward, opposite Reital, on the Bhagiruthee, he found it descend to 6,500 feet, at which level indeed, but only in the most cool and shady spots, a few small specimens may be observed near Kymthoo (Annadale), north of Simlah. Dr. H. fixes 10,000 feet as the upper limit, and describes the tree as growing on the Harung Pass, 500 feet above the *Pindrow*, which seems an exception to the general rule. Mr. Winterbottom informs me that it is common (above the cedar forests) with *Picea Pindrow* and *Pinus excelsa*, on the mountains of Kashmeer, beyond which it stretches to Gilgit and Chugur Serai; we have no evidence of its existence further north.

Abies Smithiana is known to the people of Rol, near the Shatool Pass, as "*Bhooj-rai*," and to those of the Roopin valley as "*Bung-rai;*" in Joobul it is called *Row*, *Koodrow*, *Koondrow*, probably the *Khutrow* of Dr. Royle, all denoting the "prickly fir." *Kundrow* is also applied in Joobul to *Picea Pindrow*, the more correct local name of which, "*Chilrow*," is then transferred to *Abies Smithiana*, as "*Khurok*" is in Koonawur. Multæ terricolis linguæ, cœlestibus una: the Babylonian confusion of the Vernacular may reconcile mortals to the unity, however hard, or sometimes barbarous and pedantic, of the botanist. The difficulty is older than the time of Pliny, who was as much puzzled to identify the Greek as we are the Himalayan pines, for he tells us, that "in Macedonia, et Arcadia, circaque Elin, permutant nomina, nec constat auctoribus quod cuique generi attributant: nos ista *Romano* discernimus *judicio.*" The Roman interpretation of another set of Greek words has since deluged Europe with blood; and so difficult is it permanently to connect names and things, that the *Pinus sylvestris* of the Roman naturalist is our *Pinaster*, our *sylvestris* being his *Pityada;* by *Pinus*, simply, he always intends *P. pinea*, the stone-pine, the *Pitiis* of the Greeks, from *Pitta*, pitch. By restricting the term "fir" to the spruces, and "pine" to *sylvestris*, we are ourselves forsaking the analogies of our own language, for the German *Fohre*, *Fuhre*, the origin of our word, is *P. sylvestris*, allied perhaps to *pür*, *fire*, *&c.* The etymology of the terms *Re*, *Rai*, *Row*, *Rohow*, so generally applied to the Himalayan spruce, may be sought rather than found in the Sanscrit *rohi*, a tree: *ruh*, to grow as a seed: *ri*, to move: *ru*, *reh*, to sound: or perhaps, considering the form of the tree, and the name "weeping-fir," which that form suggested to our early travellers, the root *roo*, to weep, may be accepted as a plausible derivation.

Loudon (*Arboretum Britannicum*) has noticed and explained the errors of the Penny Cyclopædia, in its description of *Abies Smithiana*, which were remarked in my original paper, p. 47: he says, "some confusion in the description of this species in the Penny Cyclopædia has resulted from the cones in Dr. Wallich's figure being placed upright, which, if they had been actually so, would have constituted it a *Picea*, and accordingly Dr. Lindley calls it Indian silver fir." Mr. Loudon was himself not exactly correct in describing the leaves "straight;" they are somewhat curved; "sub-incurva," Wallich, whose plate (246) rather exaggerates their thickness.

Abies Smithiana flowers (Busehur) in April, with solitary strobili; and immediately afterwards exhibits numerous cones, rapidly enlarging to a few inches in length; and, from the bud-like scales remaining at the base, having every appearance of being just developed; in this case the seeds only require 7 or 8 months to ripen, a fact which may be in some way connected with the very perishable nature of the timber. Nevertheless, this rapidity of fructification is still more decided in *Quercus semecarpifolia*, which flowers in April, May, and matures its fruit in July, August, when the beautiful large globular acorns fall and germinate at once; yet the Khursoo timber is considered excellent, and the name, which is universal in the Himalaya, appears taken from its being used in ploughs.

Abies excelsa, the Norway spruce, flowers in May, June, and though the seeds naturally do not fall till next spring, Loudon states that the cones may be gathered as mature any time between November and April, which reduces the period of gestation in both these spruces, in common with some others of the *Abietinæ*, to a period of six or eight months.

In *A. Smithiana* the young cones are at first upright, and the position assigned by Dr. Wallich may have originated in his having found them only at this stage ; but from their own weight, and the slenderness of the branchlets, they soon become pendulous. The very beautiful tender green shoots, as they elongate in April and May, carry before them, like an extinguisher, the brown transparent scales of the leaf-buds ; owing to a blight of some kind, the young leaves frequently turn a rich orange colour. The twigs, &c., are in general use in Joobul and other states as litter, and thus form good manure ; and the shepherds of the higher mountains are accustomed to carve out great cantles of the bark of this species and of the *Pindrow* to roof their shielings, and also to serve as water-troughs for the cattle ; full many a noble tree is destroyed in this way. But, excluding all consideration of the part which it probably plays in meteorological phenomena, the principal end and design of the Himalayan spruce, like that of the lilies, which neither toil nor spin, is to be sought in its extreme beauty. Loudon mentions a Norwegian variety with pendulous branches, which must resemble it closely : and Spenser's allusion to the Norway spruce, as "the fir that weepeth still," recalls Captain Raper's distant and independent "weeping fir" of the Gurhwal Alps.

Abies excelsa is the *Picea* of Pliny, "distinguished *tonsili facilitate*, by its fitness to be shorn, which agrees with the spruce fir, whereof I have seen close shorn hedges." * Loudon also informs us, that it differs from most of the *Coniferæ* by its property that, where the extremities of the lower branches touch the ground, they readily take root, and originate new trees.

Captain Hodgson (*Gleanings in Science*, February, 1830, p. 52) measured a fallen Rai fir, exceeded by others standing near

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* Bishop Berkeley's "Siris, a chain of Philosophical reflections and enquiries concerning the virtues of tar-water," and theology. His method of preparing the former is this. Pour a gallon of cold water on a quart of tar, and mix them well with a spatula for five or six minutes : let the vessel stand closely covered and unmoved for three days and nights : then skim the water, and pour it off unshaken into bottles, which are to be well stoppered. The Bishop's theology has outlived his tar-water. The Greeks used and still use (Hoffmeister, p. 18) tar-wine, a more generous but a less virtuous potation, which will perhaps survive the theology. "Jonstonus, in his Dendrographia, observes that it is wholesome to walk in groves of pine trees, which impregnate the air with balsamic properties." Siris : none more so than *P. longifolia* : but the dry air and soil selected by pines are more probably at the root of the salubrity.

it, and found the length 169 feet. The following dimensions in girth at 5 feet from the ground give a general idea of the size attained by *Abies Smithiana*, and agree with that assigned by Dr. Hoffmeister in Gurhwal, towards Gungotree:

No. 1	$15\frac{1}{2}$ feet,	On Muhasoo, near Simlah.
„ 2	14 „	
„ 3	$13\frac{1}{2}$ „	
„ 4	$17\frac{2}{3}$ „	Near Nagkunda.
„ 5	16 „	
„ 6	15 „	
„ 7	20 „	North-east face of Choor.
„ 8	19 „	
„ 9	$14\frac{1}{2}$ „	
„ 10	19 „	Below Rol villages.

The unfavourable influence of the southern exposure on vegetation, noticed pp. 49, 50, is thus confirmed and explained by Baron Hügel, with reference to the valley of Perhamgala, in the Peer Punjal Range (*Travels in Kashmeer*, English translation, p. 88). "Strange to say, the south side (*aspect?* *) of the valley is everywhere wild and dreary, while fine trees grow up to the very summit of the mountain on the north face. The reason may possibly be found in the fact, that on the south side the repeated action of alternate freezing and thawing destroys every kind of vegetation except a few grasses." Erman (*Travels in Siberia*, I. 76, 77), who remarked the same fact in the coldest parts of Siberia, where, at three feet depth, the soil is perpetually frozen, notices the increased luxuriance of the oak on the N. and N.W. aspect of Valdai, and of the walnut and chestnut on the Hartz, adopts the same view: "the true explanation of this phenomenon is, that the vegetation under a northern aspect is so much retarded as to be secured from the danger of night-frosts in spring." This is probable; but other causes are apparently at work, amongst the chief of which are the hot rays of the sun, and violent winds, of which the first seem especially inimical to the growth of the *Coniferæ*. Bingley notices that, even on the Scottish mountains, *P. sylvestris* flourishes best on the N. and N.E. sides. It is chiefly the arborescent vegetation, moreover, which is suppressed on the southern face of the Himalaya; many

* That Baron Hügel means aspect is confirmed by Mr. Vigne, account of Kashmeer, J. A. S., September, 1837, p. 771. "Those places on which the rays of the morning sun first break are well covered with *jangal;* the whole of the south side of the valley, for instance; while the north side, which from the height of the mountain range is kept a long time in shadow, is comparatively destitute of trees, but plentifully covered with grass." The fact is much more certain than the reason.

grasses and herbaceous plants prefer it; and where the general surface of a mountain is destitute of forest, we may perceive the trees stealing a considerable way up the ravines, where they are sheltered from sun and wind. On our own S.W. coasts trees cannot be reared unless protected from the frequent S.W. gales by a wall or fence; and no sooner is this overtopped than their heads are cut back obliquely, as smoothly and regularly as if clipped with shears.

Dr. Griffith repeatedly observed the nakedness of southern and the woodiness of northern aspects in Bhotan and Afghanistan. He says (*Journals of Travels*, p. 292)—"This is contrary to what usually happens; the south face of mountains being supposed to be better wooded than the others; but in Bhotan the difference would seem to be due to the piercing winds blowing from south or up the ravine of the Teemboo," and again, "the most marked peculiarity is the comparative absence of *Abies densa* (*Webbiana*) on the east side of the mountain, and its excessive abundance on the west," an observation equally true of the whole British Himalaya. However, in Afghanistan he found the phenomena to be exactly similar; "the opposite side of the Tezeen valley is seen, and the summit of the Sufed Koh: here, wonderful to relate, are abundance of firs, extending down and along the ridge to some distance, but not forming forests." From Soorkhab, looking south, "a fine view of Sufed Koh is obtained, the lower ranges in some places being black with firs," pp. 411, 414, which from 457, 464, &c., appear to consist of *P. longifolia* and *Gerardiana*, with *Cedrus Deodara*. Finally, at Pushut, "the mountains to the south are well wooded, the woods occurring here and there in forests," p. 436. Sir Alexander Burnes and other travellers have remarked the aridity of the Himalayan ranges as seen from Kabul, &c.; but had they been viewed from the north instead of the south, the impression would perhaps have been much modified. Colonel Jack (*Darjeeling Guide* for 1845, p. 170) concludes that—"forest grows more profusely on northern aspects, owing to the fact that the moisture on northern aspects is protected from evaporation in a greater degree than on the southern." We may recollect also, that the axis of the Himalaya having a N.W. and S.E. direction, the great spurs are thrown off to S.W., with their eastern faces fronting S.E., and therefore more exposed to the sun's rays than the opposite ones. Long, too, before the sun has attained the meridian, so as to shine on the latter, the diurnal breeze sets in, and prevents their surfaces from becoming equally heated with the S.E. exposures. Dr. Hooker also remarks to me, that the S.E. is a very strong and drying wind; and writes of the Sikhim Himalaya,—"the western faces I found much more snowed than the eastern at

15,000 feet, because the sun shines brightest in the morning, and is invariably clouded by noon." Lieutenant Strachey, in taking points of Trisool and other Alps of Gurhwal and Kumaoon, to determine the position of the snow-line, found the same fact hold true: and Schouw (*Physical Sketch of Europe*) observes of the Scandinavian chain, "on the western side the snow-line is lower than on the eastern, because the snow is not so easily melted in foggy, damp summers, as it is under a clear sky." The general result is, then, that the pine tribes flourish on the west and north rather than on the east and south sides of mountains, because they enjoy there a cooler, a calmer, and more humid soil and atmosphere; for the mechanical action of the winds seems also necessary to be taken into consideration. Vegetables, denied the faculty of locomotion, take the requisite exercise by being swayed to and fro by occasional winds; but the gales which blow so regularly and fiercely up the Himalayan glens, as remarked by Dr. Griffith, must destroy the loftier and more exposed individuals, or prevent their existence, very much as one of the higher animals would be killed by a state of perpetual action, the necessary intervals of repose being withheld.

"*Manderung*" is quoted, p. 51, as one of the "many kinds of pine" observed by Captain A. Gerard (*Journal*, September 18, 1817) and other travellers in the N.W. Himalaya: in this instance he trusted to memory or hearsay, and they copied his oversight, *Manderung* being in fact a maple, I think *Acer sterculiaceum;* and his "*Sungcha* pine" no other than the yew, as I ascertained on the spot in 1845. "*Bhurglei*" (in Gurhwal "*Bunglai*"), to which he gives 13,000 feet as the upper limit, is *Salix leucomelas*.

P. 53, Note. The testimony of Pliny corroborates that of Cæsar as to the power of larch-wood to resist fire. He says (*Hist. Nat.* LXVI.), "larice, quæ nec ardet nec carbonem facit, nec alio modo ignis vi consumitur, quam lapides." Vitruvius states that Julius Cæsar endeavoured in vain to burn down Parignum, a tower in the Alps, by heaping against it logs of larch; they would not ignite; and Loudon says, "The wood of the larch ignites with difficulty, and a fire made of it will, if not attended to, extinguish itself before the wood is half consumed." Nevertheless, Erman represents it, if I remember right, as in frequent use in Siberia, where it is in great perfection and abundance, more hardy than the birch and willow; its upper limit being 4,040 feet on the Aldan mountains, near Okhotsk. The Russian name is *Listvennetsa*, "a crown of leaves." An attempt to introduce the tree to Kumaoon failed from the seeds being soldered up in tin, and probably sent round the Cape from England.

The discovery by Dr. Griffith of a genuine larch in Bhotan (p. 53) renders Dr. Royle's "of true larix none" no longer applicable to the Himalaya. My original reference was derived from Dr. Griffith's report to Government in the Journal of the Asiatic Society; in the *Journals of Travels* (p. 287, 293) its occurrence is twice mentioned, once at 6,000, and once, above Woollookka, at 9,400 feet; dwarfed at the latter elevation. From the *Itinerary Notes*, p. 189, No. 1011, the latter only would appear to be the authentic habitat; at least it is not inserted elsewhere. Supposing the species to be the same, I am indebted to Dr. Hooker for the following account of its appearance and habitat west of Bhotan.

"The larch, which I propose should bear Griffith's name, occurs in Sikhim and in the valleys of eastern Nepal, close up to the snow. In the latter country, the Kambachen valley, immediately under the Junmu Peak of 25,000 feet, is full of it at 11,000 to 12,000 feet, mixed with *Abies Webbiana.* In Sikhim it is very common in the interior and rearward valleys and mountain slopes; but is not found in the Sub-Himalaya, or on the south flanks of Kunchinjinga. Limits 9,000 to 13,000 feet; usually 9,000 to 12,000. Rarely occurs gregarious or in clumps; habit and habitat a good deal resembling those of *Larix Europæa;* but the leaves, which redden and fall in November, are in more scattered fascicles. Cones large, erect, red-purple when young, and abounding in tears of white resin. It rarely exceeds 30 to 40 feet in height, except on shingle-banks of alpine streams, where it sometimes attains 60. It is an inelegant, sparely-branched tree, and, except for its bright-green foliage and resinous cones, unworthy of comparison with the European species. The boughs stand out awkwardly, and often droop suddenly in very pendulous and even flagelliform branches. Timber small, but splits well, and is used for flooring. The Bhotiya name is *Sah.*"

Abies Brunoniana (*Pinus dumosa*, Don). This was omitted in the enumeration of N.W. Himalayan pines, as I had never seen it; but it probably exists at its N.W. limit, in the Bhotiya purgunnas of Kumaoon, towards the sources of the Kalee, which seem to be indicated by the "*Bhotaniæ alpibus*" of Don, who states that it was there found by Captain Webb: it is perhaps to be included in the pines noted there by Captain H. Strachey, under the name "*Woomun.*" Dr. Wallich mentions the Nepalese (Newar?) name "*Changathasi Dhoop,*" implying that it is employed for incense; but Don has "*Silloo Hatarhee.*" Gosainthan, Bunipa, and Sheopoor are given as habitats; but, when in Nepal, Mr. Winterbottom learnt from plant-collectors that the tree does not grow on the latter mountain. Dr. Hooker has recently found it in Sikhim, forming a narrow belt of 1,000 feet, confined to very narrow gorges between 9,000 and 10,000 feet, on the immediate (south) flanks of Kunchinjinga, probably the loftiest peak in the world, being above 28,000 feet. In the innermost valleys the limits are 8,500 and 10,500. The Gorkhalee name is "*Thingia*" or "*Tingoori-sulla*;" the Bhotiya "*Semadoong*." Dr. Hooker considers it to be by far the most beautiful of Sikhim pines, whether as an individual tree, in groups, or in forest masses. One specimen was 27 feet in girth at the height of 5 feet. Timber inferior to that of *Picea Webbiana* (being liable to warp, Webb), bark much used for sheds and hovels; also to roof-stacks of *P. Webbiana* planks. By Dr. Griffith it is frequently mentioned in Bhotan proper, occurring from 6,500 to 9,700 feet above the sea, "a large solitary tree, with pendulous branches;" but the doubt, "probably a *Podocarpus*," "*Taxus* or *Abies Brunonis*" (*Journals*, pp. 234, 220, 242, 243, 245, 246, 261, 267), must leave it uncertain, till his specimens be compared, whether he intended this tree.

Abies Brunoniana is stated to be a tall (70–80 feet) spreading tree, branching at 15 to 20 feet, with pendulous and very brittle boughs; and nearly allied to *A. Canadensis*, the Hemlock spruce. Leaves solitary, two-ranked, an inch long, linear, obtuse, minutely toothed towards the apex, with reflexed margin; covered below with milk-white mealiness, and so deciduous that the slight shake of the branch is sufficient to detach them; a circumstance true of drying specimens, which, Dr. Wallich remarks, will not retain their leaves for a single day, but incredible of living ones, when we remember the stormy region of which the tree is a native. The cones are terminal, solitary sessile ovate; scales persistent; rounded, with eroded margin. The cones are only about an inch long, and form a striking contrast with those of *P. longifolia*, one of which, from the Thakil mountain, is about 7 inches long, and twice as many round, near the base.

V. PICEA PINDROW.—Dr. Griffith describes *Abies densa*, abundant on all the northern mountains of Bhotan, in terms which lead us to conclude this, and especially *P. Webbiana*, to be the species intended: he calls it "the black pine," alludes to its "columnar" form, and says it is "the marked indicator of great elevations;" fixing its lower limit at 8,800 feet, the upper at 12,478, and even 13,000 feet. He notes "many pines dead as if blasted;" "as usual, many blasted from lightning:" *

* Journals, 246, 260, 264, 265, 276. During a recent visit to the alpine regions of S.E. Gurhwal, I was assured by intelligent persons that these forests of dead pines are the result not of lightning, but of the fires which rage in the hot, dry months, May and June.

I found

characters and limits well suited to include both; the *Pindrow* generally commencing at about 8,000 feet, and *P. Webbiana*, exclusively, attaining 12,000 or 13,000. It is possible, however, that the *Pindrow* may be absent from Bhotan; Dr. Hooker has not detected it in Sikhim (perhaps because that country is almost wholly devoid of *Coniferæ* in the zone 8,000-10,000, proper to the *Pindrow*); and he leads me to suppose that Dr. Thomson does not recognize them as really distinct species.* There can, however, be no doubt that in habitat and several marked peculiarities there are constant differences; and between what we term a species and a variety thus characterized, the distinction seems sufficiently wide to entitle the latter to be so classed also. They are indeed very generally confounded by the natives of the N.W. Himalaya; the mountaineers of Rol, a district south of the Shatool Pass, insisting that the short white leaves of the silver fir are due solely to the cold and boisterous nature of the climate in which it flourishes. This persuasion of *the force of circumstances* in the transmutation of species is by no means uncommon in the Himalaya: and, though some of the examples are extravagant enough, it is possible that, in this case, the naturalists of Rol may be right, without having enjoyed the advantage of studying the theories of Lamarck or the Vestiges of the Natural History of Creation. I shall consider it as distinct.

Picea Pindrow forms dense forests on all the great spurs of the Kumaoon Alps, towards the heads of the Pindur, Surjoo, Ramgunga, and Kalee rivers, where (as in Gurhwal) the Khusiya name is "*Ragha*;" the Bhotiyas of Byans call it "*Woomun*." In central Kumaoon it is confined, so far as I have observed, to the great mass of Bhutkot and Boora Pinnath, from about 7,500 to 9,000 feet, where it clothes the sources of the Kosilla in a forest of unusual gloom and thickness. The name here (and on Doodootolee) is "*Raisulla*." This level of 7,500 feet is one at which the tree will never be found on a detached mountain of that elevation, or even a thousand feet higher; Cheenur, for instance, at Nynee Tal; but, under proper conditions, it will descend from greater heights to establish itself in this zone. The direct distance of Bhutkot from the plains of Rohilkhund is 35 miles, about 5 less than that of Muhasoo

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I found the people distinguish *P. Pindrow* as "*Telia*" or "*Chilee*" *Ragha*, from *P. Webbiana*, "*Bung*" or "*Dodhma*" *Ragha*.

Since the text was written, I have seen Dr. Griffith's figure (56) of *Abies densa*; it is that of *Picea Webbiana*.

* According to Dr. Thomson, the specimens of *Gobria-sulla* collected by Dr. Hooker in Sikhim, represent far wider differences both of cones and leaves than do the *Picea Pindrow* and *Webbiana* of the N.W.

from those of Sirhind; but on Soorkhunda Devee, near Dhunoultee forest, two stages east of Mussooree, the *Pindrow* appears on the outermost range of the Himalaya, where it attains the elevation of Bhutkot, 9,200 feet. Dr. Hoffmeister fixes its limits at 8,000 and 9,500 feet, and (p. 495, 496) states that in Gurhwal and Kumaoon, travelling N.W. from Nynee Tal, *Picea Pindrow* and *Webbiana* first occur on the spurs of Toongnath mountain. But this statement is completely erroneous, and could only arise from the most hurried and superficial survey of the intermediate country. The *Pindrow*, as just mentioned, abounds on Bhutkot, a few miles east of Dwarahat, one of his stages; while near Sunianee, the site of Lohba villa (p. 494), it is in equal or greater abundance 3 or 4 miles east on the Byansee, Kankur, Kala-jabur, and Kala-bun mountains and forests; the last being so named (black forest) from it. A few miles west of Sunianee is Doodootolee mountain, the Gundiyal Gebirge of Ritter's map, under which designation (that of a village merely) it is here named by Dr. Hoffmeister. Vast forests of *Pindrow* cover its northern and western slopes and spurs: and the last 500 or 600 feet are covered with *Picea Webbiana*, amongst which, on one side, are the sources of the (western) Ramgunga; and on the other those of the Nyar, the last considerable affluent of the Ganges before it quits the mountains. Doodootolee is a grand outburst of granite, unnoticed in any of our geological maps; the summit is nearly 10,300 feet; and here I first remarked that the tree *Rhododendron*, which in Kumaoon also flourishes to 11,000 feet, is not the common scarlet one, but has rosy flowers, and is, therefore, probably Don's *R. arboreum*, floribus roseis, a variety and elevation unknown, I think, in Busehur.* Captain A. Gerard assigns 8,340 feet as the inferior limit of the *Pindrow* on the southern face of Muhasoo; on the northern side, as well as near Illanee on the Bireh Gunga, in Gurhwal, it certainly descends nearly a thousand feet lower, delighting, like the spruce, in damp cold glens, where we search in vain for the cedar, the cypress, and the pine. In such situations, it constitutes the main feature of

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* It is needless to say that this diminution of colour is attributed by the people very confidently to the increased *cold;* yet there is a difficulty in adopting this view, even with so small an amount of difference in *form* as is here apparent. During the present unseasonably dry month of July, 1849, the common scarlet *Rhododendron* is everywhere in blossom; and the effect of the *heat* is not only considerably to diminish the size, but also the intensity of colour in the *flowers*, which is reduced nearly to that of the Doodootolee variety. Are we to reconcile the phenomena by the fact that the sun's rays on Doodootolee at 10,000 feet are really more intense than on Binsur at 7,000, and that it is their heat, and not the cold of the atmosphere, which blanches the flowers of the rosy variety?

vegetation on the Choor, the Changsheel, Shallee, and the snowy range of Busehur, forming almost invariably the belt next below *Abies Webbiana.* In the absence of more civilized mattresses the "spray" of each affords no mean bedding, and is in frequent requisition for this purpose; like *Picea balsamea*, in Canada, where "the Indians, in their winter journeys, scrape the snow together with their shoes, thus making a kind of wall to their lair, and then strewing the ground with branches of this fir, wrap themselves in their blankets. Defended in this manner, they sleep in security when the thermometer is many degrees below zero; and in this way did Captain Thompson sleep between two Indians in his unsuccessful attempt to overtake Captain Franklin in his Arctic journey."

The *Pindrow* appears not to have been hitherto traced beyond Kashmeer, where Mr. Winterbottom and other botanists found it plentifully on the Peer Punjal, and all the southern and eastern ranges, still exhibiting its preference for northern and western aspects. It probably exists with *Abies Smithiana* in the mountains of Kafiristan.

Dr. Griffith has somewhere expressed his resolution, in the event of any new pine being discovered in our mountains, to consecrate it to the memory of Captain Herbert; and should no such discovery be made, to apply his name to the very best of those already known. The Nepalese larch, being intended to commemorate himself, the local and barbarous term *Pindrow*, applied to this tree, meets the want almost equally well; and it would be no more than a merited compliment to both these gentlemen were it to be distinguished henceforth as *Picea Herbertiana.*

The names of the conquerors and explorers of the Himalaya, Ochterlony, Lawtie, Hodgson, Herbert, Griffith, Hooker, Falconer, Strachey, might thus be associated with the scenes and the objects which their zeal, science, or military skill have opened to our residence and knowledge: and that in a more pleasing and even permanent manner than by the creation of monuments in Bengal, a country which has so little in common with the Himalaya, except the Ganges.

> "While kings, in dusky darkness hid,
> Have left a nameless pyramid;
> Thy heroes, though the general doom
> Have swept the column from their tomb,
> A mightier monument command,
> The mountains of their native land."

The term *Pindrow* is chiefly used in the petty state of Komharsen (Nagkunda); in Kotgooroo and Bhujee, the name is *Boorool*, *Boorra*, and *Booldoo:* in the Tiroch (Ootroj) mountains, the *Urukta* of Royle, I found it named *Morinda*, which Dr. Hoffmeister states to be the usual designation in Gurhwal, though "*Koolloo*" appears to be occasionally used, when *Morinda* is transferred to *Abies Smithiana*. It is the *Chilrow* of Joobul and the Choor, where, however, the people often confound it with the yew. In Koonawur it is known as the *Khurok* or *Khurog;* and along the whole length of the Busehur snowy range (south side), *Picea Pindrow* and *Webbiana* are equally termed "*Kul-rai*," quasi *Kala-rai*, "the black fir."

The *Pindrow* flowers in April and May, at which seasons the tender shoots, as in the yew, have leaves of the brightest green, those of the past year being almost black. The trunk is branched nearly to the ground, but cones are only produced on the loftiest boughs, and (it seemed) more numerously on young than on old trees. From the fresh bud-scales at their base, I conclude that they are formed and matured in one season, and in about the same period as those of the spruce. By the middle of May the cones are about three inches long by one in diameter, and more or less cylindrical: as the season advances, they become completely so, and from the concealment of the bracteoles, very smooth; of the same rich and beautiful dark purple colour as those of *P. Webbiana;* they ripen in October and November. The distinction of *P. Pindrow* from *P. Webbiana* by its oval, not cylindrical, cones, is untenable; and the result of a careful examination strongly favours the supposition, that either the fruits are interchangeable or that Professor Don (in Royle's Illustrations) has exactly reversed the descriptions; the cones of the *Pindrow* being perfectly cylindrical: those of *Webbiana* nearly cylindrical, thicker, and shorter. Scales of *Pindrow* more prominently eared; bracteoles oval, obtuse, eroded, emarginate, the mucro of the same length as the border of the sinus; in *Webbiana* the bracteole is more rounded, scarcely emarginate, with thicker and longer mucro or apex.

The spiral arrangement of the scales seems identical, and each has the same copious supply of white resin. This substance perhaps indicates the origin of the name *Pindrow* (as *P. balsamea* in Canada), *pind* in Sanscrit signifying "incense," "myrrh," "frankincense;" as well as a "date tree," to which the etymology was referred, p. 57. "*Morunda*," without root or application in Wilson's Dictionary, is defined "the nectar or honey of a flower," and may originally have designated this resinous substance of the cones.

On several of the lofty Passes between Toongnath and Gungotree, Dr. Hoffmeister records instances of *Pindrow*, which he estimated from 30 to 40 feet in circumference, and about 200 in height.* It does not seem to attain this magnitude in the N.W. mountains, as will appear from the following measurements at five feet from the ground:—

No.	1	17	feet	Choor mountain.
,,	2	15	,,	
,,	3	13	,,	
,,	4	12	,,	
,,	5	16⅓	,,	Kumuloree mountain, above Nagkunda.
,,	6	14⅚	,,	
,,	7	13⅚	,,	
,,	8	13⅔	,,	Nagkunda.
,,	9	11⅓	,,	
,,	10	17½	,,	Near Kalapanee, Changsheel Range.

VI. Picea Webbiana.—Under the temporary name of *Abies densa*, Dr. Griffith informs us, that this species, rare below 9,500 feet, constitutes vast woods at 12,000 feet, below the belt of *Rhododendrons* in Bhotan, as on the Rodoola Pass: adding—"It has a tabular form, and very sombre appearance, and can be recognized even at great distances by its black columnar PALM-LIKE appearance" (*Journals*, pp. 258, 259, 265, *with Itinerary Notes*, p. 141, No. 662). We next meet it in Sikhim, where Dr. Hooker has recently found it occupying the zone from 9,700 to 11,500 feet on the flanks of Kunchinjinga, and has kindly furnished me with the following memorandum: "Gorkhalee name '*Gobria-sulla*,' Bhotiya, '*Doongshing*.' The most abundant pine of Sikhim. Limits on the south flanks of Kunchinjinga and crests of Inner Sub-Himalaya, 10,000 to 12,000 feet: but in the inner valleys and rearward ranges, 9,000 to 13,000. Wood much used for Bhotiya houses: sprigs offered in temples; and the cones on *chayts*. Resin white, exuding only on S. and S.E. side of trunk. A beautiful dye of a lovely violet colour is extracted from the young cones. A large fuscous *Agaricus* grows about the roots—'*Oonglau*' of the Bhotiyas, who eat it abundantly."

Of this portion of the Himalaya, Dr. Hooker writes to me, "between the upper limit of *Pinus longifolia* (2,000 feet) and the lower limit of *Abies Webbiana* (9,700), Sikhim has no pine

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* I take the girth from the letter to M. Humboldt, p. 498, but there is apparently an oversight: by a reference to other pages (325, 503, 508), we find the diameter of this tree stated to be 6 feet, and the circumference 20, little exceeding those of the text; perhaps not at all, as the height of the measurement is not stated:—or two trees may be referred to, for in a MS. of Dr. H.'s in my possession, a tree above Reithal is entered 32 feet in girth, and above 200 high.

whatever, not even a straggler; with very few and rare exceptions, a dense humid forest extends up to that level." *P. longifolia*, moreover, occurs only in ONE place: the statement alone of which facts is sufficient to prove the wonderful difference which must exist between the climate of Sikhim and that of Busehur: analogous in fact to that between Bengal and Sirhind. From Don's Prodromus we learn that it is found on Gosainthan, in Nepal, being there, as in Kumaoon, confined to the Himalaya and its immediate branches; none of the sub-Himalayan mountains being here sufficiently elevated for its growth. It seems to have been first discovered by Captain Webb, in S.E. Gurhwal, near Ramnee, on one of the spurs of the colossal Trisool, between the Pindur and the Uluknunda rivers; a tract which for the first time has just (June, 1849) been explored by Lieut. Richard Strachey (and in September was visited by myself), who writes to me, that this fir is common on these and on the Pilgwenta ridge, behind Josheemuth, the *Pindrow* being invariably some thousand feet below. East of this, towards the sources of the Pindur, Surjoo, Ramgunga, and other rivers in Kumaoon, it is the last fir that occurs, in approaching the glaciers in which they rise. In central Gurhwal, we first meet it on the summit of Doodootolee, at a distance of 45 miles from the plains, and still further N.W. on the Tyn or Manma Teeba, 30 miles from the plains: in this locality, Moonshee Murdan Alee assures me, that the very remarkable anomaly is exhibited of the *Pindrow* being entirely absent. Occurring so near as Soorkhunda Devee, and so generally in subordination to *Picea Webbiana*, the fact is almost incredible, and yet it receives countenance from Dr. Royle's silence in his list of habitats. (Dr. Falconer fully bears out the Moonshee, February, 1850.) Dr. Hoffmeister (p. 497) found *Picea Webbiana* "shooting up to 150 feet" (and 24 in girth, MS.) along the great spurs S.E. of Reithal, on the Bhagiruthee Ganges; though in the synopsis, p. 503, 80 feet only are assigned as the height, and by a manifest oversight, 6,500 as the inferior limit: his papers were drawn up in haste, and amidst many interruptions; and from p. 497 it appears likely this last number was intended for *Abies Smithiana*. I was myself in error in doubting the existence of *Picea Webbiana* on the Choor mountain, the boundary between Joobul and Sirmour; it is in abundance on the N.E. side for the last 1,500 or 2,000 feet, commencing nearly where the *Pindrow* ceases, about the middle zone of *Quercus semecarpifolia* (where snow remains till the middle of May), and accompanying that oak with *Betula bhojpatra* and *Rhododendron campanulatum*, nearly to the summit, 12,150 feet, when, however, it is beaten down and starved to a mere straggling bush. The distance from the plains of Sirhind is 27 to 30 miles. Dr. Royle quotes this mountain amongst others as the location of *Picea Pindrow* at 10,000 to 12,000 feet, but I do not think it ever much exceeds the former limit, and the fact that there are no pines in Sikhim below this level, will account for Dr. Hooker having missed the *Pindrow* there.

Dr. Hoffmeister (p. 501) mentions *P. Webbiana* at Nagkunda and above Kot-gurh, but I have examined that neighbourhood minutely, and never observed it there, nor even on Huttoo, which rises 1,500 feet higher, and where *Betula bhojpatra* and *Rhododendron lepidotum* occur sparingly; nevertheless, as on the main ranges trees certainly ascend higher and descend lower than on such detached summits as the Choor, it is probable 10,000 feet is (a few hundred feet more or less) the lower limit of *Abies Webbiana*, on the south face of the Himalaya: and that whenever we read of *A. densa* in Dr. Griffith's Bhotan journey, below this, we may understand the *Pindrow* to be intended. If the former, and not the spruce fir, be, as I suppose, Gerard's "*Khutrow*" or "*Rooee* pine," he fixes its highest limit in lat. 31° 20′, at 11,780 feet on the south face of the Himalaya, and at 12,591 on the north; a near approximation to the 13,000 feet assigned by Dr. Griffith for Bhotan. On Doodootolee mountain the *Pindrow* gives place to *Picea Webbiana* at about 9,700 feet: the same on Toongnath, where the latter ceases with all forest at about 11,200 feet: the temple itself being 11,493 feet, and the Chundur Sikhur Peak, immediately above, 12,134; as lately determined by Mr. John Strachey: the map, on some insufficient observation, omitted altogether by Captain Webb in his pamphlet of revised heights, gives the temple 9,989 only. Near Kolara, on the north face of Pilgwenta (*i. e.* Pilcoonta hill, map), *Picea Webbiana* ceases at 11,500 or 12,000 feet: nor does the *Pindrow* show itself till we descend at least a thousand feet. "Not one specimen of the fir tribe is to be seen on the way to Kedarnath," says Dr. Hoffmeister, p. 496. This is but partially true, for the *Pindrow* occurs on the road side below Bheemoodiyar; while *P. Webbiana*, though rare, reaches the limit of forest. The deficiency is to be accounted for by the eastern exposure of the route from Goureekoond upward: across the river (Kalee Gunga) both species are in abundance in their proper zones.

If sought in its proper zone, *P. Webbiana* is by no means "one of the rarer species." On the northern side of the Shatool Pass it forms most dense and extensive forests below the birch, at Ating Wodar; and is even still more magnificent lower down between the Ootulmai Ghatee and Panwee village. On the southern face of Shatool, above Rol, it does not flourish;

but on the S.W. approach to the Roopin Pass, from Rasrung (or Surra), nearly down to Jaka, and all over the upper Changsheel, the silver fir is abundant and luxuriant, associated with *Pyrus foliolosa*, *Cerasus cornuta*, *Rosa Webbiana*, *Quercus semecarpifolia*, *Betula bhojpatra*, *Rhododendron campanulatum* (and in Kumaoon and S.E. Gurhwal, *R. arboreum* also), *Syringa emodi;* in these last named districts, also, it may often be seen graced with the splendid festoons of a very large and handsome *Clematis*, near *C. montana.*

Notwithstanding the whiteness of the under-face of its leaves, the general effect of the Himalayan silver fir is exceedingly dark and gloomy; more intense, indeed, than that of the cypress, which, from any distance, it a good deal resembles. The form has pretty nearly the tall columnar outline of the *Pindrow*, with boughs somewhat less bushy and pendulous; and, on the whole, the long-leaved, thorough-going black *Pindrow* must be pronounced the handsomer tree.

Picea Webbiana has not hitherto, that I am aware of, been identified beyond the Sutluj: but there is no reason to doubt its presence in Kashmeer and Kafiristan. The largest specimen measured on the Choor was 11 feet 8 inches round; at Kolara is one of 16 feet, both at the height of 5 feet, but on the mountains of N.W. Gurhwal, Dr. Hoffmeister estimated several at 24 feet girth. In Sikhim at the same height Dr. Hooker measured one of 30 feet girth. Captain Webb alludes to "the silvery hue of the bark," but commonly it is rough and brown, as in the older samples of *Picea pectinata*, the European silver fir, where, after 50 or 60 years, the smooth, greyish-white layers peel off, and fall in large scales.

The young shoots of *P. Webbiana* appear in May, in which month the tree flowers: the strobili are then of a purplish-red, and when mature, probably assume the rich orange tint of *P. pectinata.* The leaves are from three-quarters of an inch to two inches long, with the double white band beneath, as in the European species: the apex is rather more obtusely bidentate than in the *Pindrow*, but a close examination is necessary to perceive this character, which escaped Captain Webb, who described the leaves as sharp-pointed: and indeed the amount of difference, though apparently constant, is sufficiently minute to justify the expression. As in the *Pindrow*, the leaves originate all round the branch, but dispose themselves laterally in two rows, except in the dwarf bushes at extreme elevations, when those of the upper half become horrent. On comparison with the description of the "Indian silver fir" of the *Penny Cyclopædia*, referred to in p. 47, they fail in the test "slender, four-cornered;" and if the cone of the tree there intended be really erect, it is clear the leaves of *Abies Smithiana* have, by some mistake, crept into the description (written before a reference to the *Arboretum Britannicum* showed the error to lie in the erect position assigned to the cones of the last).

As to the value of the silver fir as timber, Captain Webb states, that "the wood even equals in the texture of its grain and in odour the Bermuda cedar," but this requires qualification: Mr. Batten calls it "white and not very good." By the kindness of Captain W. Jones, Engineers, I am enabled to annex the results of experiments carried on by him at Almorah on the strength of pine timber, amongst which is the *Raisulla*, considered to represent *P. Webbiana:* the fragments fully bear out Mr. Batten's opinion, being white, very soft, rather coarse-grained, and without any odour of Bermuda cedar: the specimens, however, may be *Pindrow* (known as *Raisulla* on Bhutkot, the nearest site to Almorah), but this is too closely allied to the silver fir to allow the supposition of much difference in the nature of the timber: and though it were otherwise, the localities of *P. Webbiana* are too remote and difficult of access to admit its being brought to market, or even much used by the N.W. Himalayan mountaineers.

The vernacular terms to express *Picea Webbiana* are, for the most part, identical with those of the *Pindrow*. It is the *Ragha* and *Rao Ragha* of Kumaoon and S.E. Gurhwal; *Chilrow* of central Gurhwal and Tiroch; *Morunda* of N.W. Gurhwal and the Roopin valley, in Busehur; *Kulrai* of Rol; and "*Spun*" of Koonawur, under which name it is frequently mentioned in Captain A. Gerard's Journals. On the Choor, my guides called it *Kilounta*, which appears to be merely a Sanscrit compound ("end of the pine"), to signify the fir-cone, which is properly "*ronk*" in the Joobul dialect. The observations of Captain A. Gerard, made under favourable circumstances and with excellent instruments, are of much interest generally, but in some cases lose much of their value from the want of precision in the nomenclature, which unfortunately is always the vernacular. Thus in the account of Koonawur, p. 67, he gives the upper limits of the *Khutrow*, 12,000 feet: as the *Rai* or *Ryung* (*Abies Smithiana*) is distinguished in the list there given, I conclude that *Picea Pindrow*, or rather from the great elevation *P. Webbianá* is intended. On the north face of the Busehur snowy range he notes (Appendix) the "*Khutrow* or *Rooee*" pine at 12,591 feet, and 11,780 in another locality. He further mentions the "*Pindrow* or *Row*:" but, on Huttoo, correctly separates "*Ro*" (*Abies Smithiana*) from "*Pindrow*." His "*Ro'oo*" of Muhasoo, "covered with large creepers" (*Hedera* and *Ampelopsis*), is certainly *Abies Smithiana*, which, on Choor, and indeed commonly, is so called. Nevertheless, from some acquaintance with the localities, I am persuaded that his *Khutrow* or *Rooee* at 12,591 feet is *Picea Webbiana*. At p. 5 he tells us, that in some situations, the pines of the outer Himalaya approach 13,000 feet elevation: "The pines and oaks grow at all elevations, from the bed of the Sutluj, 5,000, to the height of 12.000 feet, after which they become stunted and in the form of bushes, are rarely met with at 13,000 feet." Dr. Griffith, as already cited, found it the same in Bhotan. On the Yoosoo Pass, near the source of the Soopun, Captain Gerard (Lloyd and Gerard, I. 25, II. 19) finds that though some pines and oaks reach 11,950 feet, the general limit of forest is 11,800, where "the trees grow stunted and in the form of bushes," a fact much more generally true than Dr. Gerard's, who (I. 243) states that the pines commonly "disappear suddenly while in full perfection," but the Dr. was accustomed to write, with what M. Humboldt mildly terms, "abandon."

Captain A. Gerard became very early aware that trees are most abundant on the N.W. aspects; and he also observes, that "they in general rise several hundred feet higher there than on the opposite face; in some cases, the difference exceeds 1,000 feet (II. 35, 39), the altitude on the N.W. side, 12,850 feet, being the same as on the north. In the valley of the Buspa, the upper limit of pines is 12,000 feet (II. 39, 42).

VII. CEDRUS DEODARA.*—Well informed brahmans of Kumaoon assure me, that no other tree has ever been considered the *Deodaroo* of the Shastras, and the universal practice of the inhabitants of the province (where the tree seems to be not indigenous) quite corroborates the grammarians, for we find groves of it, carefully protected, about every temple of sanctity: and nowhere else. It has no provincial appellation, except *Diyar* and *Deewar*, to which Khusiyas and Gorkalees sometimes abbreviate the orthodox Sanscrit. The "*Kelon*" of Busehur and N.W. Gurhwal (occasionally varied to *Keool*, *Kelee*, *Keltoo*, &c.) and still nearer, "*Kelmung*" of the Arian population of Koonawur, is manifestly the Sanscrit "*Kilimuh*," "*Kilimu*," rendered *Pinus deodara* by Dr. Wilson; and "*Kilimum*," its resin or extract (*Kelon-ka-tel*), from *Kil*, to

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* It appears from the Gleanings in Science for February, 1830, p. 68, that it was introduced into Great Britain by Dr. Govan in 1818, four or five years anterior to the period I have stated, p. 62.

It is worthy of inquiry, whether the luxuriance of the vegetation on the western coast of India and its comparative poverty on the Coromandel side, is connected with the same phenomena on the western and eastern faces of the Himalayan ranges, where the abundance of species is by no means restricted to the *Coniferæ*.

throw or cast (out resin), also *to be white*, alluding to its colour. In Arabic, *Kitran*, tar (*Kitt* of the artillery laboratory), from *Kutur*, he distilled, and *Kedria* (Greek or Syriac), the product, point to a similar etymology of *Cedrus*. The Umurkosh gives *Kilimuh* as a synonyme of *Deodaroo*, with others, which put the identity beyond question; such are "*Snehuvriksh*" and "*Snehuviddh*," from *Snehu*, oil, *Vriksh*, tree, and *Viddh*, pierced, impregnated.*

It seems clear, too, that the Brahmans of Gungotree (whose testimony was desired, p. 78, to decide this *questio vexata*) have no notion that the usual application of "*Deodara*" is a blunder, and that the term really belongs to the cypress or juniper. For Fraser (Asiatic Res. XIII. 233) tells us that between Duralee and Gungotree "several trees of cedar were pointed out to us by the Brahmans; but they were not abundant; it appeared the common red cedar, and is called by the natives *Dhoop* (incense): they regard it as very sacred." Being associated with the gooseberry, the elevation must be great, more adapted to *Juniperus excelsa* than to *Cupressus torulosa:* but in either case, "*Deodar*" is there exclusively understood of the "*Kelon*." The local and partial application to the cypress by the people about Simla, of the word *Deodar*, may have arisen from that of "*Kelon*" to the cedar, and their ignorance that the terms are synonymous.

With respect to the derivation of "*Cedrus*," it appears from Rosenmüller, Loudon, and others, that the Romans knew the *Mauritanian Arar* or *Thuja* by the name "*Citrus*," which is probably the same term, and the Greek Κεδρον: thus intimating that the name was not restricted to the cedar of Lebanon, which, however, was also a native of Africa, and is reported to have been recently found on Mount Atlas. Pliny says—"*Cedrus* in Creta, Africa, Syria, *laudatissima*." Κεδρον would come to the Greeks from Syria, *Citrus* to the Romans from Carthage, a Syrian colony: indicating the etymology given in the text, from *Kudr*, worth, value, or *Kutur*, distillation; our *Citron* and the French *Cedrat* being derivatives. Nevertheless, Pliny describes the process of making "*Cedria*" in terms which vindicate my friend's etymology (p. 112) from *keo*, to burn, *drio*, to sweat or distil: his words are (*Hist. Nat.* XVI. 21, XXIV. II.,)

* Another Sanscrit synonyme is "*Snigdhuh*," signifying oily, unctuous, from *Snih*. Have we not here the sources of the term "*Schnee*" applied to a tree which occurs in Afghanistan, on the Kojuk Pass, called *Xanthoxylon* or *Balsamodendron* by Dr. Griffith (*Journal of Travels*, p. 344; *Journal of As. Soc. Bengal*, No. 120, for 1841), and *Pistacio terebinthus* by Dr. Robertson (*Calcutta Journal of Natural History*, October, 1841), "Exuding viscid gum, with strong terebinthine odour?"

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"Lignum ejus concisum furnis undique igni extra circumdate fervet. Primus *Sudor* aquæ modo fluit canali; hoc in Syria cedrium vocatur:" and "Cedrus magna, quam cedrelaten vocant, dat picem quæ *cedria* vocatur, dentium doloribus utilissimum. Frangit enim eos et extrahit (the pains or the teeth?): dolores sedat.*" Our modern Creosote is therefore but an old remedy revised. Pliny also affirms that *Cedria*, and especially its oil, was useful in elephantiasis and similar maladies. Dr. Walsh (on Coins, Medals, and Gems, p. 67) tells us that "the elephantiasis was at this period (the reign of Gordian) a very loathsome and mortal distemper. It was so called because the limbs swelled into shapeless masses, divided by contracted rings, and the body, but particularly the face, was covered with blotches and papulæ like those of the elephant. Quintus Serenus, the Basilidian physician, who describes the disease, also prescribes the cure, which he says is the juice of the bark of the cedar tree.

> "Est elephas morbus tristi quoque nomine dirus,
> Non solam turpant infandis ora papillis,
> Sed cita precipitans funesto fata veneno;
> Hinc erit adversus cedri de cortice succus,
> Varios sic ungere frontes,
> Sic faciam, sic redde salutem."

The Creosote of Pliny was probably more potent in tooth-ache than the abracadabra of the Gnostic physician in tertian ague; but since each attests the vis medicatrix cedri, our *Kelon* oil is worth a trial in the cases of elephantiasis, leprosy, &c., unfortunately so numerous in India.

The association of Atys, the Phrygian Bacchus, with the pine tree, alluded to at p. 79, is not yet extinct. Our proverb "good wine needs no bush," is explained by the Continental practice, obsolete in England, of suspending a bush, commonly the head of a young pine, over the door of the vintner's shop. In Elmes' Dictionary of the Fine Arts, we are told that the Greeks decorated their Pans, bacchanals, &c., with pine leaves; and that on several *bassi relievi*, the pine tree appears growing near the

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* Dr. Hoffmeister, p. 367, describes the method of making cedar oil in Koonawur: it is also obtained from the cones. "Resinous cedar wood, cleft into many small pieces, is carefully squeezed into a new round pot, in such a manner that nothing can fall out when the pot is whirled round and round. It is then turned upside down over a copper bowl set in a little pit, every opening being filled up with small stones and moss. Round about the pot, a heap of billets of wood is piled up so high as entirely to cover it, and kept burning for fully two hours. Next morning the little pit is opened, and the copper vessel removed, in which the cedar oil is found to have gathered in the shape of a thin liquid substance resembling tar. * * * It is used as a medicine, internally and externally, in cases of intestinal disease and in eruptions of the skin."

figures of Cybele and Atys. The Thyrsus of Bacchus was a lance, the iron head of which was hidden in a fir cone, (*Elmes*,) as may be seen in plate VIII. of Keightley's Mythology. Pliny says, "Pix in Italia ad vasa vino condendo maxime probatur Brutia;" and Loudon, (*Arboretum Britannicum*,) "The cones of pines were used by the Romans to flavour their wine, having been thrown by them into the vine vats, where they float on the surface along with the scum that rises up from the bottom, as may be seen in the wine tanks attached to inns and farm-houses in Tuscany and other parts of Italy at the present day. Hence the Thyrsus, which is put into the hands of Bacchus, terminated in a pine cone. Pine cones or pine-apples were in consequence much employed in Roman sculptures, and the latter application, pine-apple, has been transferred to the fruit of the *Ananas*, from its resemblance in shape to the cone of a pine. * * * * Throughout Attica the wine is preserved from becoming acid by means of the resin (of the *Peukas*, *P. Halepensis*, var. *maritima*), which is employed in the proportion of an oke and a half to twenty okes of wine. * * * * The cones are sometimes put into the wine barrels." A writer in the *Westminster Review* has shown the lineal descent of the vintner's "*Chequers*," or sign of the Chess-board, from Osiris the Egyptian Bacchus, represented in England, at the present day, by the Chancellor of the Exchequer, and immortalized by the genius of Canning in the Knife-grinder.

> "Only last night, a —— drinking at the Chequers,
> This poor old hat and breeches," &c.

Dr. Hoffmeister found the modern Corinthian wine undrinkable from the above mentioned dosing of resin; but fortunate is the man who gets nothing worse.

Since the Hindoos, however, do not drink wine, and abhor the calling of the vintner, the sanctity of the *Deodar* cannot be connected with any such classical use of its cones or resin. In the absence, then, of all records and traditions on this topic, we must consult the genius and the customs of the people; and, guided by this clue, may not inconsistently come to the conclusion that it originally owed its fame not to its beauty or utility, but wholly to the fact of its being *a phallus-bearing tree*, the cones being regarded as so many lings; and for this reason, we always find the tree planted by the temples of Muhadeva and Devi, the patron and patroness of that symbol.*

* In a rough sketch of Kylas, by Captain H. Strachey, the sacred mount stands out from the average range, with sufficient resemblance to a cedar-cone; and the name is probably from the same root, *kil*, to be white, as *kilimuh*, the *Deodar*. To this form it is indebted for its fame: being only 20,700 feet high, as measured by Lieut. R. Strachey, it yields to Goorla,

The idea, it is true, strictly considered and in its most apparent application, involves a physiological blunder, and is otherwise reprehensible in our eyes; but the Hindoo was contented with a certain congruity or natural fitness of the outward and visible sign, and is far from participating in our very modern fastidiousness. It remains to be considered whether the cone of Bacchus, Atys, &c., is not to be interpreted in this Indian sense; the symbol was evidently ancient and widely diffused, and with *the lotus* (equally mystical in the Hindoo system), is frequently represented on the sculptures recently discovered at Nineveh, and described in the *Athenæum.* Compare too Gibbon's account of the Syrian deity, selected by Heliogabalus as his chief object of worship. But the example of a Bishop discussing alternately tar-water and Plato, can alone justify this and similar digressions.

The most southern point to which the cedar has yet been traced, is indicated in Captain R. B. Pemberton's report on the Eastern Frontier, where we find that "Cedars of gigantic size crown the summits of the loftier ranges, immediately west of Muneepoor;" an interesting region, which, with the Singfo mountains S.E. of Assam, carrying the zone of perpetual snow furthest south in Asia, we may hope will be shortly illustrated by the researches of Dr. Hooker. Captain Pemberton's cedar is not absolutely certain; and some doubt must rest on the *Abies* or *Pinus cedroides* of Dr. Griffith, which he describes as common from 7,500 to 9,800 feet on the mountains of Bhotan, a tall handsome tree, with the habit of a cedar, attaining six feet in diameter, and occurring next below *Abies densa*, (*Journals*, pp. 245, 265, 266, 273, 276.) Dr. Hooker is inclined to think *Abies Brunoniana* is intended; but at p. 246, *both* are specified, (with the reservation indeed, that *A. Brunonis* itself was undecided,) and towards the end of the Journey, (pp. 276, 277, 286, 295,) all doubt seems to have ceased, and it is entered "cedar," without any qualification.* As Captain Pemberton was in company, we may suppose it to be also his Muneepoor tree.

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on the opposite bank, which is 23,900, to say nothing of still loftier points to the southward. The Ruldung or Chhota Kylas Peaks in Koonawur, though reputed a mere chip of the Tibetan mountain, are, in reality, higher, being 21,400.

* In a letter from Captain Pemberton, printed in the J. A. S., May, 1838, 461–2, "cedars" are twice mentioned; first on the Doonghala Pass, exactly corresponding with Griffith's entry (p. 245) of abundant *Abies cedroides;* and next on the Rodoola Pass (pp. 257 to 259, inadvertently headed Dhonglaila Pass), where the Journals mention no pines but *Abies pendula*, *spinulosa*, and *densa*. Nevertheless Dr. Hooker informs me, that Bhotiyas who have seen the *Deodar* in the Darjeeling gardens do not recognize it, which strongly militates against the supposition of its being indigenous to their

The *Deodar* has not been seen by Dr. Hooker in eastern Nepal or in Sikhim; in central Nepal, Gorkhalees assure me that it is limited to the snowy range. In Kumaoon, it commonly occurs from 5,000 to 6,000 feet above the sea, in groves by the villages and temples; as near Lodh, Bala Jagesur, Gungoleehath, Furka, Lohooghat, Chumpawut; but though it has spread from some of these centres to a considerable distance, it is wholly unknown on the more remote and lofty mountains, occurs nowhere near the snowy range, and, I am persuaded, is not indigenous. Heber was misinformed as to its presence on the Gagur; this range exceeds the elevation of 8,500 feet, but is without a trace of cedar; its *Coniferæ* are *Cupressus torulosa*, which the good Bishop probably did not see; and *Pinus longifolia* in beautiful forests, which he must have taken for the cedar, as at Agra and Dehlee he invariably converts the Roopbas sandstone into red granite. That the *Deodar* has been introduced to its actual localities in Kumaoon is proved by the fact, that all the finest trees are found nearest the temples, where the first would naturally be planted, just as in Great Britain the largest yews are those by the churches. The pilgrim to Budureenath and Kedarnath may occasionally be met carrying a young cedar as the most acceptable gift to the shrine, next to the Com-

country: and the recent publication of Dr. Griffith's Itinerary Notes (the completion of which, as a debt due to his fame and for their intrinsic value, we may hope will not be long delayed) puts the matter beyond doubt, and amply vindicates Dr. Hooker's view. *Abies cedroides* is there noted (p. 141, No. 663) in terms which can only apply to *A. Brunoniana:* the leaves indeed are described as "distant," while Dr. Wallich, Pl. As. Rar. III. 24, calls and figures them "valde approximata:" but the rest of the character, and especially the "strobilis terminalibus ovatis ovi pigeonis magnit," corresponds exactly. It may be added, that the long entry made by Dr. G. (p. 331, No. 34) is a proof that he had not seen *Cedrus deodara* till he travelled in Afghanistan. So far, therefore, as European observation goes, I am not aware that we have any valid evidence that the *Deodar* is indigenous anywhere along the Himalaya east of Gurhwal. Dr. Mill states (J. A. S., July, 1833, p. 343), probably on the authority of Dr. Wallich, that it "abounds in the high regions of Nepal," and intelligent natives have corroborated the statement; but Dr. Wallich does not appear to have visited those districts where the tree may be common, and yet no more indigenous than in Kumaoon. At page 63 of my original paper, "Pilgrim" (Mr. P. Barron) is cited as authority for the presence and great size of the "cedar firs" on Toongnath mountain; where, however, a personal search enables me to affirm that none such exist; the only firs are *Picea Webbiana* and *Pindrow*, and none of these attaining the girth and stature asserted by him. In like manner his "cedars" at Mirg are actually cypresses; and his cypresses along the margin of Nynee Tal are, as some one averred, whom he rashly corrects, willows. The accuracy of Moorcroft stands forth in constant contrast with the carelessness and errors of his followers into these regions: he is very seldom wrong: they are scarcely ever right.

pany's rupee, which is everywhere the most sacred and all-sufficient.

The nearest truly indigenous habitat of the *Deodar* to Kumaoon is that noted by Moorcroft (p. 75), in the vicinity of Josheemuth, where it is not uncommon on the mountains immediately north and east, and up the course of the Dhoulee and Vishnoo-gunga rivers. From Messrs. Batten and R. Strachey I learn, that it descends to the level of the former above Mularee, and is in abundance from Jooma to Phurkia, and Bumpa, 10,600 feet. On the Vishnoo-gunga, I found it commence on the floor of the valley at 7,000 feet nearly, a few miles above Pundkesur, evidently wild, but not abundant. Hence it extends upward to about 500 feet above the Rooringa Sanga (considerably under 10,000 feet), beyond which, birch excepted, there are no trees.* The glen of the Kaleegunga (to Kedarnath) has no cedar: nor does it occur on any of the huge ranges N.W. to the Ganges; at least on the line traversed by Dr. Hoffmeister. But (p. 498), he writes in terms of admiration and in capital letters of the almost continuous CEDAR FOREST of the Bhagiruthee Ganges, and its affluents, especially between Duralee and Bhyrooghatee, which can be no other than that celebrated in the "birth of *Uma*," as the *Deodara* of young Gunga: cypress or juniper being apparently too rare and remote to constitute a prominent feature in the scenery: nor is either mentioned by Dr. H. He states (l. c. and MS. penes me) that the cedar first appears in the bed of the river at Jhalla, extending thence even a stage above Gungotree, and up the Jahnuvee to Neelung; places, however, which he did not visit. Mr. Wilson supplies the deficiency in the *India Sporting Review*, December, 1847, and June, 1849, and from him Dr. Hoffmeister must have had his information. Describing the tree as growing in dense and noble forests from Jhalla, via Duralee (9,000), Bhyrooghatee (9,500), Gungotree 10,319 feet, he tells us that thence up to the glacier the phenomena are these: "on the slope on the right bank the forest continues quite up to the glacier, broken only by landslips. At first cedar and pine are predominant, but these gradually disappear and give place to stunted birch trees, white *Rhododendron*, juniper, and other bushes. On the left, for the last three or four miles, the forest entirely ceases, and the slope is clothed with a rich and luxuriant vegetation of grass." This

* It is strange how universal the impression is amongst European writers and travellers, that Gungotree is the most sacred shrine of the Himalaya: yet the truth is, that in comparison with Budureenath, it is in little estimation. The demands of the latter, and of Mana, for timber, not to mention the vast annual concourse of pilgrims, must have had a sensible effect in diminishing the forests.

does not give the limit of the cedar, which is here probably under 11,000 feet; and it is remarkable how the account of the vegetation reaching up to the glacier coincides with what we know of the lower limit (about 12,000 feet) of other Himalayan glaciers, and induces a suspicion that the elevation (13,800 feet) assigned to the Cow's-mouth is too much.

The gorge of the Jahnuvee or Jad Gunga, the more remote but still cis-Himalayan source of the Bhagiruthee, as far as Neelung, probably 10,500 feet, is, in like manner, "covered in most parts with a forest of cedars," which cease in the next stage upward, Soonam, where no trees grow except a few willows and stunted cypress (more probably juniper).

S.W. of Gungotree, in Lower Gurhwal, extensive groves of cedar, apparently indigenous, occur on the flanks of Tyn Teeba, as at Oontur village, &c., and it is wild in profusion on Deobun, a fine mountain (9,000 feet) of Jounsar, between the Tons and the Jumna.

Beyond this to N.W. specification is needless; the cedar is established alike on the central and the culminating ranges, as far at least as Tezeen in Afghanistan; here and at Olipoor (or Otipoor) Dr. Griffith (as already cited, *Journals*, pp. 461, 464, and *J. A. S.* No. 118, p. 798) was inclined to believe that it ended abruptly: but there is reason to suspect its further extension. Dr. Robertson (*Calcutta Journal of Nat. Hist.*, Oct. 1841, p. 330) states, that "various species of pines (*Chulghozeh, &c.*) and CEDARS are found, along with the oak, elm, ash, and juniper," in the Kohistan of Kabul. This tract was not explored by Dr. Griffith; but the passes to Bameean, further west, have no forest of any kind; while the ambiguity of the term *cedar* in common parlance leaves it doubtful whether Dr. Robertson did not mean the tree juniper of Shawl and Bilochistan. The Afghans call the *Deodar* "*Nokhtur*," perhaps from its pungent leaves.*

In Kashmeer, as I understand from Mr. Winterbottom, the cedar abounds on the Peer Punjal and Baramoola mountains, from 5,000 to 8,000 feet; but is rare on the eastern ranges, the west faces of which are occupied, as usual, chiefly by *Picea*.

The N.E. limits of *Cedrus deodara* are uncertain, but in all probability it never extends beyond the N.E. face of the Himalaya. According to Dr. Lindley, in the *Penny Cyclopædia*

* Much probably remains to be discovered of the *Coniferæ* of their country. Lieut. Irwin (*J. A. S.*, November, 1839, p. 898) says, that they "distinguish at least seven kinds" of pine, and notes the districts where they are found, but without any specification except the names *Julghozeh* and *Shouty;* the last (*P. longifolia?*) "remarkable for its being so combustible, that the natives use it as a torch."

(copied in the *Arboretum Brit.*, IV. 2429), two varieties, or perhaps nearly allied species, called *Shinlik* and *Christa Rooroo,* are mentioned by Moorcroft as natives of the forests of Ludakh* (if any such there be) : but the inhospitable soil and climate of the Tibetan table-land (where it freezes more or less every night in the year) must form an impassable barrier to the transverse progress of this and other Himalayan *Coniferæ*, excepting, perhaps, *Juniperus excelsa:* as, on the other hand, it and its continuation forbid the extension to the Himalaya of the larch, spruce, and pines of Siberia and the Altai. A cedar was, indeed, long believed to inhabit Siberia; but Loudon (confirmed by Erman) shows this to be a mistake which originated in the Russian name for *Pinus Cembra*, "*Kedr*," being taken for cedar.

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* This proviso is very necessary. I know not what materials Dr. Lindley consulted, but in the expurgated edition of Moorcroft's Travels, published by Professor Wilson, so far from any forest or cedar of any kind being mentioned, I find (I. 267) that "a few willows and poplars are the only trees" in Ludakh. This is confirmed by Mr. Vigne (II. 342), with exception of his "here and there a bunch of fir trees" in the neighbourhood of Le, which, on the authority of Captain H. Strachey, I eliminate as being imaginary. Captain S. assures me that the only trees are the Lombardy and a balsam poplar, willows, brier-bushes, and *Hippophae* by the rivers: to these must be added *Juniperus excelsa*, which, however, does not occur within twenty miles of Le, and is called *Shookpa*. In spite of the discrepancy of name, I concluded this to be Moorcroft's cedar, *i. e.*, *pencil*-cedar or juniper, and understood by Dr. L. of the *Deodar;* but by comparing Moorcroft's volumes (I. 287, 289) it is clear that *Christa Rooroo* is not a cedar at all, but doubtless *Hippophae conferta* (*salicifolia*) or some allied species ; "a prickly shrub called *Cheerma* and *Chesta Ruru*," growing by streams, and producing a small, round, orange berry, "too acid to be eaten." As *Chasta Rooroo* is "a variety or perhaps nearly allied species" of the *second* Ludakh cedar, it follows that the last, "*Shinlik*," must belong to the same family; probably the "*Sunjit*" or "*Sarsing*" (properly "*Sershing*" or gold tree) *Elæagnus Moorcroftii*, which also grows in Ludakh and Kashmeer, and of which Dr. Royle (in Vigne, II. 456) mentions a Kabul variety "*Singilla*," which might easily in transcription become "*Shinjik*." "*Chirma*" in Tibetan denotes *any* thorn; properly *Tserma.*

The *Hippophae* forms the most abundant brush-wood of the river-beds in Ludakh, and though so common as to fix the notice of *all* travellers, has been, nevertheless, the subject of a second series of mistakes on the part of Mr. Vigne. He tells us (II. 360), that at a certain spot in the Nubra valley of Ludakh, "a long belt of *jungul*, chiefly of the Tartarian furze, occupies the banks of the river:" and in pp. 268, 269, 272, 319, as well as engraved on the map, near Khoppalu, on the Shayuk, the same shrub, explained to be *Cytisus Gerardiana* or *versicolor*, is said to occur in thick *junguls* on the stony and sandy banks of streams in Shighur and other parts of Baltistan. These are exactly the localities where we should expect *Hippophae*, while their comparatively small elevation would naturally induce a doubt of the presence of *Caragana versicolor*. But the matter does not rest on inference; Captain Strachey has visited the Nubra site, and he assures me that the shrub there is *Hippophae:* and so of course the rest.

Masson (II. 25, 33, 152) states that the plain of Lus, near Sonmeeanee, as well as the country between Sehwan and Kurachee, in Sindh, is " overspread with the magnificent *Dedar;*" associated with tropical trees, and flourishing in that burning climate, we must not confound this with the Himalayan *Deodar;* in his journey to Kelat, also, the *Deodar* is classed amongst trees common to Bilochistan and Hindoostan, and may be *Guatteria longifolia*, the *Deodar* of Bombay and Calcutta; but Richardson has *Deevdal* or *Deewdal*, Persian for the white poplar; and as both Griffith and Vicary mention a species of *Populus* in Sindh, allied to, if not identical with, *P. euphratica*, we may conclude this to be Mr. Masson's *Dedar*.

Captain A. Gerard fixes the lowest limit of the cedar, on a south aspect near Simla, at 6,436 feet, but the fact of its attaining a considerable size near the south cascade there, suffices to justify my lower estimate of 5,500; and Captain Hodgson, who says it flourishes most between 6,000 and 10,000 feet, adds that it occurs below and above those limits.—(*Gleanings in Science*, Feb. 1830, p. 52.) Mr. Winterbottom informs me, that it descends certainly to 5,000 in Kashmeer; and it is quite at home at Hawulbagh, 4,000 feet, and ripens its fruit well, though not abundantly, at Almorah, 5,500, where it is equally an exotic. In some seasons, as this of 1849, there is a general failure of seed. On the northern face of the Busehur Himalaya, lat. 31° 30′, Captain Gerard assigns 7,414 feet as its lowest, and 10,943 feet as its highest limit; but it certainly descends much lower along the Sutluj, north of the Shatool Pass. Dr. Hoffmeister's limits are 8,000 and 11,000, of which the first is at least 2,000 too high; by his manuscript I find that he met scattered specimens only 300 feet below *Rhododendron campanulatum*, on the north face of the Harung Pass, above Sungla, in Koonawur; and we have seen that the tree reaches considerably above Gungotree, itself 10,319 feet; 10,500 feet must be, therefore, rather under than above the mark, for the upper limit on the southern face of the Himalaya. Captain Herbert expressly informs us (*Gleanings in Science*, Feb. 1830, p. 69), in contradiction of a report that he had seen the cedar at 13,000 feet in Koonawur, that 11,300 was the highest point at which he observed it; but Captain A. Gerard, who explored that district in every direction, says (Lloyd and Gerards, II. 296), "the *Kelon* seldom occurs below 6,000 feet, and its upper limit is nearly 12,000 feet: in a few favourable situations I have found the latter above 12,300." Two above 12,000 had been previously recorded (pp. 264, 267), viz. 12,300 near Soongnum, and 12,100 on the Werung Pass. Dr. Gerard measured *Deodars* of 13 feet in circumference, and 140 feet high, above the level of 10,600 feet (I. 6, I. 342). But this upper limit of 12,300 is proper only to Koonawur and similar climates, where the range of arboreous vegetation rises with the snow-line, as remarked by Mr. Colebrooke.

Further observation has overthrown an idea hazarded in the original paper, that the cedar shuns limestone formations: Shallee mountain N.E. of Simlah, and Deobun in Jounsar, both of this rock, are well grown with cedar; in fact, with exception of the ranges, however lofty, next to the plains, it seems very indifferent to site and substance, flourishing equally amongst the clefts of the most scarped rocks, gneiss, quartz, limestone, granite, clay and mica slates, as in the black vegetable mould of the brae or glen, provided always the surface of the latter slope to an angle sufficient to ensure thorough drainage. This condition seems indeed essential to all our forests: even in the Turaee a dead level is invariably grass jungle: but the moment a rise commences, the land is occupied by forest.

Although the *Deodar* abounds and attains a great girth on mountains thirty miles from the plains, all the gigantic specimens on record occur near the snowy range. On Choor, not one exceeded 17 feet round at 5 high; but at Sildes, near Looloot, on the western side of the Changsheel Range, there exists a hollow, flat-crowned patriarch, 36 feet round, at 4 from the ground; there is another of the same dimensions near the sacred fish tank below Cheenee, in Koonawur; and at Sheong, on the north face of the Boorun Ghatee, one of 33 feet. Dr. Hoffmeister (p. 504) mentions "individual specimens above 40 feet in circumference."

Between Kugna and the Choor, there is a cedar forest in which nine-tenths of the trees were snapped in two by the snow of the winter, 1844-45; a sufficient proof that their *needle-leaves* do not preserve them from destruction by this cause (p. 67), which acts with peculiar force when frost succeeding a partial thaw is followed by a gale of wind. A little reflection, indeed, on the facts of the case suffices to demolish the theory alluded to; for the longest-leaved pines, on which snow rests with most difficulty, as *Pinaster Halepensis*, *australis*, *longifolia*, prefer a zone in which it is unknown or comparatively rare; while *P. sylvestris*, *Picea Webbiana*, *Pindrow*, *pectinata*, with short stiff leaves and branches, well calculated to arrest the snow, flourish exactly where it falls most copiously. Whole forests of some of these may be observed dead in many places from Bhotan to Busehur, as well as in the European Alps, for which no cause has been assigned; but lightning seems the most probable (compare, however, note, *ante.*)

Dr. Lindley (*Veg. Kingdom*, 227) remarks, that Dr. Brown "has noticed a very general tendency in some species of *Pinus* and *Abies* to produce several embryos in a seed;" both in Kumaoon and Busehur we frequently meet cedars with several stems from the very base, which may proceed from the same cause.

Dr. Hoffmeister not unjustly terms the cedar "the crowning glory of the Himalayas;" and Baron Hügel (account of Kashmeer) must be added to the list of those who eulogize "the incorruptible Himalayan cedar, the invaluable *Deodar*." As long ago as 1845, I suggested to the worthy and zealous Editor of the Medical and Literary Journal the propriety of experiments to ascertain if the timber really repels the white ant; in which case, and if it could be brought to the spot at a cheaper rate than kyanized materials, it would be invaluable in forming the sleepers of our Indian railways: but looking at railway prospects, the cedars are probably not yet planted which will be required on any line above Allahabad.*

The occurrence of larch in Bhotan and eastern Nepal has been noticed: in the abstract of the Flora of Lower Koonawur, p. 515, Dr. Hoffmeister enters "*Larix*" "very rare;" but, as if he had afterwards seen reason to doubt its correctness, any such allusion is omitted in the letter to M. Humboldt. Captain A. Gerard, also, *Account of Koonawur*, pp. 204, 206, mentions "several larch trees" near Kotgurh, and "a species of larch" on Huttoo; but none such exists. Since my original notes were drawn up, I have visited Bulsun and Joobul, the States in which Fraser also notices two varieties of the same genus: but diligent observation and enquiry satisfy me that *Cedrus deodara* is intended; the "two varieties" being no other than the ordinary conical (or where compressed, columnar) form, and the somewhat rarer specimens with broad tabular crowns. Below Chansoo, near Sungla, a steep ridge from the Buspa is grown and feathered with enormous trees of this form, which is due to the loss of the leading shoot by storms, and sometimes apparently by birds perching on and wearing it down. Rosenmüller, quoting Burckhardt's Travels in Syria, says of the cedar of Lebanon, "The oldest cedars are known by the circumstance of the foliage and small branches being found only at the top." This seems to be pointed out by the Hebrew word Tzammereth in Ezekiel, xvii. 3, "the highest branch of the cedar," and xxxv. 3, "his top was among the thick boughs." Loudon too observes, "the summit in young trees is spiry, but in the old trees it becomes broad and flattened." In a lesser degree this is true also of *P. longifolia*, *pinea*, and *sylvestris*, which, as they grow old, lose the lower branches, and acquire

* Prospects have brightened considerably since this was written.

rounded or spreading crowns by the development of the uppermost boughs and the decay of the rest.*

It would appear that even on its native mountains (p. 64) the cedar of Lebanon affords timber little if at all superior to the coarse, soft, warping wood of the English specimens. Pococke, in 1744-45, examined the trees on Lebanon, and says "the wood does not differ from white deal in appearance, nor does it seem to be harder;" in the "*British Gunner*" its specific gravity is given 613; that of Indian cedar 1315; but this last cannot be the *Deodar*, which, on an average of 20 trials by Captain W. Jones, shows only 680.

The *Deodar* grafts freely on the cedar of Lebanon; the village of Eden, the chief or only site where the latter remains, is 6400 feet above the sea. Authorities differ as to the number of cotyledons, some allowing only 6, others from 9 to 11, which agrees with the *Deodar*. "The female catkins are produced in October, but the cones do not appear till the end of the second year; and, if not gathered, they will remain attached to the tree for several years;" but in the *Deodar* they are produced and fall to pieces annually: and Roxburgh was certainly misinformed when he was led to represent the scales as "so close as in general to prevent the escape of the seeds without help." On the con-

* In the botanical portion of Berghaus' 'Physical Atlas' we are told, that *Pinus cedrus*, the cedar of Lebanon, as well as the *Deodar*, inhabits the Himalaya, for which I think there is no other authority, unless this be intended to intimate their identity. The site of the latter is said to be "the Alps of Nepal and Tibet, at a height of from 10,000 to 12,000 feet." An English editor had the means of discovering that there is no proof of its presence in Tibet, and that at Simla, &c., it descends to 6000 feet.

The same work furnishes the following distinctive habitats of our *Coniferæ*. amusing as samples of critical variety of expression employed to disguise a total ignorance of details:

Pinus Webbiana. "The cold regions of northern India."

Pinus Brunoniana. "Northern Provinces of India."

Pinus Smithiana. "Mountains adjoining the Himalaya."

In one page we are told that *Quercus semecarpifolia* forms the limits of trees at 11,500 feet on the south face of the Himalaya, which is true enough; but in the next page, the same level, with the same aspect, is assigned as the limit of shrubs, juniper, *salix*, *ribes*, which is necessarily and naturally false.

It is asserted that "snow is unknown" below 5000 feet. In the Gleanings in Science, April, 1830, p. 116, we have the notorious fact recorded, that in 1815 it fell at Kalsee, on the Jumna, at 2500 feet; and "lay deep" on the Sewalik range, from 2000 to 3500. This was repeated in the winter of 1846–47, when it fell at 2500 or lower in the Dehra Doon, and certainly to 3000 at Bagesur, in Kumaoon. In February, 1836, I am assured snow fell at Bilaspoor, on the Sutluj, 1465 feet. These, no doubt, were exceptional seasons, occurring at long intervals; but their possibility is a very necessary element in a view of botanical geography: while *every* severe winter snow falls, though it rarely lies, a thousand feet below the zone where this work affirms it to be unknown.

trary, the cones break up spontaneously while still on the tree, as soon as they are ripe; and hence, when Moorcroft visited some *Deodar* groves in Kashmeer, he was disappointed in procuring seeds. This is a marked difference: but its glaucous leaves would scarcely warrant a specific distinction, for, in the *Arboretum*, Loudon mentions a variety of *Cedrus Libani*, "the silver cedar," with leaves quite glaucous. In general, however, the distinction here also holds good, for even on the oldest *Deodars*, the shoots and tufts of fresh leaves, from April till June, are of a light blue-green, which, in immediate contrast with the dark foliage of the last season, imparts during these months a curious mottled appearance to the tree: on many trees this tint is permanent.

Dr. Rosenmüller, following many ancient versions, is of opinion that the Hebrew *Berosh* denotes the cypress, not the pine or fir, as rendered by our translators; and thus the temple of Solomon, with doors and floor of *Berosh*, may have been indebted for its durability to the cypress rather than to the cedar of Lebanon. He shows that the former entered into the construction of many other temples of antiquity. Thus Pliny (XVI. 42) states that the doors and other parts of the Ephesian Diana's temple were of cypress; and Athenæus describes a splendid ship of Hiero, containing, amongst other articles of *vertu*, a shrine of *Venus* incased in cypress wood. The German critic would include under *berosh*, *Cupressus sempervirens*, *Thuja articulata*, and *Juniperus Sabina*, which last was called *Brathys* by the Greeks, adding their own termination to the Syriac form *berosh*. (*Brathys* has recently been applied to some species of *Hypericum*—a division rejected by Dr. Lindley.) Pliny (XII. 39) adds, that the *Bratus* grew on Mount Zagros (the range east of the upper Tigris), and that it resembled the cypress, with wood having the odour of cedar. The passage of Arrian, referred to p. 88, is in B. VII. c. 19, of Rooke's translation: "The same author (Aristobulus) also tells us that Alexander had ordered cypress trees to be cut in that province for building several other ships, they growing there in great plenty." Our own experience proves how mutable are names amongst the *Coniferæ*: or it may be that the original or vague term *berosh* of Solomon's time had at the epoch of the Captivity become obsolete, or yielded to the more precise appellation "*gopher*," of which was constructed the ark; cypress, according to Rosenmüller, who remarks that *copher*, pitch, *gapherith*, sulphur, and *gopher*, in the Greek from *kupar*, are cognate terms in sound and sense. *Copher* also signified, he supposes, our *Mendee*, *Lawsonia inermis*, and perhaps the several odoriferous *Cyperi* (Κυπειρος) may be traced to the same origin.

XXVII.—*Report on "Roberts's Horticultural Double Tile for Strawberries."* By Robert Thompson.

(Communicated June 28, 1850.)

These tiles are each about a foot in length and six inches wide. Two edges are turned down square; and on these turned down edges alone the tile rests on the ground, leaving between the latter and the under surface of the rest of the tile a clear space of an inch and a half. The ends are not turned down, so that when these are placed against each other, the cavity may be said to be continuous. A semicircular opening is cut out of one side of each; and a couple being placed, one on each side of the plant, a circular hole is formed for its growth, and the foliage and fruit can spread over the one-foot square platform constituted by the two tiles.

Plants of Keens' Seedling, British Queen, and Old Pine Strawberries were planted under equal circumstances last autumn, in a row on the border in front of a south wall. When planted, tiles were placed round eighty plants of the above varieties; to the remainder, left for comparison, nothing was done.

The weather was hot and dry when the fruit was ripening, and ripe fruit was quite as soon gathered from those plants which were not surrounded with tiles as from those that were. It was observed in many instances, that where the fruit rested on the tiles, the part in contact was pale, showing that the ripening process was not uniform throughout, consequently the flavour was not found superior to that of others grown in the most common way. The produce on the whole was inferior; for it must be observed, that the tiles afford excellent shelter for many insects, some of which attack the plants, others the ripening fruit; in both ways deteriorating the crop.

These tiles might be employed in particular cases where straw, or the more enriching litter employed by market gardeners and others, would be considered unsightly even though bleached by sun and rain. The cavity is bad, for the reasons above stated. Were it done away with, or, in other words, if the straight side were left as it is, at right angles with the top, and with the semicircular opening, but no edge turned down on the opposite side, then the soil or other top-dressing could be raised round the plants, and on it the tile could rest and form a straight edging where desirable.

All that can be said in favour of the tiles in question is, that they keep the fruit clean from soil. But, on the other hand, they prevent the rain from refreshing the roots, and thus prove injurious to the health of the plants, whilst they also harbour insects that spoil the fruit.

XXVIII.—*A Chapter in the History of Hybrid Rhododendrons.* By Standish and Noble, Nurserymen, Bagshot, Surrey.

(Communicated September 10, 1850.)

Every lover of flowers is charmed with the appearance of Rhododendron arboreum. Its symmetrical trusses of the richest crimson are objects which attract the most ordinary observer, and the connoisseur amongst plants is equally delighted with them. But on account of the protection of a conservatory being necessary during a considerable portion of the year to ensure the production of these beauties, comparatively few who possess gardens can enjoy this fine plant in perfection. From this circumstance an early desire evinced itself in the gardening community to procure hybrids between it and the hardier American kinds, but the results of such crosses, although much was accomplished, were not of a satisfactory nature. It is true many beautiful hybrids were produced, among which we may mention Russellianum and Altaclarense, presenting a richness of colour almost equal to their Indian parent, but they did not inherit sufficiently the hardy constitution of the American. Their tendency to bloom so early in the year, generally from the latter part of February to that of April, invariably exposed them to cutting winds and severe frosts, so prevalent in this climate at that season. And again, the length of time required to bring them into a blooming condition was a severe tax upon the patience of the cultivator, from ten to twelve years being occupied in this probationary state. We have known many instances where hybrids of the character we are describing have been full twenty years old before the anxious eye has been gratified with a flower; and often, when the production of flower buds had been effected, and the promise of abundant bloom was about to be realised, an unfavourable season has prostrated all hopes of seeing the flowers in anything like perfection, if at all.* Knowing that the many disappointments of this character were exercising a retrograde movement in the taste for hybrid Rhododendrons as they were then constituted, about twelve years ago we commenced a series of "crossings," with the view of remedying the great defects so apparent in the earliness of blooming and susceptibility to frost. In this we have been perfectly successful. By crossing the American species again by the first

* At Highclere, the seat of the Earl of Carnarvon, are large masses of Rhododendron Altaclarense and Russellianum, 10 to 12 feet in height, which for the last two seasons were well covered with flower buds. Had the weather been favourable, they would have formed magnificent objects; but unfortunately this was not the case, and the whole were completely destroyed by the frosts.

hybrids, such as Altaclarense, &c., we have still retained the rich tints of the Indian kinds, with all the hardiness of the American; and what is of equal import, the results of such crossings are the production of varieties which have a tendency to bloom in a very young and dwarf state, and sufficiently late in the season to escape spring frosts, producing their flowers from the middle of May till the latter part of June.

As so little is known in connection with the nature and effect of hybridizing amongst plants, we shall take this opportunity of endeavouring to describe, with reference to the Rhododendron, some of the peculiarities which a very extensive practice has presented to us. We find that, analogous to what is observed in the animal kingdom, the greater the cross the more healthy the progeny, and that breeding "in and in" produces weak and deteriorated constitutions. We have a remarkable instance of this in a batch of hybrids, raised from Caucasicum album (that being a hybrid), fertilized by its own pollen. The plants are extremely dwarf, with variegated foliage. So dwarf are they, that many of them had eight or ten flower buds on, when only from 4 to 6 inches high, and four years old. They, however, bloomed quite freely when only three years old, and about as many inches high. Flowers produced by these dwarfs were again fertilized by their own farina, and although seeds were produced and vegetated, the plants could not be kept alive, but after various durations of existence, from two to eighteen months, they finally disappeared. One of the dwarfs above-named, which we have called "Bride," fertilized with the pollen from another distinct hybrid, has however produced some very healthy seedlings. A remarkable example of the varied nature which hybridizing effects in the Rhododendron is afforded in a hybrid raised from R. Catawbiense by a large yellow Ghent Azalea. The object was to raise a hardy yellow hybrid, but in this we have been disappointed, as it has proved to be pink, and we have named it "Deception." It is an extraordinary cross; we never recollect meeting with so decided a "sport." It resembles neither of its parents, being one of our best growers, with foliage large and thick, of a bright green, and when in a young state it has the appearance of being coated with varnish. Another remarkable sport is a hybrid, which we have called Towardii, raised from Catawbiense by Altaclarense, being a perfect giant in every respect. The foliage is very fine, and the flowers, both individually and in the truss, remarkably large, each forming a perfect cup. We know no Rhododendron equal to it in size and perfection of flowers.

Having shown some of the effects of hybridizing upon the Rhododendron, and the various breeds produced, we would beg to recommend all who intend practising this very interesting branch of horticulture, no matter what class of plants they propose to operate on, to choose the parents, whether species or hybrids, as far removed from each other as is consistent with the constitution of the plants and the result aimed at. We have in a tabular form appended a description of eight distinct sections of hybrid Rhododendrons, and it will be seen that all our third crosses, although all hybrids, have been selected as distinct from each other as possible. The plants raised from these crosses are all as healthy as we could wish, and they present a very great diversity in the characters of their foliage. We anticipate that many of them will flower in the spring of 1852, and we shall derive much pleasure in watching their different characters.

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*SECTION I.

Catawbiense Arboreum	*Altaclarense*	Catawbiense Altaclarense	*Blandyanum.* *Towardii.* *Meteor.* *Elegans.* *Nobleanum bicolor.* *Pulchellum.*

SECTION II.

Ponticum Maximum	*Hybrid Maximum*	Hybrid Maximum Altaclarense . .	*Standishii.* *Mrs. Loudon.* *Picturatum.* *Virid.* *Captivation.* *Raeanum.*

SECTION III.

Ponticum album Caucasicum . .	*Caucasicum album.*	Caucasicum album, fertilized by its own farina . .	*Bride.* *Original,* and a race of remarkable dwarf and variegated varieties.

SECTION IV.

Purpureum Altaclarense	*Queen Victoria.*

SECTION V.

Caucasicum . . Arboreum album	*Coriaceum.*

* When the name in this arrangement is printed in ordinary type, it indicates the plant to have been a breeder; when in italics, a hybrid produced. Thus, Catawbiense, fertilized with pollen of Arboreum, produced Altaclarense. Then taking Catawbiense as the female again, and fertilizing it with the pollen of the hybrid Altaclarense, a race of excellent flowers, such as Blandyanum, Towardii, &c., were produced.

Section VI.

Catawbiense . . . . . Large Yellow Ghent Azalea	*Deception.*

Section VII.

Campanulatum . Hybrid Maximum	*Hybrid Campanulatum.*

Section VIII.

Bride . . . . Dried farina of Dalhousieanum	Seedlings not yet flowered.

Queen Victoria. Blandyanum.	Bride. Hybrid Campanulatum.
Queen Victoria. Picturatum.	Bride. Pictum.
Standishii. Blandyanum.	Coriaceum. Pictum.
Captivation. Blandyanum.	Coriaceum. Hybrid Campanulatum.
Mrs. Loudon. Blandyanum.	Coriaceum. Album elegans.
Hybrid Campanulatum. Pictum.	Album elegans. Multimaculatum.
Bride. Album elegans.	

All the above crosses were fertile, and the seeds have produced a quantity of fine healthy seedlings, none of which have as yet flowered.

DESCRIPTION OF RHODODENDRONS IN ANNEXED TABLE.

Altaclarense	hybrid	deep crimson.
Arboreum	species	deep crimson, sometimes nearly scarlet.
,, album . .	,,	nearly white, and very much spotted.
Album elegans . . .	hybrid	pinkish white, fine form.
Blandyanum . . .	,,	rosy crimson.
Bride	,,	flowers pure white, foliage much variegated.
Campanulatum . . .	species	white tinged with lilac, much spotted.
Catawbiense . . .	,,	rosy lilac in many shades.
Caucasicum . . .	,,	pinkish white.
,, album . .	hybrid	whiter than the last, and shaded with pink.
Coriaceum	,,	white with green spots, fine foliage.
Captivation	,,	rosy crimson, black spots.
Deception	,,	pink spotted, very fine foliage.
Dalhousieanum . .	species	large white, tinged with pink.
Elegans	hybrid	deep rose, fine truss.
Hybrid Maximum . .	,,	rosy white.
Hybrid Campanulatum	,,	shaded white, much spotted.

Maximum	species	white tinged with rose, spotted.
Meteor	hybrid	fine rosy crimson.
Multimaculatum . .	,,	pinkish white, much spotted.
Mrs. Loudon . . .	,,	pale bright rose, and, unlike any other Rhododendron, the whole of the petals are spotted.
Nobleanum bicolor .	,,	deep rose, white throat.
Original	,,	pinkish white, foliage very much variegated.
Ponticum	species	lilac.
,, album . .	,,	white tinged with lilac.
Picturatum	hybrid	bright rose, very much spotted with crimson.
Pictum	,,	pinkish white, spotted.
Purpureum . . .	species	purple.
Pulchellum . . .	hybrid	rosy pink, white throat.
Queen Victoria. . .	,,	deep claret.
Russellianum . . .	,,	rosy crimson.
Raeanum	,,	deep crimson, black spots.
Standishii	,,	violet crimson, black spots, free bloomer.
Towardii	,,	rosy lilac, immense flower and truss.
Vivid	,,	bright purplish rcse.

XXIX.—*On the Effects of the Winter in Devonshire.* By James Barnes, Gardener to the Lady Rolle, at Bicton, Sidmouth.

(Continued from page 175.)

Quercus glaucescens, callosa, and petiolaris have been killed. Q. polymorpha, incana, virens, lanata, dealbata, insignis, and mexicana have had their young wood destroyed; while Catesbæi, heterophylla, ambigua, obtusifolia, coccinea sinuosa, laurifolia, and pannonica, slightly protected, are uninjured. Q. macrocarpa, m. major, prinos, appennina, rubra taraxacifolia, louettii, coccifera, Meerbeckii, asplenifolia, chinquapin, gramuntia, falcata, pseudo-coccifera, aquatica, serrata, japonica, tauzin, quexigo, phellos, nigra, and ægilops have all wintered well without protection, as has also Q. glabra, which is 6 feet in height, and the same in diameter.

Fagus Cunninghamii is uninjured, but it was slightly protected. F. antarctica, ferruginea, and asplenifolia, interesting trees on account of the singularity of their foliage, have proved quite hardy.

Garrya elliptica and macrophylla are uninjured; and so are Taxus adpressa, bariensis, Harringtonii, elegantissima, and variegata; as is also Phyllocladus trichomanoides, but the latter was slightly protected. Podocarpus purdieana and latifolia have been killed; while P. longifolia and Totara are uninjured. Dacrydium Mai, although protected, has had its young shoots killed.

Pinus patula, Llaveana, Laricio, pygmæa, Montezumæ, umbraculifera, brunoniana, filifolia, longifolia, and tæda were protected, and have wintered well; but P. tenuifolia, though protected, has been killed. P. pumilio, P. Fischeri, colchica, pithyusa, variabilis, Coulteri, Gerardiana, ponderosa, leiophylla, brutia, devoniana, Fraseri, pseudo-strobus, palustris, australis, Russelliana, Hartwegii, pyrenaica, Teocote, and oocarpa have all stood well without the least protection. Of P. insignis we have a fine specimen 40 feet in height: it made a leading shoot 4 feet in length this season. The circumference of the stem at 3 feet from the ground is 4 feet 6 inches; the diameter of the branches close to the ground 21 feet; at 12 feet from the ground, 33 feet; and at 20 feet from the ground 21 feet. It has produced cones ever since 1847, and young plants have been raised from the seeds. P. macrocarpa is nearly 40 feet in height; the circumference of the stem at 2 feet from the ground is 4 feet 6 inches; at 6 feet from the ground, 3 feet 6 inches. The diameter of the branches close to the ground is 32 feet; at 15 feet from the ground, 32 feet; and at 28 feet from the ground, 15 feet. P. californica is 15 feet in height, and is making rapid growth. It has produced shoots upwards of 4 feet in length this season.

Abies Smithiana, orientalis, gigantea, gracilis, Khutrow, carpatica, and dumosa have all wintered well. We have A. Menziesii 20 feet in height, and very handsome. Picea Pinsapo, nobilis, grandis, Pichta, amabilis, Hudsoni, Nordmanniana, and cephalonica are 16 feet in height; P. Webbiana is 20 feet in height, and covered with long purple cones.

Cryptomeria japonica is 12 feet in height, and quite hardy.

Araucaria excelsa has been killed, and so has elegans—the latter to the ground. A. braziliana, slightly protected, is uninjured. We have A. imbricata 20 feet in height; the circumference of the stem at 2 feet from the ground is 2 feet 4 inches, while the diameter of the branches is 13 feet. It is a beautiful object, having nearly 50 large cones upon it. Cunninghamia sinensis is 16 feet in height. Dammara australis, slightly protected, is injured.

Thuja orientalis tatarica has been killed; while T. nepalensis, japonica, chinensis variegata, Wareana, and pendula have not received the least harm.

Cupressus Uhdeana, although protected, has been killed; and so has C. juniperoides—the latter to the very ground. C. lusitanica, torulosa, thyoides, Lambertiana, religiosa, pendula, diœca, bacciformis, and thurifera, unprotected, have all stood well.

Taxodium sempervirens is not the least hurt; but T. distichum virens has had its young wood slightly injured.

Juniperus squamata, Oxycedrus, echinæformis, flaccida, humilis, uvifera, pendula, tetragona, rependa, Gossainthania, recurva, phœnicea, lycia, virginiana pendula, bermudiana, canariensis, virginiana glauca, depressa, dealbata, oblonga, o. pendula, Bedfordiana, virginiana variegata, flagelliformis, religiosa, and Chamberlaini have all stood well without protection, and are all fine healthy specimens.

Smilax sarsaparilla, tamnoides, glauca, quadrangularis, virginica, hastata, aspera, and caduca have not been harmed in the least; while S. laurifolia has been killed to the ground.

Ruscus racemosus and aculeatus laxus are uninjured.

Yucca, stricta, recurvifolia, filamentosa, f. angustifolia, and glaucescens have proved quite hardy.

[The names are given as they were received from Mr. Barnes: but some of them are unknown to us.]

XXX.—*On Retarding the Blooming of Fruit Trees.* By John Saul, Durdham Down Nursery, Bristol.

(Communicated August 29, 1850.)

It strikes me that the majority of gardeners proceed upon incorrect principles in regard to protecting the blossoms of fruit trees in spring. I do not consider protection unnecessary; on the contrary I believe it to be highly beneficial when scientifically and properly applied. In my opinion, the great aim of the fruit grower should be to retard to as late a period as possible the blooming of his fruit trees, and when blossoms do come to protect them with care. In the 'Gardener's Chronicle' of April 27, Mr. Errington makes some excellent remarks upon this subject, stating at the same time his own experience and remarkable success in the matter.

In the first place let us consider the native climate of our hardy fruit trees, and we shall arrive with more certainty at correct conclusions. Take for example the Apricot and Peach: in their native country they are subject to intense heat during summer, which well ripens the young shoots; this is followed by extremely cold winters, which the trees are well enabled to withstand on account of the firmness and solidity of their wood. In the middle States of North America, where these fruit trees are cultivated to an immense extent, more particularly the Peach, the climate is similar to what I have been describing. The winters are not only severe, but long; the springs are short, though at night severe frosts frequently occur up to the time when these fruit trees commence expanding their flowers; about the latter period nearly all frosts disappear, and crops of fruit follow, of the abundance of which we have in this country little conception. This would lead us to infer that frost or cold does little or no injury before the flowers are expanded, a fact I believe now generally admitted by gardeners. Before they burst into bloom in spring, I have seen many varieties of fruits with their bloom buds completely browned by cold winds and frost, which upon fine weather setting in have expanded freely, apparently not much the worse for the effects of the previous severe weather, and they have set abundant crops. I am aware of the sad havock frosts make among them when in bloom, an occurrence which at times also happens in some localities in America, when the crops of the whole district for the season are destroyed.

Let us now observe the treatment which the same fruit trees receive in this country. They are planted on shallow, well-drained borders, trained with all due care and attention on good south walls, in order that they may have as much heat and light as is possible for them to receive in our murky atmosphere, and which makes up for the deficiency of the bright light and intense heat of America or the East: so far so well; but I fear the autumn management of these trees in general is not what it should be. Growing as they do in countries such as I have been describing, where the burning summer's sun heats the ground intensely, followed by a dry clear warm autumn, the tissue of the wood acquires a maturity unknown in a climate like our own. If they cannot have an autumn such as their native country gives them, should not our cultivators meet the difficulty in another way?—Why not protect the borders from wet? This I know is now done by some of our best gardeners, though it is not so generally practised as it should be. And if the Peach and Apricot walls are heated (as they ought to be), they should be kept well warmed during autumn in order to assist the perfect ripening of the wood.

We shall now pass by their winter treatment and commence with the end of the month of February. The trees are then pruned and nailed. At this season we sometimes experience some warm sunny days. Early in last March we had a week or more of hot sunny weather. During this time the sun is permitted to shine on the wall in all his brilliancy; the wall absorbs the heat which he communicates by day, and radiates it at night; this speedily brings the Apricots and Peaches into full bloom. Protection is then afforded in the shape of fir-branches, canvas, &c., to guard the flowers from cold winds, frost, &c.; and with all the care a gardener can bestow, he but too frequently loses the greater portion of his crop. While the trees are in bloom cold weather returns, accompanied by severe frosts, piercing winds, sleet, &c.; and with all the protection at a gardener's command, he finds it impossible to get his blossoms to "set well:" hence a failure takes place. This, in general, is what is termed a bad fruit season; and what else could be expected under the circumstances? Now, what is a good fruit season? A severe winter, with a cold backward spring, having little or no sunshine—the less the better; or, in other words, a season approaching what is peculiar to America, where the Peach is cultivated with such success. We say that such seasons "keep back vegetation till its proper time," *i. e.* until fine weather has arrived, and then every description of fruit-tree blooms and sets freely. Now why not imitate these "cold backward springs" and transatlantic seasons by retarding the blooming till kindly weather has set in? In the middle of February I would commence to protect the trees and walls from every ray of sunshine up to the time when the trees are fully in bloom, exposing them all night, and during the mornings and evenings, to the cold, be it ever so severe, whether wind, sleet, or frost; for finding as we do that they do not suffer from the like visitations in America before they are in bloom, we need not fear them here. At this early period of the season the sun will not generally shine more than a few hours every day; but during whatever length of time he does shine, the trees and wall should be covered. I mention the latter, as it is important to protect it from the sun's rays in order to prevent radiation at night, which would take place if it was left exposed. No fears need be entertained of "drawing the bloom" during the time this protection is given to the trees and wall. The long cold nights, with the equally cold mornings and evenings, during which time the trees are exposed, with the sun's rays shut off by day, will retard the blooming, without weakening the blossoms, to a much later period than many might be led to suppose. Indeed, as late as is necessary this course should be followed until the trees are fairly in bloom, then the blossoms must be protected at night, and from bad weather during the day. The transition from retarding to affording protection must be gradual, but steady. The kind of weather to guard against is severe frosts, sleet, cold rain, hail, &c. Cold, dry, clear weather does little injury to the bloom. In confirmation of this, I have a garden under my eye in which the trees (Apricots and Peaches) received no protection during the past spring, and yet they have set most abundant crops. The situation is high, dry, and very cold; and the trees, when in bloom in March, experienced frequently 8 or 10 degrees of frost, accompanied by a very clear dry atmosphere. I do not however advocate the exposure of trees to such degrees of cold: on the contrary, it is better to guard against it.

The kind of protection I would use is canvas, or any material that would effectually exclude the sun's rays whilst retardation is going on. Spruce fir branches, however useful in the old system of protection, would not be suitable here. The canvas will be found a better protection against sleet, hoar-frosts, and all moisture during blooming-time, than branches would be. It is incalculable to what an extent retardation may be carried. Pyramidal pears, with Mr. Rivers's calico protectors, may be retarded until late, and richly they deserve it. Many of the very finest and most beautiful French and Belgian varieties swell their buds and burst into bloom early, and under the present system of mere protection they are cut off by frosts; while, on the other hand, had they received a little timely retardation, the result would in general be very different.

XXXI.—*Report on New Fruits and Vegetables which have been produced in the Garden of the Society.* By R. Thompson.

(Sept. 3, 1850.)

1. Bromham Hall Melon.

Seeds received from Mr. E. Tiley, of Bath.

From 2½ to 4 lbs. weight, roundish, a little depressed at the stalk and crown, indistinctly ribbed, more or less netted, greyish green, usually tinged with yellow next the sun. Flesh green, close-grained, very rich and sugary. It is tolerably early, and a good bearer with similar treatment to that required for the common green-fleshed melon. This sort has taken the lead of prizes for the last two seasons.

2. Winnigstadt Sugar-Loaf Cabbage. *Chou pointu de Winnigstadt.*

Presented to the Society by M. Vilmorin, of Paris.

This bears considerable resemblance to the Pomeranian Cabbage as regards form; but its leaves, till blanched, have the glaucous hue of broccoli or cauliflower leaves. It hearts firm, and boils tender. Its cultivation is similar to that of other late cabbages. Whether it is as hardy as the Pomeranian Cabbage remains to be proven, but it stood last winter very well.

3. Pomeranian Cabbage. *Chou conique de Poméranie.*

This was obtained from M. Vilmorin, of Paris.

It is remarkable for its conical tapering form, very compact, and firm to the apex. It is very hardy, and may be cultivated like other hearting cabbages. But it may be interesting and useful to know that at Maçon, in France, the market-gardeners take it up out of the quarters when full grown, before winter, and lay it in the soil to the neck in a sloping direction. Thus treated it withstood the severe winter of 1847. The quarters thus cleared can be trenched and prepared for other crops,—an important advantage in small gardens. It is likely to prove valuable in colder situations than is suitable for the Battersea and other cabbages grown in the neighbourhood of London.

4. Haricot d'Alger.

Presented to the Society by M. Vilmorin, of Paris.

In the 'Bon Jardinier Almanach' for 1850 it is stated that this excellent variety has been long cultivated in Lorraine, and that it has been lately reproduced under the names of *Haricot beurre*, *cire*, &c.

The pods are of a pale colour, and entirely destitute of any tough lining to the pod. They are exceedingly tender, and excellent when cooked.

The plants are runners, and consequently require sticks, or to be topped, if sticks cannot be afforded. It would probably not suit growers for the market, as it is not so early as the dwarf sorts usually cultivated, and its pale colour would not be attractive; but, when known, it will doubtless be esteemed for private gardens.

5. Wilmot's Black Hamburgh Grape.

Presented by Mr. Wilmot, of Isleworth.

The berries of this are larger than those of the common Black Hamburgh, firmer-fleshed, and generally reckoned not so fine flavoured. It requires more heat than the Black Hamburgh. In order to ripen and colour it well, it must have a high temperature and abundant circulation of air.

6. Varieties of Peas.

Essex Champion.—Received from Mr. Glendinning. This is only a variety of the Early Frame, from which it has doubtless been saved, and over which it appears to possess no advantage either as regards earliness or productiveness. In some market gardens where the Essex Champion and Early Frame were this season extensively grown, the Early Frame proved the better of the two, and a few days earlier.

Warner's Early Emperor.—From Mr. Warner.

Warner's Early Conqueror.—From Mr. Warner.

Early Bedalean.—From Noble, Cooper, and Bolton.

Early Railway (or *Stevenson's Railway* of Mr. Wrench).—From Messrs. Garaway and Co.

Early Wonder.—From Mr. Waite.

These six may be considered identical. Warner's Early Emperor is stronger and taller than the Early Kent, not quite so early; but a few days earlier than the Early Frame.

Pois Malpeau.—Received from Messrs. Bossin and Co., Paris. Smaller podded than the Early Kent, but in other respects very similar to it. Evidently a breed, not improved, of the *Pois le plus Hâtif.*

Danecroft Rival.—Received from Mr. Glendinning;—

Danecroft Early Green.—From Mr. Warner. These proved the same; and are not different from *Farnes's Conservative Green Marrow*, from Mr. Farnes, and the *Transparent Pea*, from Mr. Charlwood, noticed in the Journal of the Society, vol. i. p. 168. It is a very remarkable sort, the foliage and pods being destitute of the usual glaucous hue; but this renders it objectionable for market; for, although recently gathered, the pods appear as if they had been much tossed and rubbed, like those that have been hawked about till the *bloom* on the pod is lost.

Clarke's Lincoln Green Podded New Early Marrow.—This proved to be not a Marrow Pea, but one in the way of Early Frame. Some plants had long, straight pods, containing 6—8 peas, about 12 days later than the Early Frame, which may have been accidental; but in general the dry seeds in the bag, as received from Mr. Clarke, are very similar to those of the Early Frame.

American Dwarf.—Received from Mr. Glendinning. Sown April 6th; fit for use July 8th; about 1½ foot high; pods flattish, containing 6—7 peas, of good quality, yellowish white when dry. A good bearer, ripening about a week or ten days later than Bishop's New Long-Pod. A very good dwarf variety.

Early Surprise.—Received from Mr. Epps. Sown April 6th; fit July 10th; a dwarf about 1½ to 2 feet high; pods large, thick, containing generally 6 large blue peas. The plants have the strong stems and vigorous habit of the Marrows.

Stubb's or Burbidge's Eclipse.—Received from Mr. Waite. Sown April 6th; fit for use July 12th; a dwarf, from 12 to 18 inches high; pods short, but well filled, containing 5—6 peas of good size, compressed, of a bluish olive-green colour when dry. Tolerably prolific. Not being so early as Bishop's New Long-pod, it is not so valuable as that variety; but it is a very good dwarf for its season, having the peas larger perhaps than those of any other variety equally dwarf.

Early Blue Surprise.—From Mr. Waite; proved to be the same as

Fairbeard's Early Surprise.—From Mr. Glendinning. Described Hort. Soc. Journal, vol. i. p. 168.

The Champion of England, received from Mr. Waite, is the same as

Fairbeard's Champion of England, from Mr. Glendinning. Described Hort. Soc. Journal, vol. iv. p. 272.

Thurstone's Reliance.—Received from Messrs. Bass and Brown. Sown April 6th; fit July 15th; 5—6 feet high; pods very long, some 4—5 inches, slightly curved, tapering, pointed, a little flattened, containing 5 to 8 large, white, marrow peas of good quality. In the present season it has not borne abundantly, but it deserves further trial.

Queen of England.—Received from Mr. Glendinning. Sown April 6th; fit July 15th; 5 feet high; pods roundish, containing 6 peas. A sort of White Marrow. *The British Queen*, described Hort. Soc. Journal, vol. iv. p. 272, is a variety much superior to this.

Noble's Green Marrow.—Received from Messrs. Noble, Cooper, and Bolton. Sown April 6th; fit July 10th; 4 feet high; pods short, thick, containing only 5—6 large roundish peas.

Ne plus ultra.—Also received from Messrs. Noble, Cooper, and Bolton. Sown April 6th; fit for use July 15th; 5—6 feet high; pods long, straight, flattish, containing 6—7 peas of good quality, some of an olive colour when dry, others yellowish white; all indented or wrinkled like Knight's Marrows. A good bearer.

Waite's King of the Marrows.—Received from Mr. Waite; resembles the preceding; dry peas somewhat larger and lighter-coloured.

Great Britain.—Received from Messrs. Garaway, Mayes, and Co. Sown April 6th; fit for use July 22nd. Similar in every respect to Knight's Tall White Marrow.

Hunter's New Marrow.—Received from Mr. Glendinning. Sown April 6th; fit for use July 18th; about the same height as Knight's Dwarf Marrow; pods roundish or a little flattened, containing about 6 large peas, larger than Knight's, of very sugary quality; when dry, indented; yellowish white. A good bearer.

7. Tomato Capsicum.

Received from M. Vilmorin of Paris. The fruit bears considerable resemblance to the large red tomato in form and colour. It is very productive, and much milder than the small sorts.

There is a yellow tomato capsicum, but it is stated to be more difficult to ripen.

8. Chou de Milan très Hâtif d'Ulm (Earliest Ulm Savoy).

This was received from M. Vilmorin of Paris, and is described in the 'Bon Jardinier' as being "very dwarf, quickly forming a heart, which, though not large, is excellent." It is the earliest in cultivation. The specimens exhibited were sown April 8th, along with other varieties of the Savoys, none of which are yet fit for use. It may be planted, in proportion to its size, considerably closer than the larger kinds. Notwithstanding the greater number that may thus be produced on a given space, the amount of produce would not answer the purpose of growers for the market; but in gentlemen's gardens it will be found very useful, on account of its earliness.

END OF VOL. V.

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PROCEEDINGS AT MEETINGS OF THE SOCIETY.

October 2, 1849. (Regent Street.)

Election. M. Jean Pierre Pescatore, 13, Rue St. Georges, Paris.

Awards. *Large Silver Medal:* To Mr. Fleming, gardener to the Duke of Sutherland, at Trentham, for a magnificent Ripley Queen Pine-apple. This beautiful fruit weighed 7 lbs. 10 ozs., and yet its crown was as small as it could be, if the proportions of the fruit were to be preserved. This is 11 ozs. heavier than the largest Queen Pine ever exhibited to the Society on any former occasion, and the fruit had all the appearance of being as good as it was handsome. It was grown on the Meudon plan, planted out in a warm bed of soil.

Banksian Medals: To Mrs. Lawrence, F.H.S., for a collection of Stove and Greenhouse plants; but more especially for an immense bush of Crowea saligna. To the same for nicely bloomed plants of Cattleya guttata, Oncidium Harrisoni, Dendrobium formosum, and Phalænopsis rosea.

Certificates of Merit: To Messrs. Henderson, of Pine-apple Place, for pretty bushes of Crowea saligna, elliptica, and stricta. The latter was much better coloured than the other two. To Messrs. Rollisson, of Tooting, for Ipomæa limbata; a species something in the way of Pharbitis Nil. It had handsome rich purple flowers bordered with white. To Mr. Bray, gardener to E. Lousada, Esq., Sidmouth, for a well-grown Queen Pine-apple, weighing 5 lbs. 3 ozs. To Mr. Brown, gardener at Wilton House, Salisbury, for an example of the same kind of fruit, weighing 5 lbs. 1 oz. To Mr. Rust, gardener to J. Maclaren, Esq., F.H.S., for a dish of Black Hamburgh Grapes, large in the berry and well coloured. They were stated to have been grown in a lean-to greenhouse, without the aid of fire-heat. The vines were planted about three years ago outside the house in common garden soil, and all the care taken of their roots since had been a little rough dung put over them in winter.

They are trained up every alternate rafter, and there is a Melon-pit the same length as the greenhouse, six feet from it, in which there is about four feet of warm tan for about eight months in the year. To Mr. Davidson, gardener to W. Stuart, Esq., F.H.S., for four bunches of Black Hamburgh Grapes, well coloured and swelled—in short, equal to the best of the average samples of Black Hamburgh. The circumstances of their production were thus described by Mr. Davidson :—" These grapes were grown in a house which, owing to the recent alterations and improvements carried out by Mr. Stuart, has been suffered to fall into the last degree of dilapidation ; while the flues have been for more than a year actually done away with. The houses have for many years been forced, and every precaution taken to ensure success in an early crop without any good results ; but since the removal of the flues, the vines have been subject to drip from the glass, a free circulation of air and a low light temperature, varying with the seasons, and, indeed, having been anything but killed with kindness. Notwithstanding, the whole crop has been better than for several years past, and has well ripened off; the quantity of wood the vines have made, and their general appearance, sufficiently indicate that, with proper care, a crop under the same circumstances may be expected in future years." The heaviest of the bunches exhibited weighed 1 lb. 7 ozs.

MISCELLANEOUS SUBJECTS OF EXHIBITION. Specimens of the famous Chasselas de Fontainebleau Grapes from Paris, of which it is said that 30,000 lbs. are sent daily to that city. Their condition explained the reason why they are never seen in London ; they do not bear carriage well. Although packed in Fontainebleau with much care, they were bruised, broken, and greatly injured. They showed, however, how Grapes alter their appearance according to their treatment; for no one could have recognised our Royal Muscadine in the little sun-burnt bunches from Paris. A letter which accompanied these specimens stated that, in the old kitchen garden of Versailles, the heavy, damp clay soil produces this Grape of very inferior quality ; whence the writer seemed to infer that the light loam of Thoméry was necessary to it. But it was suggested that the soil was immaterial, and that the dryness and warmth of Thoméry was the real cause of the excellence of the Grapes. The same letter also contained the following paragraph, which was brought forward to show the bad effects of burying putrid animal matters in Vine borders. "The manure which we sometimes must give, in order to keep up the full vigour of the Vines, invariably injures the quality of the fruit. It is, therefore, evident that manure should always be withheld, except when indispensable to the health of the Vine, and this is seldom the case, except in hot, dry land." Mr. Glendinning, of the Chiswick Nursery, sent Browalia speciosa, a rather pretty violet-flowered plant; Mr. Summerfield, gardener to J. S. Venn, Esq., of Highbury Park, a nice Odontoglossum grande; Messrs. Paul, of Cheshunt, boxes of Autumnal Roses, among which were beautiful blooms of Acidalie, Buist, Bréon, Abricoté, Elise Sauvage, Adam, Coronet, Dr. Marx, Safranot, Robin Hood, Madame Angelina, Jacques Laffite, La Reine, and Duchess of Sutherland. Mr. Munro, gardener to Mrs. Oddie, St. Alban's, produced a box containing eight bunches of well-ripened Muscat of Alexandria Grapes. Mr. Fleming exhibited two specimens of his Trentham hybrid Melon, weighing respectively 3 lbs. $6\frac{1}{2}$ ozs. and 3 lbs. 3 ozs. This is an oblong, bright yellow-coloured sort, raised between the Ispahan and Hoosainee. It was remarked that specimens of it from Trentham are generally well flavoured, but that it is rarely grown so fine elsewhere. Mr. Turner, gardener to W. Blake, Esq., of Danesbury, contributed a Gourd of the Potiron jaune kind, which weighed $116\frac{1}{2}$ lbs. It was mentioned that this kind of Gourd makes good soup, and that it is used for that purpose in France. Mr. Ivison, gardener to the Duchess Dowager of Northumberland, sent a fruit of Trichosanthes colubrina, or Serpent Cucumber. It was green, with lighter stripes of the same, but when ripe it becomes red, and is very ornamental. Dr. Lindley stated that some had endeavoured to obtain a cross between this and the common Cucumber, with a view of getting long Cucumbers; but he said it should be recollected that all Snake Cucumbers are poisonous, and that such a cross might prove dangerous to eat. Captain Martin, of Rutland Street, Regent's Park, produced an ingenious contrivance for enabling plants in pots to bear the dry climate of a drawing-room, and also to hide the pots. The invention consisted of a bottomless zinc case, painted ornamentally, and having the form of a common flower-pot; together with a zinc pan to hold it. Water being poured into the pan, and the pot covered by the zinc case, its sides will be necessarily kept moist by the damp air passing over them from the pan below. It was stated that the contrivance is apparently well suited for plants in sitting-rooms, its principle being that of the hollow-sided or double pot. Mr. Stuart showed a new kind of Garden-roller, which was reported to effect a perfectly level surface on walks. It consists of two common iron rollers placed in a frame, with a small horizontal cylinder moving on the walk between them.

NOVELTIES FROM THE SOCIETY'S GARDEN. Niphæa rubida, a worthless species, and Mr. Fortune's blue autumn-flowering Aconite (Aconitum autumnale), a very handsome kind.

BOOKS PRESENTED.

Monographia Generum Aloes et Mesembryanthemi. By His Serene Highness the Prince of Salm-Dijck. From the Author.
Flora Batava. No. CLIX. From His Majesty the King of Holland.
Catalogue of the Calcutta Public Library. From the Society.
Miscellanea Botanica. Nos. VI., VII., and VIII. By Professor Antonio Bertoloni. From the Author.
Transactions of the Royal Society of Edinburgh, Vol. XVI., Part 5, Vol. XIX., Part 1; and Proceedings of the Society, Vol. II., Parts 33 and 34. From the Society.
Transactions of the Horticultural Society of Berlin. Vol. XIX., Part 2. From the Society.
The Athenæum for September. From the Editor.

November 6, 1849. (REGENT STREET.)

Mr. H. Dobree, C.M.H.S., of Beau Séjour, Guernsey, communicated the following fact:—

"On the occasion of our last Fruit Show, a Chaumontel Pear of perfect shape, and of the remarkable weight of 2 lbs. 4½ ozs. English weight, was exhibited by my neighbour Mr. T. A. Corbin, and subsequently transmitted by him to Sir George Grey, with a request that it might be respectfully presented to Her Majesty. You may possibly recollect that I some years since transmitted a Chaumontel Pear to the Society, of the weight of 29½ ozs. English weight, being the heaviest which had hitherto been produced in any of our islands, and of which, if I mistake not, a model is to be seen in the Society's Museum. It may not prove uninteresting to know that the Pear produced by Mr. Corbin grew on a Quince-stock, and that no artificial means were employed to increase the weight of the fruit, of which there was in addition a fair crop on the tree itself; the soil is a deep strong brown loam, which is occasionally manured."

AWARDS. *Knightian Medal*: To Messrs. Loddiges, of Hackney, for a collection of Orchids, but more especially for a specimen of the rare Oncidium oblongatum, which is one of the handsomest of the small bright yellow-flowered kinds.

Banksian Medals: To Mrs. Lawrence, F.H.S., for Cymbidium giganteum, the Gongora-like Cycnoches barbatum, and two other Cycnoches, one with white and the other with yellow flowers, covered thickly with minute bright brown spots. The latter smelt strongly of honey. To Mr. George, gardener to W. Long, Esq., M.P., Rood Ashton, Trowbridge, Wilts, for a Queen Pine-apple, weighing 6 lbs. 4 ozs. To Mr. Henderson, gardener to Sir George Beaumont, Bart., for a fruit of the same kind of Pine-apple, weighing 6 lbs. 2 ozs. To J. G. Nash, Esq., of Bishop's Stortford, for beautiful specimens of Muscat of Alexandria and Black Hamburgh Grapes. The latter were well swelled and coloured, and the Muscats were quite ripe, large, and fine. The houses in which these Grapes were grown are heated with brick flues. The rafters are nearly 20 feet long, with upright sashes in front. There is a pit in the middle of each filled with tan, which is renewed annually. The glass is chiefly crown; but the lower sashes of one house are glazed with 16-ounce sheet. Ventilation is managed by opening the sashes in front, and sliding down those at the top. The Black Hamburgh Vines were planted in 1843, and cut back in 1844, when each at once made the whole of the single rod that furnishes the crop. These rods are now, on an average, 5½ inches in circumference, and run straight up the centre of each light, so that the leaves and bunches are exposed to all the light and air which the houses can furnish. The borders are admirably constructed. The houses are built on the side of a low hill, with a gravelly bottom. On the *surface* of the natural ground, which was coated with concrete, the border has been formed, 3½ feet deep at the back, and 2½ feet deep in front, so that it slopes from back to front, where it is rounded off. No rain can ever lodge there. It was formed with burnt clay (the bottom of some old brick-kilns), loamy turf from an old pasture, plasterers' rubbish, hair and trimmings of hides (called fleshings) from the tan-yards, and an enormous quantity of thoroughly rotten stable manure—the last border alone consumed a barge-load of 40 tons of such manure. All these materials, after being thrown together, were *thoroughly incorporated*. They form so loose a bed that a stick may be easily pushed through it to the very bottom. Every November these borders receive a good mulching of stable-manure, which remains to rot in the succeeding summer; so that the surface is always covered by a rich decaying material which absorbs heat from the sun, and detains the natural dampness of the border. The Vines are managed upon Mr. Crawshay's plan.

Certificates of Merit: To Mr. Davis, of Oak Hill, East Barnet, for very good Muscats; but inferior to those just mentioned. To Mr. Rivers, of Sawbridgeworth, for examples of his large fruited Monthly Raspberry. This sort produces fruit from lateral shoots, which it puts forth from every joint; and in this respect, as well as in the size and flavour of the berry, it is said to differ from the old Double-bearing Raspberry. To Mr. Bray, gardener to E. Lousada, Esq., Sidmouth, for a Queen Pine-apple, weighing 5 lbs. 3 ozs. To Messrs. Henderson, of Pine-apple Place, for a handsome hybrid Veronica, raised by Mr. Anderson, of Maryfield, near Edinburgh, between V. speciosa and V. salicifolia, or Lindleyana, and named V. Andersonii. The flower spikes are thicker than those of V. salicifolia, and much less thick than in V. speciosa, while the foliage is nearly intermediate between the two. When the blossoms first appear they are violet; but they gradually change to white. In the plant exhibited one-half the spike was white and the other violet, producing a charming contrast.

Miscellaneous Subjects of Exhibition. Oncidium Forbesii, from Messrs. Rollisson, of Tooting. One of the Feather Grasses (Stipa pennata elegantissima), from Messrs. Henderson. The sweet-scented, white-flowered Verbena trifida, from Santa Martha, from the Duchess Dowager of Northumberland. It was mentioned that this would cross with our common garden sorts, and that the result would in all probability be a race of sweet-scented Verbenas. The same establishment also furnished two Nutmegs, quite ripe, split, and showing the red-coloured mace, which covered the seeds—the Nutmegs of the shops. Before they split they look not unlike middle-sized Peaches. Two specimens of Providence Pine-apples, weighing 7 lbs. 9 ozs. and 7 lbs. 7 ozs., were exhibited by Mr. Davis, market gardener, Starch Green, Hammersmith; and Mr. Bundy, gardener to Lord Dynevor, Dynevor Castle, Llandilo, showed two Queen Pines, whose weights were 5 lbs. 5 ozs. and 4 lbs. 7 ozs. They were stated to have been raised on the Polmaise system of heating, and not to have been sent as extraordinary examples of growth, but to show that good Pine-apples can be produced as well by Polmaise as by any other system of heating. Mr. Bundy grows his Pines on Hamilton's system, planted out in the bed. The two fruit shown were stated to have been grown upon single plants, by which is meant that one sucker only had been left on the stool instead of two, which is Mr. Bundy's usual practice, in order that he may obtain a large supply of fruit. Mr. Groom, gardener to Mrs. Bentley, Eshald House, Oulton, near Leeds, sent good bunches of Black Hamburgh Grapes, from an open-flued wall. They received no protection except what a net, put on to keep the birds off them, afforded. The Vine on which they grew was stated to cover a piece of wall 67 feet long and 11 feet high. Last year it produced 300 bunches, this year the crop is quite 400 bunches. The Vine is about 17 years old, and is stated to have doubled its size during these last 3 years. It rises from the ground with a clean straight stem 15 inches in length. A branch is then trained horizontally on either side of the stem, and the bearing shoots are led off this perpendicularly, 15 inches apart. The young shoots grow the height of the wall in one season, and ripen perfectly to the very top. In this situation good average Grapes are produced, but the rain and frost spoil many of them before they can be used; it is therefore contemplated to put a temporary roof over them next season. W. S. Grey, Esq., Norton, Stockton-on-Tees, Durham, sent a Jargonelle Pear, ripe and of a fair size, the produce of a second crop from the same tree this year. The tree was stated to grow 8 miles north of Norton, against the south side of a house; it is about 25 years old, and was removed into its present place when it was about six or seven years old. After the fruit has well set in summer it flowers again on the young wood, and perfects a second crop, consisting this year of between two and three dozen fine Pears spread all over the tree. These Pears swell and ripen well; but are seedless—at least the one shown was in that condition. J. Mannington, Esq., of Uckfield, again sent specimens of his Seedling Apple, called Mannington's Pearmain. It is a nice-looking sort, Pearmain shaped, tinged with red on the sunny side, well flavoured, and said to bear and keep well. Specimens of Forty-day Maize and of Cobbett's Corn were exhibited by Mr. Charlwood, of Covent Garden. They had been sown in a garden at Putney, in the middle of May, and raised without heat. They had ripened well, as Indian corn will generally do in warm sunny spots in a favourable season like the past; but it was remarked that it would never become a profitable crop in the climate of England. The nature of Indian Corn is well known. Boussingault's description of it is one of the latest and best. "Maize," says this great authority, "succeeds in all kinds of soil, provided they are suitably manured; I have seen excellent fields in sandy land and in the heaviest clay. The treatment which it requires is such as is necessary to other cereal crops; it is *climate alone* which determines its fitness for a given locality; it must have a proper amount of heat, and more especially security against too low a temperature. *The susceptibility of Maize in regard to climate appears to me to be exactly analogous to that of the Vine, and I doubt the wisdom of attempting to cultivate it on a large scale in places where Grapes do not regularly ripen.*" Messrs. Lawrence, of Parliament Street, contributed specimens of zinc labels, which looked as if they would prove useful.

NOVELTIES FROM THE SOCIETY'S GARDEN. The Sweet-scented Epidendrum ceratistes, and Oncidium varicosum.

BOOKS PRESENTED.

Mémoires de la Société de Physique et d'Histoire Naturelle de Genève, tome 12, Première Partie, et Premier et Second Supplément au tome 12. From the Society.

Paper on the Destructive Powers of the Scolytus Destructor and Larva of the Cossus Ligniperda. By Dr. Cox. From the Royal Botanic Society of London.

The Athenæum for October. From the Editor.

December 4, 1849. (REGENT STREET.)

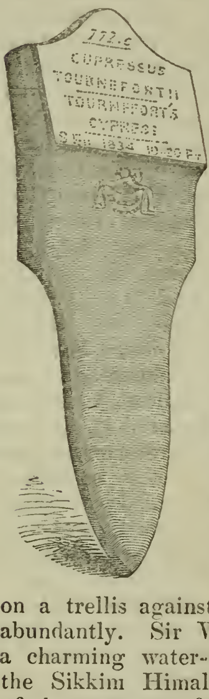
ELECTIONS. His Grace the Duke of Hamilton, Easton Park, Woodbridge; S. R. Heseltine, Esq., Chase Side, Enfield; T. Henry, Esq., Bush Hill, Edmonton. Also as Home Corresponding Members, Mr. H. Bailey, gardener to G. Harcourt, Esq., Nuneham; Mr. R. Errington, gardener to Sir P. G. Egerton, Bart., Oulton; Mr. T. Ingram, gardener to Her Majesty at Frogmore; and Mr. A. Toward, gardener to Her Majesty at Osborne.

AWARDS. *Knightian Medal:* To J. H. Schröder, Esq., F.H.S., for 3 charmingly bloomed plants of the rosy purple Barkeria Skinneri, each plant bearing from 12 to 15 flower-spikes, the graceful Two-lobed Augræcum, and a nice plant of Vanda tricolor.

Banksian Medal: To Mrs. Lawrence, F.H.S., for well-managed specimens of Vanda Suavis, V. tricolor, and Saccolabium denticulatum.

Certificates of Merit: To Mr. Munnock, gardener to E. Druce, Esq., F.H.S., for an exceedingly well-cultivated Cypripedium insigne, on which there were 27 perfect blossoms. To Messrs. Jackson, of Kingston, for three varieties of the beautiful Lælia autumnalis. To the same, for a specimen of the well-known but scarce Vriesia speciosa, bearing a long, feather-like spike of crimson floral leaves, in which the beauty of the plant alone consists. Messrs. Jackson stated that the flower-spike, after it had somewhat advanced, was much improved both in size and beauty by keeping the heart of the plant out of which it issued full of water. To Mr. Wilmot, F.H.S., for a little-known kind of Pine-apple, named Black Prince, weighing 5 lbs. 6½ ozs. It resembled the sort called Buck's Seedling or an Enville ; but it was stated to be better flavoured than the latter, to keep better, and not to be so liable to decay at the core. It is reported to have been raised by a Mr. Entwistle, near Rochdale, who has grown it nearly 10 lbs. weight, and of excellent flavour. It is a first-rate Pine-apple.

Miscellaneous Subjects of Exhibition. Very fine specimens of Cannon Hall Muscat Grapes from J. Nash, Esq., of Bishop's Stortford. A Blood Pine-apple, weighing 3 lbs. 12 ozs., from Mr. Wilmot, F.H.S. The extremely rare and beautiful Vanda violacea, and 3 small plants of the Orange-flowered Aphelandra aurantiaca, from Mrs. Lawrence, F.H.S. The delicate Odontoglossum membranaceum and other Orchids from Messrs. Jackson. Zygopetalum Mackayii from J. S. Venn, Esq., of Highbury Park. A seedling Heath, called elegantissima, raised between E. Hartnelli and hiemalis, from Mr. Henderson, of the Wellington Road Nursery, and a dwarf handsomely-flowered Chrysanthemum from Mr. Moore, Apothecaries' Garden, Chelsea. "The accompanying plant of Chrysanthemum," Mr. Moore stated, "is part of the result of a rough trial to grow these showy autumnal subjects in a more compact form than that in which they are generally seen. It is the best of half-a-dozen, of which two or three were failures, in consequence of the flower-buds going blind. This plant, however, though past its best, shows, I think conclusively, that Chrysanthemums may be grown to very great perfection as regards the proportions of the plants, and that it is by no means necessary to have them with such bare and lanky stems as the generality of even tolerably bushy plants are seen to possess. The plants experimented on in this case were single-stemmed cuttings without roots in March of the present year. They were planted in the ordinary way, and, when rooted, potted singly, sheltered for a month or two in a cold frame, and during the remainder of the summer, up to the end of September, have stood exposed on a gravel walk. They were first topped when about 3 inches high, that is, as soon as they were established separately ; and from time to time, as soon as shoots had grown to this length, more or less, they were again and again topped, making in all three toppings. They were shifted twice, first from the small pots into 8-inch ones, and from these into 12-inch pots, in which they are growing. Towards the end of September they were placed in a light, airy greenhouse, where they have remained ever since. Further than this they had no special attention. The plant sent is 20 inches high and 20 inches across; it has 31 stems or branches, of which 28 bear one or more blossoms each. I may mention that Fortune's Chusan daisy, naturally a dwarf and compact grower, was not at all improved by this attempted dwarfing process; but as regards the abundance of bloom it was considerably deteriorated. The plant sent has not required any stakes or support, except for the purpose of transmission." It was mentioned that plants grown in this way are very apt to go "blind," and that the best plan is to layer them, and then take them up for the purposes of decoration. Mr. Rauch, of Turnham Green, produced the accompanying specimen of a tally, being the kind used in the Derby Arboretum. It was made of some sort of hard earthenware, and faced, where the name was written, with a lighter-coloured and finer description of the same sort of material. The name is inscribed while the label is soft, and it is then burned in. This kind of label was stated to be durable, and not very liable to break; but it is rather expensive, the price being 1*s.* 3*d.* each. Mrs. Dorvell, of Oxford Street, exhibited some beautiful wax flowers. Very fine ripe fruit of Benthamia fragifera, some of it measuring 6 inches in circumference, was furnished by H. W. Stephens, Esq., of Bishop's Teignton, Devon. The plant which produced it was stated to be trained



on a trellis against the wall of a house, where it bears abundantly. Sir W. J. Hooker, of Kew, communicated a charming water-colour drawing of the country where the Sikkim Himalayan Rhododendrons are found, and of the costume of the natives. Dr. Lindley produced a specimen of counterfeit rough plate glass, in illustration of the frauds of certain dealers in glass; and Mr. Wilmot, of

Isleworth, sent two branches of a Nelis d'Hiver Pear-tree, attacked by a new blight called Eriosoma Pyri, which has been thus described and figured in the 'Gardener's Chronicle' for the 1st of December:—"The accompanying figure is a representation of one of the most remarkable instances of the effects of the attacks of insects upon vegetable structures which has ever fallen under our notice. It is a portion of a branch of a Nelis d'Hiver Pear, grown against a wall in the garden of Mr. Wilmot, of Isleworth. The branch sent appears to be three years old, and was evidently once in fine healthy growth, but the shoots are now very generally covered, on the *side next the wall*, and in some parts even all round, with a vast number of woody knobs united

into solid masses, so that the portion of the branch now before us weighs about half a pound. It is not a little curious that the shreds and nails used in fastening the branches to the wall are also embedded in the solid growth of the tubercles. Out of the mass has grown a number of two-year old shoots, none of which are more than $1\frac{1}{2}$ inch long, and at the tips of these are to be seen the buds of the present year, which have never grown beyond the size of buds; in fact, the natural growth of the tree has, in this part at least, been entirely interrupted, and the whole power and energy thrown into the elaboration and growth of tubercular masses of wood. The agent which has produced this disease is a species of aphid nearly allied to the American blight of the Apple. At the present time the tubercles and adjacent part of the stem are clothed with a fine grey powder, and the former are thickly studded with minute white particles, which are the cast-off skins of innumerable aphids, which are of a very small size, and are seen crawling about the knobs. In the absence of the winged states of the insect we shall abstain from giving a technical description of the species, which may be named *Eriosoma pyri.* The small wingless individuals are greyish black, with white woolly matter exuding from the hind part of the body, the antennæ six-jointed, with a very small appendage or joint at the tip of the sixth joint, and the tarsi are two-jointed and terminated by two claws. The size of the largest of the individuals we have met with is shown near the * in our woodcut. For the size of the insects the proboscis is remarkably strong, being at least twice as thick as the legs or antennæ; and it is this instrument which has produced all the disorganization which we have described. It would lead us into a wide field to inquire into the effects produced on different kinds of plants by the punctures of insects, effected either by the proboscis, for their own food, or by the ovipositor, for the establishment of a situation for the safe deposition of the eggs. The question also involves the fact whether the growth of these and similar tubercles or galls is produced partially or entirely by the introduction of some irritating fluid discharged by the insect into the wound, or simply by the effect of the wound itself. How far too the state of the plant at the period of the infliction of the wound may tend to the greater or less development of these galls, is also to be determined; at all events it is perhaps certain that, under all circumstances, the attacks of this particular kind of aphid, upon any kind of Pear-tree, would result in the formation of galls of a larger or smaller size, in which case we may perhaps be correct in considering this aphid as a new importation, as dangerous as the American blight. The specimen is further interesting, from showing that results, apparently identical, occur from wounds inflicted, whether by the proboscis or ovipositor of insects. Many instances are recorded of large woody galls being found on different trees: the large root-galls of the Oak and Elm, caused by the deposition of the eggs of one of the Cynipids (see 'Gardener's Chronicle,' 1841, p. 732); the hard woody galls of the Willow, caused by a minute midge; and the galls of the Thistle, produced by Tephritis Cardui, are instances in which insects of different orders are found to be capable of causing the growth of hard woody masses; but in all these cases the effect is produced in order to afford a place of safety for the eggs, and the supply of a sufficient mass of food for the young insects when hatched; but in the instance before us the mass of matter is for the latter object only, and it is this kind of excrescence which Rennie, in his 'Insect Architecture,' has termed pseudo-galls, giving several examples obtained from different trees, some of which, however, may have been the result of disease in the plants, independent of the attacks of insects. The numerous minute aphids now on the branches of the Pear-tree in question may be destroyed by hot water, or by washing the branches with the oily mixture used in killing the American blight. One very curious circumstance attending this attack is, that the aphids in question have confined themselves to the Nelis d'Hiver, and have touched no other Pear tree in Mr. Wilmot's extensive grounds."

NOVELTIES FROM THE SOCIETY'S GARDEN. Abronia umbellata, a plant requiring nearly the same kind of treatment as a Verbena.

BOOKS PRESENTED.

Hooker's Journal of Botany and Kew Garden Miscellany. No. 12. From Sir W. Hooker.
The Quarterly Journal of the Geological Society. No. 20. From the Society.

January 15, 1850. (REGENT STREET.)

AWARDS. *Certificate of Merit*: To Mr. Davis, of Oak Hill, East Barnet, for three dishes of West's St. Peter's Grape, well coloured, plump, and finely bloomed.

MISCELLANEOUS SUBJECTS OF EXHIBITION. An unnamed Odontoglossum, apparently O. maxillare, from Messrs. Jackson, of Kingston. A variety of Chorozema cordatum, not very showy, and called flavum, from Mr. Henderson, of the Wellington Road Nursery, St. John's Wood. Two bunches of Muscat of Alexandria Grape from Mr. Davis, of Oak Hill, East Barnet; and a collection of Pears and Apples from Messrs. Paul, of Cheshunt. The latter contained some nice-looking specimens of both kinds of fruit, but as they were not cut up no opinion of their qualities can be given. Messrs. Paul stated that "the novelties among the apples were De St. Sauveur and Reinette du Vigau. The former is a very large fruit, pale yellow, and slightly streaked with crimson on the one side. It is of the first quality, bears freely as a standard, and is in greatest perfection in November. Reinette du Vigau is also a large fruit, similar in colour to the preceding, less handsome but of first-rate quality, and in perfection from February till March: this also bears well as a standard. The greatest novelty among the pears is the Bergamot d'Esperen, which is a melting pear of first quality, in perfection in February and March. Suzette de Bavay is an excellent fruit, not over large, skin clear yellow, oblong, melting, free bearer, and in season in January and February. Vrai Amberg is a regular shaped oval fruit of moderate size; skin pale yellow, a little russety: it is of the first quality, melting, and in season in December and January. Colmar des Moulides, and Passe tardive, are also new pears, but appear at present of doubtful merit." Mr. Little, of Lock Hall, Bath, sent specimens of "metallized gutta percha labels"—neat, but not so legible as could have been desired; and doubts were expressed whether or not they would be found to stand the weather. Mr. Morrell, of Fleet-street, contributed examples of his zinc-backed labels, whose cheapness and ready use render them convenient for many purposes; and finally, Dr. Lindley drew attention to a specimen of the old-fashioned stamped leaden label, which is one of the most lasting, and when the face is nicely painted so as to leave the sunk letters black, it looks both neat and legible.

BOOKS PRESENTED.

Annales de la Société Centrale d'Horticulture de France, Volume Quarantième, numeros d'Octobre, de Novembre, et de Décembre, 1849; Rapport de la Commission nommée pour examiner une Communication relative à l'Exposition Industrielle Quinquennale de 1849; and Rapport du Comité du Jardin sur la situation du Terrain d'expériences et l'état des cultures en 1848: from the Central Society of Horticulture of France.
The Athenæum for December. From the Editor.

February 19, 1850. (REGENT STREET.)

AWARDS. *Large Silver Medal:* To Mr. Duncan, gardener to the Rev. C. Fox Chawner, of Bletchingley, for a magnificent specimen of Dendrobium speciosum. This Orchid is one whose low price enables most growers to possess it, and whose peculiarities of constitution generally defy all efforts at making it blossom; the few have succeeded, the many have failed, although among the latter are to be reckoned some of the best gardeners in the world. The plant in question was about 12 feet in circumference, reckoning from the ends of the flower racemes, of which it had 35, each averaging about 75 flowers, of the most delicate cream colour, veined with violet. Therefore, about 2625 of these flowers were expanded or ready to expand at the same time. It is impossible to do justice by words to the appearance of such a specimen, nor is it easy even to imagine the extent of its beauty. It might be said to be a fountain of flowers. Dr. Lindley observed, that "the history of such few successes and so many failures, in regard to this plant, is briefly told. Many Dendrobes inhabit the hottest and dampest parts of Asia, where the season of rest is short, and the temperature while they are growing excessive. Hence the warmest part of the stove is their habitation, and moss perpetually moist their favourite soil. The object of the cultivator is to imitate the jungles of the Malay Archipelago, where there is not more than two or three degrees of difference in the quarterly mean temperature of the year. At Singapore, for example, it appears that the mean temperature ranges near 80° all the year round, there not being a difference of more than $3\frac{3}{4}$° between the means of the hottest and coldest months: and at Buitenzorg, the Botanic Garden of Java, the difference is said not much to exceed $2\frac{1}{2}$°. But the family of Dendrobes is a very large one, comprising members of most dissimilar habits and constitution, some Alpine species appearing upon the branches of Oaks and tree Rhododendrons in the Himalayas, and others inhabiting the arid forests of New South Wales. It is, therefore, evident that the cultivation suited for species from Singapore would be inapplicable to those from Australia and Northern India. Inattention to this circumstance is what has produced the failure of so many, and the success of so few, in the management of the showy Dendrobe. That plant is wild in New Holland, where it is said to occur as far south as Port Jackson, and also within the tropic. It has been brought from Port Bowen, in latitude 22° 50′ S. The characteristic of this Australian climate is long dryness, moderate mean temperature, and excessive difference between the cold and warm periods. It appears from Sir Thomas Mitchell's observations, as quoted in the Journal of the Society, that in latitude 29° S., which may be taken as a middle point for the range of this species, in the summer there is a difference of 41° between the day and night, and the lowness of the night temperature throughout the year must greatly depress the average of diurnal temperature. Where this great explorer found an epiphytal Orchid in flower (*Cymbidium canaliculatum*), the night temperature was as low as 33°, and that of the day not more than 86°. It is therefore evident that the constitution of plants, placed by nature in such a climate, must be essentially different from that of species from the jungles of India. The following memorandum by the Rev. Mr. Chawner's gardener, brief as it is, explains distinctly the history of this noble specimen: 'The plant has been grown in an intermediate house, varying from 45° to 55°, for the last three or four years; during the summer the house is kept from 65° to 75°. Last May the plant was put in a cold pit and exposed to the sun, with very little water; in September it was put back into the intermediate house, and has since that time had plenty of water.' Nothing can better express the conditions which are most favourable to the health of this and all such plants. During the season of rest the Dendrobe is stowed away in an unheated pit, where its surface is acted upon freely by air, and such sunlight as the season naturally affords; at this time it has little water. In the month of September, the beginning of its own natural spring, it is introduced to a better climate, where the heat is 20° or 30° higher; water is gradually supplied; as it fully renews its vegetation it receives this kind of food in abundance. Then it is that the latent vigour acquired during its rest begins to manifest itself; the organisable matter which was formed during a period of dryness and sun-warmth is rapidly converted into new parts; blossoms appear in profusion, and, by the month of February, they gush forth in one vast floral stream. In May the new growth is accomplished; all the parts are fully organised and charged with the rich fluid which is to furnish further blossoms after some months' digestion in dryness and lethargy, under the influence of sun and air. In May the plant is transferred to the place whence it was taken in the previous September, and there it remains till the September following. This would be the history (Dr. Lindley further remarked) of all New Holland plants, and of half the other plants in gardens, if means existed for carrying out the practice. This *is* the history of the noble specimens of Azaleas, Cactuses, and other prodigies which grace the Exhibition tents of the

Society in the months of May and June. Moreover, the principle upon which Mr. Chawner's gardener proceeded is applicable, with some modifications, to almost every plant that is known to us. To the Orchids from the highlands of Mexico and Guatemala it is indispensable; it is suitable to those of Brazil, Continental India, and China; it is applicable alike to greenhouse plants and stove plants, to forced fruits, and those which naturally inhabit climates which render 'forcing,' strictly so called, the only method of cultivation that is applicable in a country like England."

The Knightian Medal: To Mr. Dobson, gardener to Mr. Beck, F.H.S., for a nice collection of Orchids, consisting of Cyrtochilum maculatum, four finely-bloomed Oncidiums, Cœlogyne flaccida, and the fringe-lipped C. cristata.

The Banksian Medal: To Mr. Bevington, gardener to Mark Philips, Esq., F.H.S., for a bunch of Black Barbarossa Grape, weighing 4 lbs. 13 oz. This is a Grape which was imported a few years ago from the Continent, and about which very little is known. It grows to a large size, and is an excellent winter and early spring sort, keeping plump and good after other Grapes are out of season.

Certificates of Merit: To Mr. Beck, F.H.S., for a group of nicely-grown and bloomed Cinerarias, consisting of Cerito, Nymph, Maid of Artois, Bessy, Gem, and Adela Villiers. To Mr. Ingram, gardener to Her Majesty at Frogmore, for a bundle of Asparagus, containing 100 shoots, which weighed collectively 13 lbs. It was "White Asparagus," and had been produced in low glazed pits, of which the plan in the next page will give some idea.

Miscellaneous Subjects of Exhibition. A small imported plant of the variety of Dendrobium aureum called heterocarpum—a very fragrant kind, from Messrs. Veitch. An example of Calanthe vestita, from Borneo, and a cut specimen of Burlingtonia rigida, from Mr. White, gardener to A. Kenrick, Esq., of West Bromwich. A prettily flowered plant of Primula altaica, a purple species, from the Asiatic side of the Bosphorus, from Mr. Turner, F.H.S.: it is quite hardy, and when potted and placed in the greenhouse is very ornamental in early spring. Mr. Ingram sent a specimen of Ceanothus dentatus, a new, deep blue species, imported by the Society from California, and expected to be hardy. It was not sufficiently in bloom, but it was

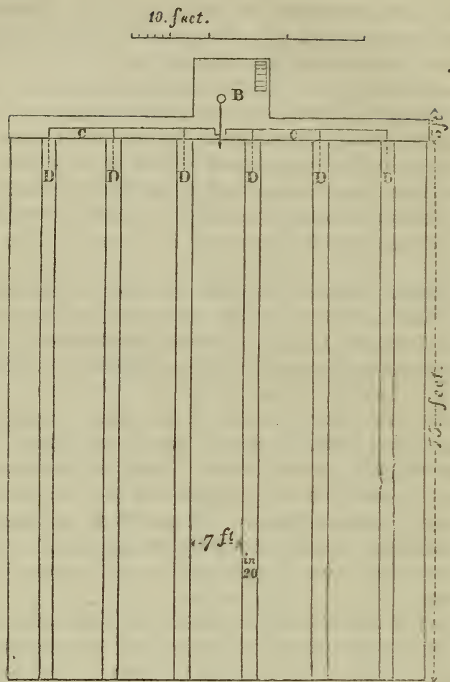


Fig. 1.

Fig. 2.

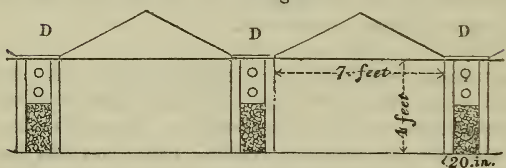


Fig. 1. A ground plan of five pits, 75 feet in length and 7 feet in width, sunk to the depth of 4 feet. B, boiler (technically called a saddle-boiler); C, space for two main-pipes which spring directly from the boiler, and from which is conducted a flow and return pipe between every divisional space marked D; the lower part of each division is filled with rich soil to the depth of 2 feet; the sides of the pits have holes (termed pigeon-holes); the upper space of 2 feet is left vacant for the radiation of heat from the pipes. The divisions are 20 inches across.

Fig. 2. A section of two pits, showing the beds, pipes, and roof; which last, as above stated, is composed of wood.

PLAN AND SECTION OF ASPARAGUS PITS IN H. M.'S GARDEN AT FROGMORE, REFERRED TO AT P. XIX.

covered with flower-buds, and promised to be a valuable acquisition. Mr. Frost, gardener to Lady Grenville, at Dropmore, sent a purple Azalea, called Howardii. Mr. Henderson, of St. John's Wood, had a small plant of the violet purple Mirbelia floribunda, a very pretty spring blooming species, but stated to be somewhat difficult to cultivate; two Begonias; and Pimelia Verschaffeltiana, a glaucous-leaved, unattractive sort. Messrs. Backhouse, of York, produced two rather shrivelled bunches of a dark-coloured Seedling Grape ripe in June, and stated to keep good till spring; and Mr. Dunsford, of Chingford-green, Essex, sent a punnet of Black Hamburgh, reported to have been ripened on plants in pots. Mr. Kestell, of Dropmore, showed variously painted specimens of Garden Labels, some made of cast-iron, and others of zinc. They had oval heads, with the front cast hollow, in which the name was painted and then glazed over; but as the glass, lying hollow, is liable to be broken, and will permit water to condense beneath it and deface the name, Mr. Kestell has tried another plan with these labels, which is, to embed the glass in an elastic cement, which not only prevents it from being easily broken, but also more perfectly preserves the letters from external influences. Mr. Frost, gardener to Lady Grenville, at Dropmore, stated that he had used Mr. Kestell's *improved* labels in the open ground for these last two years, and had found them efficient, while those of his first effort failed. Mr. Morrell again exhibited specimens of his zinc-backed labels.

Novelties from the Society's Garden. Spiranthes cerina, a singular terrestrial Orchid, from Guatemala, having a dull olive-brown aspect, and flowering without leaves; and a plant of the Winter Violet Grass (Inopsidium acaule, or Cochlearia acaulis), a small Portuguese annual, whose value is now beginning to be recognized. If sown on a dry American border in autumn, it will produce in abundance diminutive patches, in which its little cross-shaped, pale, but bright violet blossoms lie in such profusion as to almost hide the foliage. As long as the weather is cold, or cool, these patches are to be seen everywhere; and they only lose their brilliancy when a hot sun and a drying wind have breathed on them. A patch of the plant in winter may be scooped out, transferred to a saucer, and placed in the drawing-room, where, if furnished with water, it will thrive and flower for many days. Even in summer it possesses a certain degree of attractiveness if allowed to sow itself in the shade among bushes; but it is in winter and early spring that the value of the plant appears most conspicuously.

BOOKS PRESENTED.

The Quarterly Journal of the Geological Society, No. XXI. From the Society.
The Athenæum for January. From the Editor.
Proceedings of the Linnean Society, Nos. XXXIV. to XL. From the Society.
Journal of the Royal Geographical Society. Vol. XIX. Part 2. From the Society.
Journal of the Royal Agricultural Society. Vol. X. Part 2. From the Society.
Comptes Rendus des Séances de l'Académie des Sciences à Paris, Tome XXIX. Nos. VII. to XXVI.; and Tables des Comptes Rendus, Tome XXVIII. From the Academy.

March 5, 1850. (REGENT STREET.)

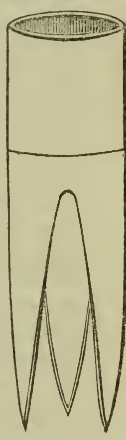
ELECTION. H. H. Calvert, Esq., of Erzeroum, a Foreign Corresponding Member.

AWARDS.—*Banksian Medals:* To Mr. Packman, gardener to J. Gadesden, Esq., F.H.S., for a very fine specimen of Bletia Tankervilliæ, now generally called Phaius grandifolius. It had about two dozen flower spikes on it, all in the greatest perfection, and measured 4 feet in height, and as much in diameter. It was growing in an 18-inch pot. To Mr. Loddiges, F.H.S., for a collection of Orchids, but more especially for Phalænopsis amabilis, a brilliantly-coloured Dendrobe, in the way of D. nobile, from Darjeeling, and a charming rose-coloured variety of Odontoglossum Cervantesii.

Certificate of Merit: To Mrs. Lawrence, F.H.S., for a cream-coloured Mormodes, new to gardens.

MISCELLANEOUS SUBJECTS OF EXHIBITION. A dwarf unattractive Eucomis, called nana, and a cut specimen of an Acacia, very much in the way of A. paradoxa, from Mr. Davis, of Regent's-park; a bright sky-blue Cineraria with a white disc, called "Hammersmith Beauty," from Mr. Layton, of Hammersmith; and a collection of Hyacinths, from G. Glenny, Esq., F.H.S. The latter consisted of the following sorts:—Emilius, Madame Catalani, Duc de Buffon, Reine des Pays Bas, Mahomed Ali, Nonpareil, Perle Brillant, Orondates, Zopolow, Mont Blanc, Charlotte Mary Anne, Angelique, Pasquin, States General, Alida Catherina, double flesh, dwarf, and compact, Bouquet Royal, King of the Netherlands, Cocus Blanc, Laurens Koster, Paarlboot, Vulcan, Blocksburg, Anna Powlowna, Nimrod, Duchess of Richmond, Voltaire, Cornelia Maria Fireball, Robinson, and Zitella, rich lake, very brilliant.

Mr. Roberts, of Eastcheap, sent specimens of what he has recently registered as "ventilating flower-pots." They had a hole in the side near the base, instead of in the bottom, like other pots, and were furnished inside with a moveable perforated drainage tile or stage placed so as to leave a cavity between it and the bottom of the pots. Mr. Roberts stated that the intention of the contrivance was, first, to give perfect drainage to the plants and air to the roots; and secondly, to enable such liquid manure to be placed in the bottom of the pot as might be required. He is of opinion that whatever decaying substance is placed in the bottom in a liquid state will enter into slow combustion; and that carbonic acid gas will be generated, which, being the principal food of all plants, will be taken up by capillary attraction with the moisture, and that the plants will thereby always be nourished without the risk of excess, provided the liquid is put into the holes instead of over the soil, which can readily be done by means of a small watering-pot, with a spout suitably bent for the purpose. The value of the invention, however, like all such plans, remains to be proved. A cast-iron socket for placing poles in, of which the accompanying woodcut will give some idea, was exhibited by W. Everett, Esq., of Enfield. "I have," said Mr. Everett, "sent for inspection a cast-iron socket for poles for roses and other climbers. I have a very long avenue of roses, and find the poles constantly rotting off just above the ground, and have hitherto found no mode of preventing it. I think these sockets may answer the purpose. I mean to fasten the pole into them by pitch, or some other substance that will preserve them dry. Their price in London will be about 3*s*. a-piece. They weigh 14 lbs. each, and will last for ever."



NOVELTIES FROM THE SOCIETY'S GARDEN. Boronia tetrandra, a promising kind, something in the way of B. pinnata; and Siphocampylus Manettiæflorus, a handsome species, with glossy, deep green, myrtle-like leaves, and long red tubular blossoms, tipped with yellow.

BOOKS PRESENTED.

Eighteenth Annual Report of the Royal Horticultural Society of Cornwall. From the Society.
The Athenæum for February. From the Editor.

March 19, 1850. (REGENT STREET.)

ELECTIONS. C. S. P. Hunter, Esq., Mortimer Hill, Berkshire; M. Louis Vilmorin, Quai de la Mégisserie, Paris; J. Spode, Esq., Armytage Park, near Rugeley; Rev. J. L. Petit, Uplands, Shiffnal, Shropshire; William Somerville Orr, Esq., Paternoster Row and Walthamstow; Frederick Crockford, Esq., St. James's Street and Harrow Weald; James Watney, Esq., Haling Park, near Croydon; David Barclay Chapman, Esq., Roehampton; and Mr. S. Maw, Aldersgate Street, City.

AWARDS. *Large Silver Medal:* To Mrs. Lawrence, F.H.S., for a specimen of the long-tailed Ladies' Slipper (Cypripedium caudatum), an extraordinary looking species, which has just flowered at Ealing Park for the first time in England. As far as colour is concerned, the flowers have little to recommend them, being, as near as possible, greenish yellow; their peculiarity consists in the petals being extended into two long brown narrow tails, which hang down from either side of each blossom, and keep on growing and growing as the flower gets older, till it is difficult to say what length they may eventually reach. Those in the specimen exhibited were nearly 18 inches long, and when the flowers are elevated, as they should be, some 2 or 3 feet above the foliage, these tails must give them a most remarkable appearance. Dr. Lindley stated that the existence of tails was not uncommon among Orchids, and that an unimported species of Uropedium named Lindenii, inhabiting New Grenada, near the Lake of Maracaybo, possessed these appendages even in a more remarkable degree than this Cypripedium caudatum. The latter was obtained from Peru by M. Linden, and may now be met with in one or two collections in this country.

Certificate of Merit: To Mr. Ivison, gardener to the Duchess Dowager of Northumberland, F.H.S., for a flowering plant of the halberd-lipped Odontoglossum (O. hastilabium). Like the Ladies' Slipper mentioned above, this is not distinguished by brilliancy of colour; but it is, nevertheless, a pretty species. It had a fine spike of flowers on it, whose sepals and petals were pale green, transversely marked with brown dots or lines; the lip was large, pure white, and pale red at the base. Mr. Ivison stated that it comes from New Granada. It had been in flower six weeks. To Messrs. Henderson, Pine Apple Place, for a most beautifully grown and flowered Acacia diffusa, a free blooming variety, which, by a little tasteful training and tying up, is very suitable for pot culture.

Miscellaneous Subjects of Exhibition. Boronia triphylla, a variety of Eriostemon cuspidatum with pink-tipped flowers, and a beautiful white-blossomed Epacris of the Impressa breed, named Hyacinthiflora candidissima, from Messrs. Henderson, of Pine Apple Place; a dwarf bright Scarlet Gesnera named G. macrantha purpurea, a seedling Heath called Burnetti, Siphocampylus lanceolatus, and a new Composite named Conoclinium ianthinum, from Mr. Henderson, of Wellington Nursery, St. John's Wood. Along with these plants Mr. Henderson sent the following memoranda :—" The Gesnera is a hybrid between G. Cooperii and G. macrantha, and blooms most freely; if cut down directly after blossoming, it will flower profusely in about six weeks or two months afterwards. It can thus be bloomed three times a-year. The Seedling Erica is a pretty hybrid, between E. Linnæoides and E. Hartnelli. It was named after Mr. Burnett, gardener to Mr. Alderman Buckland, of Peterborough. I am inclined to think that the Siphocampylus lanceolatus, under better culture, would prove brighter in colour. It appears to bloom very freely. It was received from the Continent. The Conoclinium is also a Continental plant; I believe it was introduced from St. Catherine's. The plant sent has been very much used for cuttings, and can give no true idea of its merits. It is a free-flowering winter plant, and I think will prove an acquisition to the greenhouse." Mr. Fry, gardener to Miss Dent, Manor House, Lee, Kent, exhibited a self-acting contrivance for fumigating glass houses. It was of sheet iron, furnished with a moveable chimney, or cylinder, and with a grate at the bottom on feet sufficiently high to allow a current of air to pass through the fuel on which the fumigating material is placed. Mr. Fry stated that he had employed his apparatus for the purpose of fumigating plant structures of every description. His method of using it is to put into it a few pieces of charcoal, coke, or cinders from the furnace. He then places the tobacco on the cinders somewhat lightly, and over that a covering of damp moss. In this manner it is left to burn by itself, without any one being required to attend to it, until the house is filled, when, if required, any given number of places may be fumigated by an addition of a small quantity of tobacco. The smoke may be also introduced into the interior of any place by merely fitting on to the cover a piece of pipe with an elbow, introducing the same into the house through an aperture from the outside. He had found it to possess advantages over any contrivance of the kind he had seen, and that it will burn the very commonest tobacco that can be purchased, as well as that grown in our own gardens, which can be used with complete success. Its construction is so simple, that it can be made by any country tinman or smith.

NOVELTIES FROM THE SOCIETY'S GARDEN. A beautifully bloomed specimen of the orange-flowered Epidendrum (E. aurantiacum), a species which few can flower at all, or if they do get it to form blossoms, the latter drop off the moment they expand. At the Garden, however, under ordinary management, it flowers regularly every year, and the blooms remain in beauty for a considerable length of time. Forsythia viridissima, and Hovea chorozemæfolia. The latter formed a nice little greenhouse shrub, covered with brilliant purplish-blue flowers; but like all Hoveas it is somewhat difficult to manage. Though the Forsythia is quite hardy, it was mentioned that the blossoms required some protection in early spring, otherwise the cold and stormy weather of that season destroys their gay appearance.

BOOKS PRESENTED.

The Gardener's Magazine of Botany, Horticulture, Floriculture, and Natural Science. Parts 1 and 2. From the Publishers.
Paxton's Flower Garden. No. I. From the Publishers.
The Country Gentleman, a newspaper, conducted by Mr. G. Glenny, F.H.S. From Mr. Glenny.

April 2, 1850. (REGENT STREET.)

AWARDS. *Large Silver Medal:* To Messrs. Veitch and Son, of Exeter, for a fine specimen of the Magnificent Medinill (M. magnifica), a noble-looking species, imported by them from Java. Its massive leaves are nearly a foot long and 4 or 5 inches broad, of a firm, leathery texture, and of the richest green. From the ends of the branches hang down panicles, from 15 to 18 inches long, of rich, glossy, rose-coloured flowers, with purple petals, and large, many-ribbed bracts of the clearest pink. It is the large-bracted Medinill (M. bracteata) of the Nurseries.

Banksian Medal: To Mr. Plumbly, Gardener to E. J. Dimsdale, Esq., for four large specimen Heaths, consisting of Willmoreana, transparens, triumphans, and penicillata. To Messrs. Rollisson, of Tooting, for Dendrobium macrophyllum, Oncidium sphacelatum, and Cypripedium Lowei, of which the accompanying woodcut is a representation.

It is difficult to imagine anything more beautiful in its way than this Bornean Lady's Slipper. The lip is a purplish green, and smooth as if French-polished ; the sepals are green, with a purple tinge near their base ; the petals are quite 3 inches long, spreading and then curving gracefully inwards and upwards, narrow near the base, pale, greenish yellow, blotched with deep brown, and rose-coloured at the ends, which are twice as broad as the other parts. It is said to be a plant of easy cultivation, and is a great acquisition.

Certificate of Merit: To Mr. Loddiges, of Hackney, for an example of the Sweet Trichopil (T. suavis), a charming species from Costa Rica, with broad, thin pseudo-bulbs, and large leathery leaves. The flowers emit the most delicate odour of Hawthorn. When well grown they are full 5 inches in diameter, delicate in texture, nearly white, with a few slight stains of red on the sepals and petals, and a great convolute lip richly spotted with clear rose, which, it is said, becomes in the natural climate of the species a rich and brilliant red. It is cultivated like Lycaste Skinneri and similar terrestrial Orchids. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for Cœlogyne cristata and the Long-tailed Cypripedium (C. caudatum). To Mr. Glendinning, F.H.S., for a Seedling Heath, apparently a cross between E. Hartnelli and E. aristata. To Mr. Mitchell, of Kemp Town, Brighton, for well-ripened bunches of Black Hamburgh Grapes.

Miscellaneous Subjects of Exhibition. A nice light-coloured Seedling Camellia, named Countess of Ellesmere, from Messrs. Jackson, of Kingston. A variety of Gledstane's Azalea, called Magnifica, from Mr. Ambrose, of Battersea. Gloxinia, "Frederick Leming," and several small plants of Cantua bicolor, which were sent to show that it will bloom in a very small state, from Mr. Henderson, of St. John's Wood. Epimedium pinnatum, and a double-flowered, dark purple Auricula, from Messrs. Rollisson. A fine branching spike of Ansellia africana, from Chatsworth. This Ansellia was stated to have been in blossom in the middle of January last, and to have continued in flower up to the present time. Mr. Higgs, Gardener to J. Barchard, Esq., F.H.S., had good examples of forced Keens' Seedling Strawberries; Mr. Halliman, of Kensington, some glass fruit-protectors; and Mr. Brown, specimens of his patent fumigator, whose utility is now universally recognized.

Novelties from the Society's Garden. Dielytra spectabilis; Nuttallia cerasiformis, a green-flowered Californian shrub of no beauty; and Boronia tetrandra, a species in the way of B. pinnata, and sold in the Nurseries under the name of B. microphylla.

Books presented.

Verhandlungen der k. k. Landwirthschafts Gesellschaft in Wien, Vol. VI., Part I. From the Agricultural Society of Vienna.
The Athenæum for March. From the Editor.

April 16, 1850. (REGENT STREET.)

ELECTION. Courtland Skinner Shaw, Esq., M.D., Cheltenham.

AWARDS. *Large Silver Medal:* To Messrs. Veitch, of Exeter, for Dampier's Clianth (C. Dampieri). This beautiful greenhouse plant has been raised from New Holland seeds by Messrs. Veitch, under the name of Kennedya speciosa. It formed a stout decumbent herbaceous perennial, of a pallid aspect, covered with long hairs. From the axils of the pinnated leaves, and shorter than they, arise angular peduncles, having on the end four or five quasiumbellate flowers of the most brilliant scarlet. The latter have a deep purple stain, convex, and shining at the base of the standard, a peculiarity which gives the blossoms an interesting appearance.

Banksian Medals: To Messrs. Henderson, of Pine-apple Place, for a collection of Cinerarias and late-flowering Hyacinths. It was stated that "the latter had been grown in the hardiest manner, the only shelter they received being a cold frame without any covering." To Mrs. Lawrence, F.H.S., for four Orchids; but more especially for Cattleya Skinneri and Trichopilia suavis.

Certificates of Merit: To Mrs. Lawrence, for a well-flowered specimen of Erica nitida. To Messrs. Fairbairn, Clapham, for a pink-flowered seedling Azalea called "Dilecta." To Mr. Henderson, Wellington Road, for Epimedium colchicum, and Ceanothus papillosus, a beautiful hardy blue-flowered species introduced by the Society from California. To Mr. Ayres, Blackheath, for an example of Pimelea Verschaffeltii. The owner stated that it was sent for the purpose of showing that this Pimelea is a much finer thing than many might be led to infer it would be from the plants exhibited before the Society at a former Meeting. "It has, in addition to its pretty appearance, the estimable property of being (in the evening) deliciously scented, and if an admixture of the scents of the Hawthorn and Heliotrope can be imagined, something of the fragrance of this plant will be realized." For his own part he considers it quite equal to the best of the Pimeleas, and under good management he has no doubt it will make a first-rate exhibition plant. To Mr. Jones, Gardener to Sir John Guest, Bart., M.P., for a Ripley Queen Pine Apple, weighing 4 lbs. 2 oz.

MISCELLANEOUS SUBJECTS OF EXHIBITION. Dendrobium Farmeri from Messrs. Veitch. Oncidium trilingue, a new brown and yellow species, from Sir Philip Egerton, Bart., M.P. Warrea discolor from Messrs. Lane, of Great Berkhampstead. Enkianthus reticulatus from Mrs. Lawrence. Malva umbellata, Chorozema flavum, Anadenia pulchella, and three Cinerarias from Mr. Henderson, of the Wellington Road Nursery. Siphocampylus manettiæflorus and an unattractive New Holland Comesperma came from Messrs. Henderson, Pine-apple Place; samples of patent rolled plate glass from Messrs. Hartley; a plaster of Paris model of a Chaumontel Pear, which had weighed 2 lbs. 4½ oz., from Mr. Dobree, of Guernsey; and examples of wax flowers from Mrs. Temple.

NOVELTIES FROM THE SOCIETY'S GARDEN. A flowering specimen of the double white-blossomed Chinese Peach, some account of which will be found in vol. ii., p. 311.

BOOKS PRESENTED.

The Gardener's Magazine of Botany, Horticulture, Floriculture, and Natural Science. Part III. From the Publishers.

Outline of a Comprehensive Plan for diverting the Sewage of London and Westminster from the Thames and applying it to Agricultural Purposes, &c., by John Martin, K.L. From the Author.

May 1, 1850. (REGENT STREET—ANNIVERSARY.)

The following Fellows of the Society, viz.:—

R. S. Holford, Esq.,
J. Barchard, Esq.,
J. M. Strachan, Esq.,

were elected new Members of the Council in the room of

Sir P. de Malpas Grey Egerton, Bart., M.P.,
Sir C. Lemon, Bart., M.P.,
R. W. Eyles, Esq.

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. Daniel, Secretary.

The Annual Report from the Council and Auditors was read (See the body of this volume.)

It was resolved unanimously that the Report now read be adopted.

May 18, 1850. (Garden Exhibition.)

The morning was misty and unpromising, but as the day advanced the weather brightened. Dark threatening clouds, however, and a slightly falling barometer, with a chilly atmosphere, made the afternoon upon the whole uninviting, and no doubt kept back numerous visitors, who, under more favourable circumstances, would have been present. The total number was 3142, exclusive of exhibitors and persons officially employed. The exhibition itself was a triumphant display of native skill and industry. The Roses, the Azaleas, the Heaths, the Orchids, and the various races of Stove and Greenhouse Plants have never been excelled, and rarely equalled. But the Queen of the whole was the Victoria Regia, two leaves and a flower of which were shown from the Duke of Devonshire's garden at Chatsworth, and one leaf and a flower from that of the Duke of Northumberland, at Syon. The leaves were about five feet across, circular, and perfectly rimmed. One was placed in water, the other two on damp moss, and notwithstanding the low temperature to which they were subjected they maintained their condition to the end. The flowers were in perfect order, and during the afternoon expanded very nearly, throwing off now and then volumes of fragrance which diffused itself around whenever the large bell glasses which protected them were removed. It may be added that the new arrangements for facilitating the access to the tents, and for the accommodation of exhibitors, appeared to be universally considered as great improvements in the appearance of the Garden. Fortunately, however, their value as a protection against rain was not put to the test.

The Award was as follows :—

The 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.

The 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. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

The Gold Banksian Medal: To Messrs. Fraser, of Lea

Bridge Road, Leyton, 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. Malyon, Gardener to T. Brandram, Esq., of Lea Grove, Blackheath, for a collection of ten Stove and Greenhouse Plants. To Mr. Rae, Gardener to J. J. Blandy, Esq., F.H.S., for twenty species of Exotic Orchids. To Messrs. Veitch, of Exeter, for fifteen species of the same. To Mr. Carson, for ten species of the same. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of Greenhouse Azaleas in twelve varieties. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for twelve varieties of Roses in pots. To Messrs. Lane and Son, of Great Berkhampstead, for the same. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for ten varieties of Cape Heath. To Messrs. Fairbairn, of Clapham, for the same.

The Large Silver-gilt Medal: To Messrs. Pamplin, Lea Bridge Road, Leyton, for a collection of twenty Stove and Greenhouse Plants. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., for a collection of fifteen Stove and Greenhouse Plants. To Mr. Stuart, Gardener to Thomas Huggins, Esq., of Norwood, for a collection of ten Stove and Greenhouse Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, Orleans House, Twickenham, for a collection of six Stove and Greenhouse Plants. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for twenty species of Exotic Orchids. To Messrs. Rollisson, of Tooting, 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. Kinghorn, Gardener to the Earl of Kilmorey, for six species of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Greenhouse Azaleas, in twelve varieties.* To Messrs. Fraser, of Lea Bridge Road, Leyton, for the same, in six varieties. To Mr. Green, for Tall Cacti, in flower. 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 Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath. To Messrs. Veitch, of Exeter, for the same. To Mr. Smith, for the same, in 11-inch pots. To Messrs. Fairbairn,

* This was afterwards made a Gold Banksian Medal; it appearing to the Council, upon consultation with the Judges, that they would have given it a first prize, had it been in their power to award two first prizes.

Clapham, for the same. To Mr. Cock, F.H.S., for six new varieties of Pelargonium, in 8-inch pots. To Mr. Dobson, Gardener to E. Beck, Esq., F.H.S., for the same. To Mr. Cock, for six varieties of Pelargonium, in 11-inch pots. To Mr. Robinson, Gardener to J. Simpson, Esq., Thames-bank, Pimlico, for six Fancy Pelargoniums, in 8-inch pots.

Certificates of Excellence: To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of fifteen Stove and Greenhouse Plants. To Mr. Speed, Edmonton, for a collection of ten Stove and Greenhouse Plants. To Mr. May, Gardener to E. Goodhart, Esq., Langley Park, Beckenham, for a collection of six Stove and Greenhouse Plants. To Mr. Dobson, Gardener to E. Beck, Esq., F.H.S., for fifteen species of Exotic Orchids. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for six species of the same. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of Helichrysums. To Messrs. Lane and Son, of Great Berkhampstead, for a collection of Greenhouse Azaleas, in twelve varieties. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for the same, in six varieties. To Mr. Gaines, F.H.S., for Greenhouse Rhododendrons. To A. Rowland, Esq., F.H.S., for twelve varieties of Roses in pots. To Mr. Francis, of Hertford, for the same. To Mr. Cole, for ten varieties of Cape Heath. To Messrs. Rollisson, of Tooting, for the same. To Mr. Cole, for the same, in 11-inch pots. To Messrs. Veitch, of Exeter, for the same. To Mr. Parker, Gardener to J. H. Oughton, Esq., of Roehampton, for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Robinson, Gardener to J. Simpson, Esq., of Thames Bank, Pimlico, for six new varieties of Pelargonium, in 8-inch pots. To Mr. Gaines, F.H.S., for the same. To Mr. Parker, for six varieties of Pelargonium, in 11-inch pots. To Mr. Gaines, F.H.S., for the same. To Mr. Stains, of Middlesex Place, New Road, for six Fancy Pelargoniums, in 8-inch pots. To Mr. Paxton, Gardener to his Grace the Duke of Devonshire, Pres.H.S., for a Flower and Leaf of Victoria Regia. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for the same. To Messrs. Veitch, for Rhododendron jasminiflorum. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Pimelea spectabilis.

The Large Silver Medal: To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of fifteen Stove and Greenhouse Plants. To Mr. Young, Gardener to C. Barron, Esq., Denmark Hill, Camberwell, 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. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of Exotic Orchids. To the same, for a collection of Helichrysums. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for ten varieties of Cape Heath, in 11-inch pots. To Messrs. Rollisson, for the same. To Mr. Stains, of Middlesex Place, New Road, for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Bruce, Gardener to Boyd Miller, Esq., of Tooting, for a collection of Greenhouse Azaleas, in six varieties. To Mr. Glendinning, F.H.S., for Hoya imperialis. To Mr. Stains, for six new varieties of Pelargonium, in 8-inch pots. To Mr. Gaines, F.H.S., for six Fancy Pelargoniums, in 8-inch pots. To the same, for a collection of Cinerarias. To Mr. Stanly, for a new species of Hovea. To Mr. Jones, Gardener to Sir J. J. Guest, Bart., F.H.S., for a Ripley Queen Pine Apple. To Mr. Davis, of Oak Hill, East Barnet, for the same. To the same, for a Blood Red Pine Apple. To Mr. Davis, Gardener to Lord Boston, F.H.S., for a Providence Pine Apple, weighing 8 lbs. 5 oz. To Mr. Davis, of Oak Hill, for the same, weighing 7 lbs. 2 oz. To Mr. Ingram, Gardener to Her Majesty, at Frogmore, for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, for the same. To Mr. Jackson, Gardener to H. Beaufoy, Esq., of South Lambeth, for Sweetwater Grapes. To Mr. Davis, of Oak Hill, for the same. To Mr. Spencer, Gardener to the Marquess of Lansdowne, F.H.S., for Cannon Hall Muscat Grapes. To Mr. Toy, Oatlands Palace Gardens, Weybridge, for Black Frontignan Grapes.

The Silver Knightian Medal: To Mr. Glendinning, F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Bruce, Gardener to Boyd Miller, Esq., of Tooting, for a collection of six Stove and Greenhouse Plants. To Mr. O'Brien, Gardener to G. Read, Esq., of Bridgewater, Somerset, for six species of Exotic Orchids. To Mr. Cole, Gardener to H. Colyer, Esq., Dartford, for Dendrobium Calceolaria. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for six distinct species of Pelargonium exhibiting superior cultivation. To Mr. Wood, of Norwood, for a collection of Alpine plants in twelve varieties. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of Calceolarias. To Mr. E. G. Henderson, F.H.S., for a collection of Cinerarias in 6-inch pots. To Mr. Edmonds, Gardener to his Grace the Duke of Devonshire

F.H.S., for Rhododendron formosum. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, for Erica Cavendishii. To Messrs. Garraway and Co., of Bristol, for six Amaryllids. To Messrs. Veitch, of Exeter, for Bolbophyllum Lobbii. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for a Providence Pine-Apple, weighing 7½ lbs. To Mr. Turnbull, Gardener to his Grace the Duke of Marlborough, F.H.S., for Black Hamburgh Grapes. To Mr. Mitchell, of Kemp Town, Brighton, for the same. To Mr. M'Walter, Gardener to Colonel Challoner, F.H.S., for Sweetwater Grapes. To Mr. Fleming, Gardener to his Grace the Duke of Sutherland, F.H.S., at Trentham, for a bunch of Black Hamburgh Grapes, weighing 1 lb. 7½ oz. To Mr. Davis, of Oak Hill, for the same, weighing 2 lbs. 3 oz. To Mr. Fleming, Gardener to his Grace the Duke of Sutherland, F.H.S., for Royal George Peaches. To the same, for Murray Nectarines. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for British Queen Strawberries, in pots. To Mr. Munro, Gardener to Mrs. Oddie, of Colney House, St. Alban's, for a Seville Orange-tree, in fruit in a pot. To Mr. Fleming, for the heaviest Melon (Hybrid Green-fleshed Persian). To the same, for the best-flavoured Melon (Hybrid Green-fleshed Persian).

The Silver Banksian Medal: To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. O'Brien, Gardener to G. Read, Esq., of Bridgewater, Somerset, for a collection of six Stove and Greenhouse Plants. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., for six species of Exotic Orchids. To Mr. Turner, of Holloway, for a collection of Alpine Plants, in twelve varieties. To Messrs. Lane and Son, of Great Berkhampstead, for a collection of Cinerarias, in 6-inch pots. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for Erica vasæflora. To Messrs. Veitch, for Mitraria coccinea. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for six Lycopodiums. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for Pimelea Verschaffeltii. To Mr. Fleming, Gardener to His Grace the Duke of Sutherland, F.H.S., for Black Hamburgh Grapes. To Mr. Toy, of Oatlands Palace Gardens, Weybridge, for Black Hamburgh Grapes. To Mr. Snow, Gardener to the Earl de Grey, F.H.S., for a collection of Apples and Pears of last year's growth. To Mr. Ingram, Gardener to Her Majesty, at Frogmore, for May Duke Cherries. To Mr. Toy, for British Queen Strawberries. To Mr. Elphinston, Gardener to the Right Hon. the

Speaker, F.H.S., for Keens' Seedling Strawberries. To Mr. Toy, for the same.

Certificates of Merit: To Mr. Ambrose, of Battersea, for six Fancy Pelargoniums, in 8-inch pots. To Mr. Miller, Gardener to R. Moseley, Esq., of Pine-Apple Place, Edgeware Road, for the same. To Mr. Gaines, F.H.S., for a collection of Cinerarias, in 6-inch pots. To Mr. Mountjoy, F.H.S., for a Seedling Rhododendron. To Mr. Wood, of Norwood, for eighteen variegated hardy Plants. To Messrs. Veitch and Son, of Exeter, for Dendrobium transparens. To the same, for Stylidium ciliare. To Mr. Fleming, for May Duke Cherries. To Mr. Meredith, Gardener to His Grace the Duke of Sutherland, F.H.S., at Cliefden, for Keens' Seedling Strawberries.

May 28, 1850. (Regent Street.)

The following "Notice of alteration in the By-Laws" was read, and posted in the meeting-room:—"The Council hereby give notice that they propose to substitute for Chapter IV., Article I., of the present By-Laws, namely, 'the admission-fee to be paid by each Fellow shall be six guineas,' the following words, viz., 'the admission-fee to be paid by each Fellow shall be two guineas.'"

Election. A. G. H. Battersby, Esq., Cote House, near Bristol.

Awards. *Large Silver Medal:* To Mr. Loddiges, F.H.S., for a new and interesting Odontoglossum, with pure white flowers, beautifully spotted with brown.

Banksian Medal: To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a dish of well-ripened Scarlet Nectarines.

Certificate of Merit: To J. D. Llewellyn, Esq., F.H.S., for Vanilla Pods, large and quite ripe.

Miscellaneous Subjects of Exhibition. A double red Azalea and A. fulgens, from J. Allnutt, Esq., F.H.S., and the following Orchids from Mr. Loddiges, viz. Vanda teres; Aërides crispum, and its pale-flowered variety; Saccolabium guttatum, miniatum, and ampullaceum; Cattleya Mossiæ, and its variety called aurantia; the bright-yellow Oncidium bifolium; Dendrobium Griffithianum; the rare Burlingtonia fragrans; Odontoglossum stellatum; and two Epidendrums. Concerning Saccolabium ampullaceum, Mr. Loddiges stated that it had been in perfection for three months, and that he considered it to be the most lasting of all orchids.

Novelties from the Society's Garden. Mimulus rubberrimus, a charming variety; and the two beautiful Californian Ceanothes—dentatus and papillosus.

Books Presented.

The Quarterly Journal of the Geological Society, No. 22. From the Society.
The Athenæum, for April. From the Editor.
The Gardeners' Magazine of Botany, Horticulture, &c., Part 4. From the Publishers.
Cacteæ in Horto Dyckensi cultæ anno 1849; by his Serene Highness the Prince of Salm-Dyck. From the Author.

June 8, 1850. (Garden Exhibition.)

The morning broke bright and joyous: about nine o'clock dark clouds began to gather, and rain fell heavily between ten and eleven; about half-past twelve o'clock all was clear and promising, and the afternoon, though slightly clouded, continued fine. The Garden was delicious, and the exhibition equal, if not superior, to any June show of former years. The number of visitors was 7452, exclusive of 267 exhibitors and attendants.

The Award was as follows:—

The 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.

The 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.

The Gold Banksian Medal: To Messrs. Fraser, of Lea Bridge Road, Leyton, for a collection of twenty Stove and Greenhouse Plants. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., 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 twenty species of Exotic Orchids. To Messrs. Veitch, of Exeter, for fifteen species of the same. To Mr. Carson, for ten species of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Tall Cacti in flower. To A. Rowland, Esq., F.H.S., for twelve varieties of Roses in pots. To Messrs. Lane and

Son, of Great Berkhampstead, for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath. To Mr. Epps, F.H.S., for the same.

The Large Silver-gilt Medal: To Messrs. Pamplin, Lea Bridge Road, Leyton, for a collection of twenty Stove and Greenhouse Plants. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for a collection of ten Stove and Greenhouse Plants. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, Orleans House, Twickenham, for a collection of six Stove and Greenhouse Plants. To Messrs. Rollisson, of Tooting, for fifteen species of Exotic Orchids. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for ten species of the same. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., for six species of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Greenhouse Azaleas, in six varieties. To Mr. Roser, Gardener to J. Bradbury, Esq., of Streatham, for twelve varieties of Roses in pots. To Mr. Francis, of Hertford, for the same. To Mr. Mylam, Gardener to S. Rucker, Esq., jun., F.H.S., for ten varieties of Cape Heath. To Messrs. Rollisson, for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for ten varieties of Cape Heath, in 11-inch pots. To Mr. Epps, F.H.S., for the same. To Mr. Cock, F.H.S., for six new varieties of Pelargonium, in 8-inch pots. To Mr. Dobson, Gardener to E. Beck, Esq., F.H.S., for the same. To Mr. Cock, F.H.S., for six old varieties of Pelargonium, in 11-inch pots. To Mr. Robinson, Gardener to J. Simpson, Esq., Thames Bank, Pimlico, for six Fancy Pelargoniums, in 8-inch pots.

The Certificate of Excellence: To Mr. Bruce, Gardener to Boyd Miller, Esq., of Tooting, for a collection of ten Stove and Greenhouse Plants. To Mr. May, Gardener to E. Goodhart, Esq., of Beckenham, for a collection of six Stove and Greenhouse Plants. To Mr. Dobson, Gardener to E. Beck, Esq., F.H.S., for fifteen species of Exotic Orchids. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, Orleans House, Twickenham, for six species of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a collection of Greenhouse Azaleas, in six varieties. To Mr. Terry, Gardener to Lady Puller, Youngsbury, Herts, for twelve varieties of Roses in pots. To Mr. Cole, Gardener to H. Colyer, Esq., of

Dartford, for ten varieties of Cape Heath. To Messrs. Veitch, of Exeter, for the same. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for ten varieties of Cape Heath, in 11-inch pots. To Messrs. Rollisson, of Tooting, for the same. To Mr. Parker, Gardener to J. H. Oughton, Esq., F.H.S., for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Black, Gardener to E. Foster, Esq., Clewer Manor, Windsor, for six new varieties of Pelargonium, in 8-inch pots. To Mr. Bragg, of Slough, for the same. To Mr. Gaines, F.H.S., for six Fancy Pelargoniums, in 8-inch pots. To Mr. Cole, for Roupellia grata. To Mr. May, Gardener to E. Goodhart, Esq., of Beckenham, for Aphelexis purpurea.

The Large Silver Medal: To Mr. Malyon, Gardener to T. Brandram, Esq., of Lea Grove, Blackheath, for a collection of ten Stove and Greenhouse Plants. To Mr. Young, Gardener to C. Barron, Esq., Denmark Hill, Camberwell, for a collection of six Stove and Greenhouse Plants. To the same, for a collection of Helichrysums. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for a collection of Roses in twenty-five varieties. To Messrs. Fairbairn, of Clapham, for ten varieties of Cape Heath. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for the same, in 11-inch pots. To Messrs. Fairbairn, for the same. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Stains, of Middlesex Place, New Road, for six new varieties of Pelargonium, in 8-inch pots. To Mr. Gaines, F.H.S., for the same. To the same, for six old varieties of the same, in 11-inch pots. To Mr. Ambrose, of Battersea, for six Fancy Pelargoniums, in 8-inch pots. To Mr. Gaines, for a collection of Calceolarias. To Mr. Bassett, Gardener to R. S. Holford, Esq., F.H.S., for Camarotis purpurea. To Mr. May, Gardener to E. Goodhart, Esq., of Beckenham, for Erica depressa. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for a Providence Pine Apple, weighing 9lb. 11oz. To Mr. Frost, Gardener to Lady Grenville, F.H.S., for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To Mr. Toy, Oatlands Palace Gardens, Weybridge, for Muscat of Alexandria Grapes.

The Silver Knightian Medal: To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Epps, F.H.S., for a collection of six Stove and Greenhouse Plants. To Mr. Cole, Gardener to H. Colyer, Esq., Dartford, for Dendrobium speciosum. To Mr. Terry, Gardener to Lady Puller, of Youngsbury, Herts, for a collection of Yellow Roses.* To Mr. Stains, of Middlesex Place, New Road, for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Robinson, Gardener to James Simpson, Esq., of Thames Bank, Pimlico, for six new varieties of Pelargonium in 8-inch pots. To Mr. Stains, for six Fancy Pelargoniums in 8-inch pots. To Mr. Glendinning, F.H.S., for a collection of Calceolarias. To Mr. Cole, for a collection of Helichrysums. To Mr. Wood, of Norwood, for a collection of Alpine plants. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for Indigofera decora. To the same, for Platycerium grande. To Messrs. Veitch, of Exeter, for Nepenthes sanguinea. To Mr. Davis, Gardener to Lord Boston, for a Providence Pine Apple, weighing 8 lb. 3 oz. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for the heaviest Bunch of Grapes (Black Prince), weighing 2 lb. 8 oz. To Mr. Stent, Gardener to W. Herbert, Esq., of Clapham Common, for Black Hamburgh Grapes. To Mr. Toy, of Oatlands Palace Gardens, Weybridge, for the same. To Mr. Chapman, of Vauxhall, for Sweetwater Grapes. To Mr. Robertson, Gardener to the Marquis of Waterford, at Curraghmore, for Royal George Peaches. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for Scarlet Nectarines. To Mr. Munro, Gardener to Mrs. Oddie, of Colney House, St. Alban's, for the heaviest Melon (Munro's Egyptian Hybrid Green-fleshed), weighing 7 lb. 8 oz. To Mr. Gadd, Betchworth Castle, for the heaviest Melon in the Market Gardeners' Class (Cantilupe), weighing 6 lb. 13 oz. To Mr. Fleming, Gardener to the Duke of Sutherland, at Trentham, for the best flavoured Melon (a Hybrid between the Hoosainee and Ispahan). To Mr. Elliott, Gardener to J. B. Boothby, Esq., F.H.S., for British Queen Strawberries in pots.

The Silver Banksian Medal: To Mr. Glendinning, F.H.S., for a collection of ten Stove and Greenhouse Plants. To Mr. Stuart, Gardener to T. Huggins, Esq., of Norwood, for the same. To Mr. Speed, of Edmonton, for a collection of six Stove and Greenhouse Plants. To Mr. Hamp, Gardener to J. Thorne, Esq., South Lambeth, for the same. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for

* Other collections of Yellow Roses were shown, but they were disqualified on account of the exhibitors not having conformed to the regulations.

a collection of Calceolarias.* To Mr. Bruce, Gardener to Boyd Miller, Esq., of Tooting, for Oncidium flexuosum. To Mr. Stanly, for a collection of Helichrysums. To Mr. W. Turner, of Holloway, for a collection of Alpine Plants. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a new species of Bejaria. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Leschenaultia biloba major. To Mr. Bruce, for Aphelexis humilis. To Messrs. Lee, of Hammersmith, for Azalea indica ("Symmetry"). To Mr. Hoyle, of Reading, for Epiphyllum platypetalum. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for a Providence Pine-Apple, weighing 6 lb. 11 oz. To Mr. Davis, of Oak Hill, East Barnet, for the same, weighing 6 lb. 12 oz. To Mr. Foggo, Gardener to the Marquis of Abercorn, F.H.S., for Black Hamburgh Grapes. To Mr. Rust, Gardener to J. Maclaren, Esq., F.H.S., for Muscadine Grapes. To Mr. Kemp, Gardener to Mrs. Grillion, of East Acton, for Muscat of Alexandria Grapes. To Mr. Chapman, Gardener to J. B. Glegg, Esq., F.H.S., for Grosse Mignonne Peaches. To Mr. Foggo, for Elruge Nectarines. To the same, for Brown Turkey Figs. To Mr. Toy, Oatlands Palace Gardens, Weybridge, for Keens' Seedling Strawberries in pots. To Mr. Busby, Gardener to S. Crawley, Esq., Stockwood Park, Luton, for British Queen Strawberries. To Mr. Wilding, Gardener to Captain Kennett, of Ham, for the second best-flavoured Melon (Hybrid Green fleshed).

The Certificate of Merit: To Mr. Fraser, Gardener to J. L. Leigh, Esq., of Luton Hoo Park, Beds, for Cattleya Mossiæ. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Dendrobium nobile. To Mr. Turner, of Barnet, for a collection of Alpine Plants. To Mr. Hill, Gardener to Thomas Davis, Esq., F.H.S., for Pimelea decussata. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for Nymphæa cærulea. To Mr. Salter, F.H.S., for a collection of Irises. To Mr. Wood, of Norwood, for a collection of Hardy Variegated Plants. To Mr. Vare, Gardener to General Lygon, Spring Hill, Oxon, for Royal George Peaches. To Mr. Toy, Oatlands Palace Gardens, for Keens' Seedling Strawberries.

* A collection of Calceolarias from Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S, was disqualified in consequence of being shown contrary to the regulations.

June 18, 1850. (Regent Street.)

Elections. F. W. Robarts, Esq., 26, Hill Street, Berkeley Square; E. Hailstone, Esq., Horton Hall, Bradford, Yorkshire; W. S. Myers, Esq., Liverpool; W. Cavendish, Esq., M.P., Burlington House, Piccadilly; Constante Santa Maria, Esq., Club Chambers, Regent Street; and W. R. Sams, Esq., 1, St. James's Street.

The following "Notice of alteration in the By-Laws" was read a second time, and suspended in the meeting-room:—"The Council hereby give notice that they propose to substitute for Chapter VI., Article I., of the present By-Laws, namely, 'the admission-fee to be paid by each Fellow shall be six guineas,' the following words, viz., 'the admission-fee to be paid by each Fellow shall be two guineas.'"

Awards. *Certificate of Merit:* To Mr. Cuthill, of Camberwell, for well-ripened examples from the open ground of his Black Prince Strawberry, a kind becoming universally cultivated, more especially for early crops. It is well flavoured and very prolific.

Miscellaneous Subjects of Exhibition. A Saccolabium like S. Blumei, from Messrs. Loddiges, with a curiously formed lip, which looked as if its end had been snipped off; and specimens of his "ornamental metallic garden labels," both for hanging up and sticking into the soil, from Mr. Restell, of High-street, Croydon. The latter were of various shapes, triangular and square; they ranged from 1*s*. 6*d*. to 10*s*. a-dozen, according to their sizes, &c. Mr. Restell states that "They require no wire to attach them, as they may be bent round anything without injury, being flexible as well as incorrodible. They may be written upon with a lead pencil, or if for *permanent* use (without removal) with a steel pen and ink. They are calculated to last for twenty years. They have been tested both in a conservatory and in the open air, and are found all that can be wished for."

Novelties from the Society's Garden. Boronia spathulata, a much better plant than it was expected to prove; and the two Californian Abronias, umbellata and pulchella, half-trailing coast plants, requiring nearly the same treatment as a Verbena. The latter has more colour than umbellata, but in all other respects it is less handsome.

July 13, 1850. (GARDEN EXHIBITION.)

The last exhibition in the season has hitherto generally been found much inferior to its predecessors: plants get out of condition; the races which decorate May and June fade and perish in July; gardeners have less leisure, and zeal begins to flag; but on this occasion there was such an assemblage of beautiful plants as no man ever saw before in July. Orchids were numerous and fine; Cape Heaths and Stove and Greenhouse Plants possessed all the beauty and freshness of May; cut Roses were abundant; and the Victoria Water Lily from Syon, in the form of a beautiful flower and two magnificent leaves, each 5 feet 10 inches in diameter, was the admiration of every one. Fruit was plentiful, and in many cases very fine; but the unripe state of some of the grapes enabled inferior specimens to beat them. The beauty of the grounds of Chiswick House, thrown open to the meeting by the noble President of the Society, and a delicious day, permitted 7970 visitors, exclusive of exhibitors and persons officially employed, to pass the afternoon in great enjoyment.

The AWARD was as follows:—

The 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., jun., F.H.S., for twenty species of Exotic Orchids.

The 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. Williams, Gardener to C. B. Warner, Esq., F.H.S., for twenty species of Exotic Orchids.

The 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. Croxford, Gardener to H. H. Barnes, Esq., of Stamford Hill, for a collection of ten Stove and Greenhouse Plants. To Messrs. Rollisson, of Tooting, for fifteen species of Exotic Orchids. 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 ten varieties of Cape Heath. To Mr. Epps, F.H.S., for the same.

The Large Silver-gilt Medal: 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 collection of ten Stove and Greenhouse Plants. To Mr. Bruce, Gardener to Boyd Miller, Esq., of Tooting, for a collection of six Stove and Greenhouse Plants. To Mr. Dobson, Gardener to Mr. Beck, F.H.S., for fifteen species of Exotic Orchids. To Mr. Carson, Gardener to W. F. G. Farmer, Esq., F.H.S., for ten species of the same. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for six species of the same. To Mr. Mylam, Gardener to S. Rucker, Esq. jun., F.H.S., for ten varieties of Cape Heath. To Messrs. Rollisson, Tooting, for the same. To Mr. Smith, Gardener to W. Quilter, Esq., of Norwood, for the same in 11-inch pots. To Messrs. Rollisson, for the same. To Mr. Stains, of Middlesex Place, New Road, for a collection of new Pelargoniums in 8-inch pots. To Mr. Dobson, for the same. To Mr. Parker, Gardener to J. H. Oughton, Esq., Roehampton, for a collection of old Pelargoniums, in 11-inch pots. To Mr. Stains, for a collection of Fancy Pelargoniums, in 8-inch pots. To Messrs. Veitch and Son, Exeter, for Ixora javanica. To Mr. Kinghorn, Gardener to the Earl of Kilmorey, F.H.S., for Phalænopsis grandiflora.

The Certificate of Excellence: To Mr. Watson, Gardener to Mrs. Tredwell, Lower Norwood, 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. Franklin, Gardener to Mrs. Lawrence, F.H.S., for ten species of Exotic Orchids. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., for the same. To Messrs. Lane and Son, Great Berkhampstead, for a collection of Roses, in fifty varieties. To Mr. Cole, Gardener to H. Colyer, Esq., Dartford, for ten varieties of Cape Heath. To Messrs. Fairbairn, of Clapham, for the same. To Mr. Cole, for ten varieties of the same in 11-inch pots. To Mr. Epps, F.H.S., for the same. To Mr. Cock, F.H.S., for a collection of new Pelargoniums in 8-inch pots. To Mr. Bragg, Slough, for the same. To Mr. Stains, of Middlesex Place, New Road, for a collection of old Pelargoniums in 11-inch pots. To Mr. Gaines, F.H.S., for the same. To the same, for a collection of Fancy Pelargoniums in 8-inch pots. To Mr. Dobson, Gardener to Mr. Beck, F.H.S., for a collection of Achimenes. To Mr. Green, Gardener to

Sir E. Antrobus, Bart., F.H.S., for a collection of Helichrysums. To Messrs. Veitch and Son, Exeter, for Rhododendron javanicum. To Messrs. Fraser, Lea Bridge Road, Essex, for Kalosanthes coccinea. To Mr. Smith, Gardener to S. Ricardo, Esq., for three specimens of Black Hamburgh Grapes growing in pots.

The Large Silver Medal: To Mr. Woolley, Gardener to H. B. Ker, Esq., Cheshunt, for six species of Exotic Orchids. To Messrs. Paul, Cheshunt, for a collection of Roses, in fifty varieties. To A. Rowland, Esq., F.H.S., for the same, in twenty-five varieties. To Messrs. Fairbairn, Clapham, for ten varieties of Cape Heath, in 11-inch pots. To Mr. Robinson, Gardener to J. Simpson, Esq., Thames Bank, Pimlico, for a collection of new Pelargoniums, in 8-inch pots. To Mr. Gaines, F.H.S., for the same. To Mr. Ambrose, Battersea, for a collection of Fancy Pelargoniums, in 8-inch pots. To Mr. Stains, Middlesex Place, New Road, for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a collection of Fuchsias. To Mr. Knott, Gardener to the Rev. C. Pritchard, F.H.S., for a collection of Achimenes. To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of Helichrysums. To Mr. Glendinning, F.H.S., for a collection of new hardy Evergreens, in pots. To the same, for a collection of Statices. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Stephanotis floribunda. To Mr. Green, Gardener to Sir E. Antrobus, Bart., F.H.S., for Lisianthus Russellianus. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for a collection of Hothouse Ferns. To Mr. Jones, Gardener to Sir J. J. Guest, Bart., F.H.S., for a Queen Pine Apple, weighing 5 lb. 9½ oz. To Mr. Spencer, Gardener to the Marquess of Lansdowne, F.H.S., for a Providence Pine Apple, weighing 9 lb. 13½ oz. To Mr. Holmes, Gardener to S. Garrard, Esq., Putney Heath, for Black Hamburgh Grapes. To Mr. Harrison, Oatlands Palace Gardens, Weybridge, for the same. To Mr. Williams, Gardener to C. B. Warner, Esq., F.H.S., for White Muscadine Grapes. To W. Death, Esq., Netteswell, Harlow, for Muscat Grapes. To Mr. Henderson, Gardener to Sir George Beaumont, Bart., F.H.S., for Grizzly Frontignan Grapes. To Mr. Gadd, Betchworth, for White Frontignan Grapes. To Mr. Chapman, South Lambeth, for Sweetwater Grapes.

The Silver Knightian Medal: To Mr. Stanly, Gardener to H. Berens, Esq., F.H.S., for a collection of ten Stove and

Greenhouse Plants. To Mr. Francis, Hertford, for a collection of Roses in fifty varieties. To Mr. Slowe, Gardener to W. R. Baker, Esq., F.H.S., for the same in twenty-five varieties. To Mr. Stanly, for six distinct species of Pelargonium, exhibiting superior cultivation. To Mr. Salter, F.H.S., for a collection of Fuchsias. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for a collection of Achimenes. To Mr. Cole, Gardener to H. Colyer, Esq., of Dartford, for a collection of Helichrysums. To Messrs. Lane and Son, of Great Berkhampstead, for a new species of Acineta. To Mr. Woolley, Gardener to H. B. Ker, Esq., for a collection of Hothouse Ferns. To Mr. Wood, Norwood, for a collection of Alpine Plants. To Mr. Dennett, Gardener to W. Gillett, Esq., Clapham Park, for Erica Parmentieri rosea. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Ixora javanica. To Mr. Drummond, Gardener to C. H. Leigh, Esq., F.H.S., for a Queen Pine Apple, weighing 5 lb. 14 oz. To Mr. Wilmot, F.H.S., for the same, weighing 3 lb. 5 oz. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., for a Providence Pine Apple, weighing 8 lb. 6 oz. To Mr. Smith, Gardener to S. Ricardo, Esq., for the Heaviest Bunch of Grapes (Syrian), weighing 3 lb. 10 oz. To Mr. Fleming, for the Second Heaviest Bunch of Grapes (Black Hamburgh), weighing 3 lb. 8 oz. To Mr. Heywood, Gardener to G. R. S. Goodman, Esq., Roundhay, near Leeds, for Black Hamburgh Grapes. To Mr. Davis, of Oak Hill, East Barnet, for the same. To some person unknown, for White Muscadine Grapes. To Mr. Wilmot, F.H.S., for Sweetwater Grapes. To Mr. Taylor, Gardener to J. Coster, Esq., of Streatham, for Muscat Grapes. To Mr. Munro, Gardener to Mrs. Oddie, St. Alban's, for White Frontignan Grapes. To Mr. Ingram, Gardener to Her Majesty at Frogmore, for Violette Hâtive Peaches. To Mr. Turnbull, Gardener to the Duke of Marlborough, at Blenheim, for Elruge Nectarines. To Mr. Davis, Oak Hill, for the same. To Mr. Davis, Gardener to J. Dixon, Esq., Astle Park, Chelford, Knutsford, for the Heaviest Melon (Green fleshed Cabul), weighing 9 lb. 10 oz. To Mr. Gadd, Betchworth, for the same, in the Market Gardeners' Class (Cantilupe), weighing 4 lb. 5 oz. To Mr. Barnes, Gardener to R. Hanbury, Esq., F.H.S., for the best flavoured Melon (Bromham Hall). To Mr. Gadd, for the best flavoured Melon (Beechwood) in the Market Gardeners' Class.

The Silver Banksian Medal: To Messrs. Pamplin, Lea Bridge

Road, Essex, for a collection of ten Stove and Greenhouse Plants. To Mr. Gerrie, Gardener to Sir J. Cathcart, Bart., F.H.S., for the same. To Messrs. Spriggins and Co., St. Alban's, for a collection of Roses in fifty varieties. To Mr. Tivey, Gardener to T. Wigelin, Esq., Golding, Herts, for the same in twenty-five varieties. To Mr. Gregory, F.H.S., for a collection of Fuchsias. To Mr. Young, Gardener to C. Barron, Esq., Denmark Hill, Camberwell, for a collection of Helichrysums. To Mr. Newhall, Woolwich, for Carnations. To Mr. Norman, ditto, for the same. To Mr. Edwards, F.H.S., for Piccotees. To Mr. Norman, for the same. To Mr. Smith, Hornsey Road, for a collection of Verbenas. To Mr. Gadd, Gardener to T. J. Lenox, Esq., Hammersmith, for a collection of Petunias. To Mr. Ivison, Gardener to the Duchess Dowager of Northumberland, F.H.S., for Cattleya Mossiæ alba. To Mr. O'Brien, Gardener to G. Read, Esq., Burnham, Somerset, for a collection of Hothouse Ferns. To Mr. Turner, Holloway, for a collection of Alpine Plants. To Mr. Ivison, for Curcuma Roscoeana. To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for Sollya linearis. To Mr. Epps, F.H.S., for Erica ferruginea. To Mr. Higgs, Gardener to J. H. Barchard, Esq., F.H.S., for a Moscow Queen Pine Apple, weighing 4 lb. 12½ oz. To Mr. Brewin, Gardener to R. Gunter, Esq., F.H.S., for a Providence Pine Apple, weighing 8 lb. 8 oz. To Mr. Henderson, Gardener to Sir G. Beaumont, Bart., F.H.S., for Black Hamburgh Grapes. To Mr. Corney, Edmonton, for the same. To Mr. Smith, Gardener to A. Anderson, Esq., Streatham, for White Muscadine Grapes. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., for Muscat Grapes. To Mr. Snow, Gardener to Earl de Grey, for Violette Hâtive Peaches. To Mr. Parker, Gardener to J. H. Oughton, Esq., Roehampton, for Nectarines. To Mr. Snow, for Black Tartarian Cherries. To Mr. Meyers, jun., Brentford, for Black Circassian Cherries. To Mr. Snow, for Elton Cherries. To Mr. Elliott, Gardener to J. B. Boothby, Esq., F.H.S., for British Queen Strawberries. To Mr. Lydiard, of Batheaston, Bath, for British Queen and other Strawberries. To Mr. Elliott, for the second best flavoured Melon, "Bromham Hall." To Mr. Smith, Gardener to S. Ricardo, Esq., for Fastolff Raspberries. To Mr. Ivison, for Fruit of Nutmeg and Papaw.

Certificates of Merit: To Mr. J. J. Foster, Edgeware Road, for a collection of Roses, in fifty varieties. To Mr. J. Ayre, Gardener to A. Currie, Esq., F.H.S., for the same, in twenty-five varieties. To Mr. Edwards, F.H.S., for Carnations. To Mr. Ellis, Woolwich, for the same. To Mr. Ward, Woolwich, for the same. To Mr. Wilmer, Sunbury, for the same. To Mr. Bragg, Slough, for the same. To Mr. Newhall, Woolwich, for Piccotees. To Mr. Ellis, for the same. To Mr. Ward, for the same. To Mr. Bragg, for the same. To Mr. Wooler, Tulse Hill, Brixton, for a collection of Antirrhinums. To Mr. Spencer, Gardener to the Marquess of Lansdowne, F.H.S., for Peaches. To Mr. Fleming, Gardener to the Duke of Sutherland, F.H.S., for Elruge Nectarines. To Mr. Whiting, Gardener to H. T. Hope, Esq., for Black Circassian Cherries. To Mr. Gainsford, Brentford, for the same. To Mr. Kemp, Gardener to Mrs. Grillion, East Acton, for Bigarreau Cherries. To Mr. Ingram, Gardener to the Marquess of Salisbury, F.H.S., for British Queen Strawberries. To Mr. Beach, Hounslow, for the same. To Mr. Ball, Gardener to H. Rogers, Esq., Stagenhoe Park, Welwyn, for the third best-flavoured Melon (Napoleon Green-fleshed). To the Rev. Mr. Peck, Houghton Rectory, Huntingdon, for Shaddocks.

N.B.—West's St. Peter's Grapes ought to have been shown in No. 2 E, and not in No. 4 E. There were some very fine exhibitions of Muscat and Cannon Hall Grapes, of which no notice could be taken in consequence of their extremely unripe condition.

In the only specimen of Peaches in pots exhibited, the fruit was very unripe.

An exhibition of twenty-five varieties of Roses, by Mr. Terry, Gardener to Lady Puller, Youngsbury, Herts, was disqualified on account of its containing the same Rose under two different names.

Only one collection of Conifers was shown; partly unnamed, and of little interest.

Achimenes Tugwelliana should not have been exhibited in the class of New Plants. Luxemburgia speciosa has been shown in the Garden in former years.

August 6, 1850. (REGENT STREET.)

The following "Notice," which had been previously read and suspended in the meeting-room on the two successive meetings held on May 20 and June 18, as directed by the By-Laws, was again read:—

"The Council hereby give notice that they propose to substitute for Chapter VI. Article I. of the present By-Laws, namely, 'the admission-fee to be paid by each Fellow shall be six guineas,' the following words, viz.: 'the admission-fee to be paid by each Fellow shall be two guineas.'"

The Meeting then proceeded to ballot for the repeal of the present By-Law, which was carried by 7 Ayes to 1 No. A Ballot having been next taken for the substituting of the amended By-Law, the Chairman declared it to be carried by 7 Ayes to 1 No.

AWARDS. *Knightian Medal:* To Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S., for five beautifully ripened Ripley Queen Pine-Apples with small crowns, the heaviest weighing 6 lbs. 4 ozs., and the lightest 5 lbs. ½ oz.

Banksian Medal: To Mr. Spencer, Gardener to the Marquess of Lansdowne, at Bowood, for a long, conical, Enville-shaped Pine-Apple, named Black Prince, a red coloured kind, about which little at present is known. It weighed 11 lbs. 11 ozs.; but Mr. Spencer stated that, under better cultivation, this kind of Pine-Apple might be expected to produce fruit much heavier than the one sent, which was the production of a small plant, and but imperfectly swelled. It was not cut up, and therefore no opinion of its quality could be formed. To Mr. Ferguson, of Stowe, for finely swelled and coloured Peaches and Nectarines, stated to have been ripened under glass without the aid of fire-heat. To Mr. Chater, of Saffron Walden, for a beautiful collection of Hollyhocks, in the shape of spikes and single blooms. The kinds consisted of Attraction, light ground, beautifully veined; Atrosanguinea, dark crimson; Black Prince, one of the darkest of Hollyhocks; Coccinea, bright red; delicata, French white; formosa, claret; Magnum bonum, maroon; Model of Perfection, white; Napoleon, red and buff; purpurea elegans, purple; Queen, blush; rosea grandiflora, pink; improved varieties of rosea alba, Snowball and Wellington; sulphurea perfecta, sulphur; Comet, ruby red; pulchella, exquisitely formed rose; Mr. C. Baron, delicate salmon; Elegans, blush; and Commander-in-chief; the latter with a flowering spike at least 3 feet in length. The same grower also produced some nice Seedlings, among which was a kind named Walden Gem, an improvement on the beautiful variety called Comet in point of colour. To Mr. Franklin, Gardener to Mrs. Lawrence, F.H.S., for a small collection of Orchids, consisting of Angræcum caudatum, Cattleya crispa, Oncidium incurvum, Burlingtonia candida, Dendrobium formosum, Aërides quinquevulnera, Miltonia spectabilis, Anguloa uniflora, a species of the genus Eulophia, and one or two other plants.

Certificate of Merit: To Mr. May, Gardener to Mrs. Lawrence, F.H.S., for a well grown plant of Ixora coccinea.

Miscellaneous Subjects of Exhibition. Blooms of twenty-four varieties of Hollyhocks from Mr. Bragg, of Slough. A badly formed, Cockscombed-crowned Providence Pine-Apple, weighing 11 lbs. 11 ozs., from Mr. Jones, Gardener to Sir J. Guest, Bart., F.H.S. Specimens of "Richmond Villa Black Hamburgh Grapes," finely covered with bloom, from H. Judson, Esq., of Brighton. A Bromham Hall Melon, weighing 2 lbs. 11 ozs., from the raiser, Mr. Bundy, Gardener to Lord Dynevor, Dynevor Castle, Llandillo; and a machine for sulphuring trees and plants, from Mr. Fry, Gardener to Mrs. Deal, Lee, Kent. The latter is on the same principle as Brown's fumigator, and looks not unlike a small-sized fumigator placed on the top of a larger-sized one. It is stated to answer perfectly.

Novelties from the Society's Garden. Haricot d'Alger and the Cabbages Chou de Poméranie and Chou pointu de Winnigstadt. For descriptions of these see pp. 280 and 281 of the present volume.

Books Presented.

Transactions of the Royal Society of Edinburgh, Vol. XIX., Part 2; and Proceedings of ditto, Vol. II., Nos. 35, 36, 37, 38, and 39. From the Society.
The Gardeners' Magazine of Botany, Horticulture, &c., Parts 6 and 7. From the Publishers.
Icones Plantarum Asiaticarum, Part 2; Notulæ ad Plantas Asiaticas, Part 2; and Itinerary Notes of Plants collected in various parts of India, Vol. II., by the late W. Griffith, Esq. From the Honourable the Court of Directors of the East India Company.
Notizie sopra due specie d'Insetti nocivi agli Alberi, &c., by Dr. Passerini. From the Author.
Verhandlungen der k. k. Landwirthschafts Gesellschaft in Wien und Statuten der kaiserlich-königlichen Landwirthschafts, &c. From the Agricultural Society of Vienna.
The Athenæum for June and July. From the Editor.
Proceedings of the 27th Anniversary Meeting of the Royal Asiatic Society. From the Society.
Essai d'un Catalogue Méthodique et Synonymique des Froments qui composent la collection de L. Vilmorin. From M. Vilmorin.
Quarterly Journal of the Geological Society, Vol. VI., No. 23. From the Society.

September 3, 1850. (Regent Street.)

Awards. *Knightian Medal:* To Mr. Scott, Gardener to Sir George Staunton, Bart., F.H.S., for some forced Late Admirable Peaches, remarkably large and fine, and some ripe Mangoes. One or two of the latter were somewhat injured by travelling; but the others were unblemished, and beautiful examples of this kind of fruit. It was stated that the tree which produced them never failed to ripen a good crop of excellent Mangoes every year.

Banksian Medal: To Mr. Henderson, of the Wellington Road Nursery, St. John's Wood, for Vriesia splendens, with a long feather-like spike of scarlet floral leaves; Beaufortia purpurea, a small Swan River shrub, bearing little round tufts of purple flowers; Eriocnema marmoratum and æneum, two Melastomads, more remarkable for their handsome, variegated, and velvety green foliage than for the beauty of their flowers; and an attractive yellow-blossomed annual, named Microsperma bartonioides. The latter was stated to be a profuse bloomer, and to be valuable for decorating greenhouses in autumn when gay flowers are a desideratum.

Miscellaneous Subjects of Exhibition. Mr. Henderson sent Achimenes longiflora alba or Jaureguia, Æchmea fulgens, the bright salmon-coloured Geranium called "Beauty of the Parterre," brilliant cut flowers of two kinds of hybrid Gladiolus, a blue Convolvulus from St. Catherine, Messrs. Veitch's variety of Gesnera picta, which is stated to be a better kind than that sent out from Kew, and an unripe example of the Serpent Cucumber (Trichosanthes colubrina). Mr. Dobson, Gardener to J. Foster, Esq., Bayswater, had a small collection of Achimenes, consisting of longiflora, venusta, Skinneri, and grandiflora. A curiosity, in the shape of a Pine-apple, was exhibited by Mr. Steers, Market-Gardener, Teddington. It was an example of one of those Pine-apples, or rather masses of Pine-apple (for one mass will often fill a peck measure), which are to be found in the markets of Batavia, and in which the pips possess the peculiar property of elongating and producing second fruits. In the specimen shown, only two of the pips near the base had pushed and were forming lateral fruit; but these furnished sufficient evidence that the peculiarity would be retained under cultivation in this country. Nothing can be stated as to its quality, for the fruit was not cut up. Mr. Middlemiss, Gardener to A. Pott, Esq., of Bentham Hill, Tonbridge Wells, sent two large coarse-looking Melons, affected with a disease which has been prevalent this season, and which exhibited itself in putrid spots here and there over the surface of the fruit, which appeared to be in a state of rapid decay. It has been suggested that injudicious watering may have had something to do with the production of the evil; but Mr. Middlemiss stated that, in his case at least, this could not have been, for his Melons had never been watered. A plant with six fruit on it was reported to have four out of the six diseased.

Novelties from the Society's Garden. The Early Ulm Savoy (Chou de Milan très Hâtif d'Ulm), and the Tomato Capsicum, descriptions of both of which will be found in page 284; also fruit of the Olwer Grape, described in Vol. III. p. 307 of this Journal. It is a Rhenish wine Grape, stated to possess peculiar properties. Along with the Olwer Grape came fruit of the Black Prince and Chasselas Musqué. The latter is considered one of the finest Muscat-flavoured Grapes; but, unfortunately for those who prefer that flavour, this variety has got a bad character, as regards the liability of its berries to crack in swelling. But it may be grown without any thing whatever of this defect. In the present *dry season* not one cracked berry has been observed on the plant in the Society's Garden; and doubtless, in seasons not so dry, borders may be managed so as to suit it. The evil, therefore, is entirely under the gardener's control.

Books Presented.

Gardener's Magazine of Botany. Part VIII. From the Publishers.
Journal of a Tour through Scotland. By Beriah Botfield, Esq. From the Author.
Archives du Muséum d'Histoire Naturelle, tom. 4, Livraison 4[e]. From the Museum of Natural History, Paris.