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ROYAL HORTICULTURAL SOCIETY.

I. On Hybridism considered as a cause of variability in Vegetables.

By M. Ch. Naudin*.

The changes of form in the species of the vegetable kingdom are very properly considered at the present moment one of the phenomena which are most worthy of attracting the attention of observers. The subject of the variability of species, which was put aside amongst questions of secondary consideration, has within a short time assumed an unexpected importance; and without mentioning the philosophical deductions to which it has given rise, it may be asserted that it forces itself on our notice at the very commencement of all our descriptive works. For the last ten years I have devoted to it all my attention, and though duly estimating the facts in this direction observed by my predecessors, it is nevertheless to my own experiments I have looked especially for enlightenment on this obscure subject. I do not pretend to have solved all the difficulties which it involves, but I think that I have arrived at results which, I hope at least, will throw some light upon points in the biology of vegetables which have been hitherto perplexed.

In a memoir which I had the honour of presenting to the Academy two years ago I established this fact, confirmed since by new experiments, that, setting out from the second generation, hybrid vegetables, when they are fertile, revert very frequently to one of the two species from whence they were derived. This

* Translated, by permission of the author, from Comptes Rendus de l'Académie des Sciences, Nov. 21, 1864.

reversion to forms authorized by nature is not universal; nothing is more common, in fact, than to find in hybrids of the same origin and of the second generation, or of a generation more advanced, in company with individuals which revert to the form of the parent species, a more or less numerous residue of individuals, which do not retrograde, or which even differ more from these last, than they differ from hybrids of the first generation. What sort of physiognomy do these refractory hybrids present, and what are their descendants? This is the question which I purpose to examine in the present memoir.

In 1862 I made numerous crosses, all of them successful, between *Datura lævis*, *ferox*, *Stramonium*, and *quercifolia*, four species perfectly distinct, between which there are no known intermediates, and which moreover do not appear susceptible of variation. Nevertheless, though very distinct, these species are sufficiently closely related to admit of reciprocal impregnation, and to give rise to hybrids, which, though sterile at first, become very fertile at a more advanced period. They were then in the most favourable condition for the object which I proposed—the observation of their hybrids during at least two consecutive generations.

In order to apprehend properly the facts which follow, I ought to state that the species of *Datura* of the subgeneric group to which these four species belong, may be divided into two groups, one in which the plants have green stems and white flowers, the other in which the stems are more or less brown, or blackish purple, and the flowers violet. For brevity I shall call them the white and violet groups. *D. Stramonium*, *lævis*, and *ferox* belong to the first; *D. Tatula*, *quercifolia*, and some others to the second.

As I have just remarked, I have made numerous crosses between these species, all of which have succeeded, and under such conditions of insolation that I could have no doubt of the results which I obtained. I will not speak here of all these experiments, which I reserve for a more extended memoir; I wish only at present to lay before the Academy the very remarkable phenomena of variation which have been elicited by these crosses, and to point out the consequences which appear to me to result from them.

Datura lævis and *ferox*, the two species which differ the most in the white group, having been fecundated the one by the other, and in both directions, I was able in 1863, by help of the seeds derived from this double intercrossing, to raise sixty individuals of *Datura lævi-ferox*, and seventy of *D. feroci-lævis*, in all 130 hybrid plants, derived from the same parents, which had alter-

nately acted the part of father and mother. All these plants attained the most complete development, and were so perfectly like each other that the two sets might easily have been regarded as one. This is a new confirmation of what I have already announced in the memoir cited above—that there is not a sensible difference between reciprocal hybrids of two species, and that in the first generation the hybrids of the same origin resemble each other as much as the individuals of pure species from the same sowing. In this first generation, I repeat, the entire collection of hybrid individuals of the same origin, however numerous they may be, is as homogeneous and as uniform as a group of individuals of an invariable species, or of a pure and neatly-defined race would be.

But these 130 hybrids presented a fact which was quite new to me: if they perfectly resembled each other, they differed strangely from the two species from which they were derived. They had neither the stature, the habit, the flowers, nor the fruit of their parents; there was not even anything intermediate between their forms which were so well known and so decided. Any one who did not know the origin of these hybrids, would not have hesitated to make a new species of them, and what is worth notice, would have classed them in the violet series, for all had the flowers of this colour and brown stems. Notwithstanding, as I said above, the two parent species belong to the group characterized by green stems and white flowers.

In the face of this unexpected result, one might have been tempted to believe that two species, intermarrying, might impart to their progeny characters which they do not possess themselves; but such a conclusion was too paradoxical to be accepted without a reexamination. I resolved therefore to recommence the experiment the following year, observing at the same time more closely not only the hybrids, but also the species from whence they were derived.

This year (1864) I have sown afresh *D. lævi-ferox* and *ferocilævis*, and by their side *D. ferox* and *D. lævis* in a state of purity. Thirty-six new plants of *D. lævi-ferox*, and thirty-nine of *ferocilævis* reproduced all the identical features of their brethren of the preceding year. They had the same brown stems, the violet flowers, and thorny fruit. But what I had not previously remarked, in *D. ferox* of a pure strain the stem at the moment of germination is of a deep purplish violet. This vivid tint extends from the root to the cotyledons, where it suddenly ceases, giving

place to the clear green tint; but it remains during the whole existence of the plant on the part which it occupies, and where it traces a coloured circle. From this moment all was clear: if the hybrids of *D. ferox*, allied to another species of the white group, have brown stems and violet blossoms, it is because *D. ferox* itself possesses the germ of this colouring. In the pure species, the colouring remains in a rudimentary state, occupying only the small interval which extends from the commencement of the root to the cotyledons; in the hybrid it acquires an enormous increase, extending over all parts of the plant, and manifesting more especially its action on the flower. Here then is a first mode of variation induced by the crossing of two species, and which produces its effects on the first hybrid generation. The second generation is about to offer us variations of another kind, and still more remarkable.

All these hybrids, though sterile at the first seven or eight dichotomies, were very fertile in those which were developed later. Their seeds, sown last spring, gave me in the second generation nineteen plants of *D. feroci-lævis*, and twenty-six of *lævi-ferox*. The two sets still resembled each other, but by a character diametrically opposite to that which was the prominent trait of the preceding generation. The most astonishing diversity of feature succeeded the former great uniformity, a diversity of such an extent, that out of the forty-five plants of which the two sets were composed, no two were found which precisely resembled each other. They differed in stature (in the proportion of one to four), in habit, in the form of the leaves, the colouring of the stem and flowers, the degree of fertility, the size of the fruit, and the degree of aculeation. With the exception of a single individual of the *lævi-ferox* set, which had completely reverted to *D. lævis*, with this slight difference that there was still at the base of the stem a circle of purplish violet, not one of these plants had sensibly approached this species, and there was only a very small number in which one could recognize faint resemblances to *D. ferox*; the greater part even more closely resembled *D. Stramonium* and *D. quercifolia*, with which they had no relationship, than the species from which they descended. Some had white flowers and green stems, either self-coloured or tinted with purple at the base, while others had violet flowers of various shades, and stems more or less brown, sometimes even of a purplish black as deep as that of *D. Tatula*, which is the most perfect type of the violet group; the fruit was of all sizes, from that of a filbert to

that of a large walnut, and some of them were very spiny, while others were covered with tubercles, or almost destitute of spines; certain individuals bore fruit at the first fork, while others were fertile only towards the last, and finally there were some which set only a single fruit. On the whole, the forty-five plants of the two sets constituted, so to speak, as many individual varieties, as if, the bond which ought to unite them to the specific types being broken, their vegetation had wandered in every direction. This is what I call irregular variation, in opposition to another very different mode of sporting, of which I shall speak presently.

I could bring forward many other examples of the excessive variability which arises in consequence of crossing. Not being able to give to this note all the space which the subject demands, I shall confine myself to the following examples, which have likewise been furnished by my experiments.

In 1863 I received from an horticultural amateur a full-grown plant of *Mirabilis longifloro-jalapa* of the first generation, the issue, as the name implies, of the common Marvel of Peru, with purple flowers, fecundated by *M. longiflora.* A seed obtained from the first cross of the two species accompanied the plant, which was destined to give me a second hybrid individual, equally of the first generation. The two plants, cultivated side by side, became enormous. Intermediate in the same degree between the parent species, which they far surpassed in stature, they resembled each other as exactly as possible, which might be expected, as they both belonged to the first generation. They were moderately fertile, and out of the many thousand flowers which they expanded in the course of nearly three months, they produced some hundreds of perfectly similar seeds.

The older of these two plants having already borne fruit the preceding year, and some of its seeds having been sent to me by the donor, I obtained the same year (1863) six other hybrid plants of the second generation. None of them acquired the large stature of the hybrids of the first generation; none, moreover, resembled them. Of these six plants, there were two which seemed to be the image of each other, so slightly did they differ: this was an exception; they flowered abundantly, but though well developed and very vigorous, they remained entirely sterile. A third almost reverted to the normal form of *Mirabilis jalapa,* of which it possessed the stature, the leaves, the flowers, and the fertility; it differed only in a slightly more expanded habit, and the tube of the corolla being more elongated. The three last were

plants of low stature, more or less deformed, as different from each other as from the hybrids of the first generation; besides, like the two first, they were sterile, or at the most yielded only a few fruits, in which the seeds were only incompletely developed. Three new plants of the second generation, cultivated in 1864, presented the same diversities of physiognomy; they no more resembled those of the former year than the first hybrids. One of these, which approached *M. jalapa* very sensibly, was extremely fertile; the two others flowered very unequally, and did not yield a single seed. What results from this second experiment is still the irregular variation of the offspring of a hybrid plant, when it does not resume the livery of the species from which it descends.

It may be asked whether this propensity of hybrids to vary continues to the third and following generations, when they preserve their fertility. My answer to this question is as follows:—

I observed in 1863 and 1864 the sixth and seventh generations of a hybrid which I have kept for several years, *Linaria purpureo-vulgaris*, both represented by some hundreds of individuals. A good number of these last reverted, some completely, the others partially, to the form of *Linaria vulgaris* with yellow flowers, a small number to those of *Linaria purpurea* with purple flowers. Others, still very numerous, inclined, so to speak, towards neither the one nor the other, but nevertheless did not resemble the hybrid of the first generation. There were all possible kinds of variation; tall or dwarf stature, broad or narrow leaves, the corolla deformed in various ways, discoloured, or exhibiting unusual tints, and out of all these combinations there did not result two individuals which were perfectly alike. It is very clear that we have to do here with irregular variation, which engenders only individualities, and that uniformity is not established between the descendants of hybrids, except on the condition that it resumes the normal livery of the parent species.

Similar facts, to which all the attention which they merited has not been paid, have been produced, and are produced daily in the practice of Floral Horticulturists. Here is a well-known and well-authenticated instance: there exist in gardens two species of *Petunia* perfectly defined, the one (*P. nyctaginiflora*) has white flowers, the other (*P. violacea*) has purple flowers, neither of which at present has varied, but intercrossing easily and yielding hybrids as fertile as themselves. In the first generation, all the hybrids are alike; in the second they vary in the most remarkable degree, some reverting to the white species, others to the purple, and a

large residue showing all the shades between the two. When these varieties are fecundated artificially by each other, as is the practice of some gardeners, we obtain a third generation still more parti-coloured, and continuing the process we arrive at extreme variations, sometimes at monsters, which the prevailing fashion regards as so many marks of perfection. The essential point is, that these varieties are purely individual, and without any persistence. Their seeds when sown yield new forms, which have no greater resemblance amongst each other than they have to the plants which produced them.

Were we to review other groups of ornamental plants, where at the commencement of their cultivation there existed two or more species sufficiently alike in organization to give rise to fertile hybrids, we should discover the same facts of individual, and not collective variability, such as I have just noticed. Primroses and roses, not to bring forward other instances, are memorable examples. Intercrossed a thousand times, either intentionally by horticulturists, or accidentally by insects, the species of these two genera have given birth to varieties so numerous, that we can scarcely reckon them up, and that the primitive types of the species, merged in this confused and ever-changing multitude, have scarcely more than a conventional existence. Whatever the variety may be of rose or of the garden-primrose, so well named *Primula variabilis*, whose seeds we sow, we may be sure beforehand that it will not be identically reproduced, and that we shall see almost as many new variations as individuals spring up from the seed.

This leads me naturally to glance at our fruit-trees, our apples and pears especially, whose varieties are counted by hundreds, and I might say by thousands, if we kept all those which we have seen arise from seeds. Well-informed cultivators of seeds are unanimous in allowing that these varieties are individual, and without permanence, and that grafting them is absolutely necessary to preserve them and propagate them, of which M. Decaisne has recently given experimental proof*. Must we conclude that these varieties are the result of crossing between distinct species and races? The direct proof is wanting, but I dare affirm that it is really the cause, and that under all this multitude of unstable forms, several types, primitively specifically distinct, are concealed, to which it is no longer possible to assign their true characters.

* A translation of M. Decaisne's memoir will be found in another part of this Journal.

Further, whatever opinion we may form in this respect, we must allow that these forms, not transmissible by way of generation, want in this very respect the essential character of species and true races, which is to perpetuate themselves faithfully by seed and to increase. We may say strictly that these varieties are no longer represented sometimes after ages of duration, save by a single individual, always the same, and always renewed by grafting, that is to say, by the indefinite division of its branches.

But if crossings have produced these phenomena of irregular variability in cultivated plants, would it not be possible that the same cause had made them arise in plants remaining in a wild state? One is led to believe, when we cast our eyes on certain generic groups, as those of *Salix*, *Potentilla*, *Rubus*, &c., where species well characterized at first sight are connected nevertheless with one another by intermediate forms so numerous and so well graduated, that at last we do not know where to place the limits of these species; thus, in spite of the most laborious studies, these genera have remained a matter of dispute amongst botanists. What renders this supposition probable is, that the species of these different groups are precisely those which occur under physical conditions the most calculated to favour crossing. But it is sufficient here that two species, when crossing, give place to fertile hybrids which do not all revert to the specific types, in order that the irregular variability should come into play, and induce, after some generations, that chaos of undecided forms in the face of which all the efforts of botanical describers miscarry*.

After having related how hybrids vary, it is time to examine how pure species behave themselves, when their forms are modified. Let us state first, that in respect of variability they are very unequally gifted. There are some which we never see varying, at least in the sense which we attach to this word; there are others which vary, and sometimes within extremely wide limits. We know not what causes determine these variations; it is nevertheless allowable to believe that emigration and cultivation are not without influence, for we see many remarkable varieties spring up in their course. But species, when they vary in consequence of their innate tendency to do so, do it in a very different manner from

* The translator of this memoir was peculiarly struck three years since with the infinite variety of forms of *Salix* which occur along the course of the Dee. It really seemed as if every bush possessed some character of its own, and in consequence a neighbouring botanist, who set out with the intention of collecting every variety of willow in Aberdeenshire, gave up the matter in despair.

that which we have demonstrated amongst hybrids. While in these last the form dissolves, from one generation to another, into individual and unpersistent variations, in the pure species, on the contrary, the variation has a tendency to perpetuate itself and to increase. When it is produced, one of two things takes place, either it disappears with the individual in which it took rise, or it is transmitted without alteration to the following generation, and from thence, if circumstances are favourable, and no crossing with the type of the species or with another variety disturbs it in its evolution, it passes into the condition of a definite race, and impresses its seal on an unlimited number of individuals. It is thus that I explain the formation of those well-marked races of economical vegetables, so homogeneous and so stable, of which cultivation has beheld the origin, and which it preserves with so much care. If we consider only the regularity of their progress, we should take them for real species ; but their instability, when they are submitted to the chance of crossing, testifies their real nature. They are not species in the botanical sense of the word, they are categories in a larger species, or, if you will, confraternities of individuals similar in organization, and having a uniform livery. This homogeneousness and fixity of character are the distinctive mark of true races, as diversity and want of permanence are the mark of agglomerations arising from half-blood or hybridity. The latter, tainted with illegitimacy, are the fruit of irregular variation, the former of the regulated and normal variation of the species. I could even say more willingly that they are the species itself adapting itself to new media and new finalities.

I know not if facts analogous to those which I have just reported have been observed in the animal kingdom ; but I should not be surprised if we came some day to recognize that there also crossings between definite races are a cause of variability perfectly individual, and that they are impotent to create new races, that is to say, uniform fellowships, and capable of enduring infinitely. It would certainly not be without interest, if, when intermarrying, races perfectly distinct should melt into a new mixed but homogeneous race; or if, as in plants, the crossing should have the effect of infinitely diversifying physiognomies and temperaments. But it is a subject for which I am not competent, and which I hasten to leave to professional zoologists.

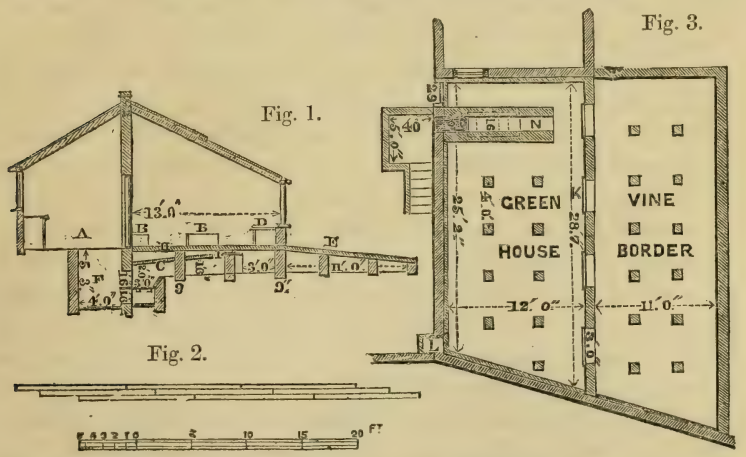
II. Hypocaust-Heating. By C. Wykeham Martin, Esq.

Having met with several discussions on the subject of providing bottom-heat for various horticultural objects, I was induced some time ago to turn my attention to the most economical mode, consistent with efficiency, of obtaining that which appeared to be very generally desired. I saw that various methods had been adopted, at varying cost and with varying success, and this had taken place more particularly with reference to vine-borders. Arches had been constructed beneath them, into which hot air had been admitted; but this appeared a very expensive mode, both in its first construction and in its subsequent working, as large quantities of fuel must be used to heat the brickwork sufficiently to be of any service for purposes of cultivation. Hot-water pipes had been passed through borders, but it did not seem easy to diffuse the heat equally by such means, though much has doubtless been done by placing rubble over the pipes to enable the heat to circulate. Then came the experiments for other purposes by Captain Clarke, of which an account was given in the 'Proceedings of Royal Hort. Soc.' vol. ii. 1861. His apparatus consisted of a long pit of brickwork five or six feet wide, covered with slates resting on iron bars, and warmed by a three-inch pipe passed down the centre. This seems to have acted extremely well for the purposes for which it was designed; but the slates appeared to be a fragile support, rather adapted to temporary and experimental than to permanent use, and not smoke-proof.

After much consideration, I determined to try a cheap imitation of the mode in which the Romans heated the principal apartments of their villas. I was aware that builders were much in the habit of using, for roofing-purposes, a covering of three courses of ordinary roofing-tiles, laid in cement instead of mortar, and that this substance would bear a considerable weight, if resting on a rigid support at intervals not greater than 6 feet. I therefore adopted in a new house which I was building, the following arrangement.

I first excavated a chamber 2 feet 6 inches deep, at the foot of my garden-wall, and in it built up pillars of brickwork 9 inches square, to that height above the ground. These were about 3 feet 9 inches apart in one direction, and rather less than 3 feet in the other, so that at no point was the bearing quite 6 feet. These formed the supports of the floor, which was constructed on a staging of wood, which was removed as soon as the cement had

sufficiently set. Previously to the construction of the floor, as I was obliged from local circumstances to place the fire and the chimney on the same side of the house, I had constructed a flue, nearly horizontal, for 7 or 8 feet across the house, in order that the heat should be delivered nearly at the corner opposite to the chimney. I was apprehensive that, without this precaution, the heat might steal along the back wall and not circulate through



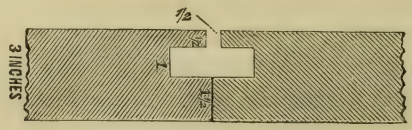
the chamber; I should otherwise have only taken the precaution of making the floor thicker over the fire, by filling up the space above it with concrete, or of leaving a vacuum between the covering of the fire-place and the floor, for a sufficient distance to prevent the floor cracking or becoming too hot. The fire-place consisted of an opening 23 inches wide and about 30 inches high, built in fire-brick, the bottom consisting of the cast-iron bars used for the fires by which hops are dried in my neighbourhood. The opening can be closed by means of a piece of sheet iron hung over a pulley by a chain with a balance weight, and in the chimney there is also a damper. By these means it was intended, when once the floor and chamber are heated, to make them part with their heat very slowly, so that, excepting in the permanent cold weather of the winter, a fire would only be needed for a portion of the twenty-four hours, and until the middle of the autumn for only a very limited portion. But in addition to the space below the hothouse, the chamber was continued under the vine-border, similarly supported on 9-inch pillars; these were not of uniform height, the outer chamber setting out with a height of 2 feet 6 inches, and dying away to 6 inches at about 11 feet from the

front wall. Also in the front wall were four openings provided with shutters, by which the heat could be kept from the outer border, if it were desired that this should not be warmed.

Having been requested to superintend the construction of a similar house for a neighbour, I found it better to dispense with the wooden staging on which the tile-floor was built, and to put together slabs of tileing, three courses thick, three or four days before they were required for use. These were then placed upon their supports, and finished off afterwards, the outer edges having been what is termed "racked off," and requiring to be filled in with tiles and cement to the level of the floor. This operation was easier, quicker, and cheaper than the other, and I decidedly recommend it in preference.

The slabs of tiling may be made in dry weather in the open air, and on any level piece of ground. In wet weather of course they should be made under cover; and if the supports are placed at 3 feet from centre to centre, which is a very good distance, they would be 3 feet square. As to the cost of this kind of work, it can be done for 6*d.* a foot where tiles can be had for 30*s.* per thousand, but would be cheaper where tiles are cheaper, which they are in very many districts. The fire-place which I used was needlessly large, and fire-bricks and fire-tiles were used to an unnecessary extent; but even then it only cost £3 complete. That used by my neighbour, for a small greenhouse 20 feet long and 10 feet wide*, was the cast off fire-place of an old copper, and is amply sufficient for its purpose.

I have since seen a material which seems to me very likely to make a good and cheap floor, but it has not yet been tried. It is an artificial pavement of cement made in blocks of any size for rather less than 6*d.* a foot (superficial), and with the edges so constructed as to make a thoroughly smoke-tight joint, by pouring in liquid cement after the pieces are laid in their places (as will be seen by the figure†). This is found very durable *as a pavement*,



* In this house there is no external border.

† It will be seen by the figure that the lower flanges of the tiles touch; the upper flanges are half an inch apart, and there is a groove in the edges, so that the whole forms a solid mass when the cement is poured in.

but has not been proved as to its power of standing fire-heat, nor as to the shrinking of the joints. The next point to be considered is the cost of fuel, the cheapness of the construction being abundantly plain; it is not easy to imagine anything much cheaper than £6 or £7 for the heating of a greenhouse 20 × 10, including an ornamental floor, every portion of which is pleasing to the eye as well as available for use. The consumption of fuel is equally moderate, and any kind of fuel can be used. I have used cord-wood, uncleft faggots, and sawdust, and the chips out of my wood yard, and I find, as I expected, that, excepting in the depth of winter, it is quite unnecessary to keep up the fire during the twenty-four hours. In the autumn four or five hours are sufficient, the magazine of heated air in the lower chamber cooling by very slow degrees, when the furnace-door is shut and the damper of the chimney pushed in. Early in November a fire was lighted at 4 o'clock and let to burn itself out; nevertheless at between 3 or 4 o'clock the following day a thermometer buried in an inner border showed a heat of 71°. The fire had consisted of a faggot of toppings of trees and about a bushel of sawdust; and there is no doubt that any loppings, prunings, cast off pea-sticks and other garden rubbish will answer perfectly as fuel. Hence the working is, in proportion, as cheap as the original construction. And it should be kept in mind that in houses of this construction the heat is not only provided *cheaply*, but it is given in a different form from that usually supplied, namely as *bottom-heat*. This is not the place for enumerating the various plants for which bottom-heat is either indispensable or highly beneficial. They are numerous, but persons conversant with gardening do not require information as to their number, and the experience of one season proves but little. I may observe, however, that bottom-heat in this form seems to be far superior to that supplied in a common hotbed. I transplanted some thinnings of early carrots last spring from a hotbed to my heated (external) border, expecting the transplanted plants to form a succession crop to the original bed. But to my great surprise, when they were fit for use, those in the bed from which they were taken were less than half their size. In trying to account for this, it immediately struck me that the heat of the hotbed was daily exhausting itself, whilst, by the aid of the sun, that of the heated border was daily increasing. And although it was on the outside border, whilst the hotbed had a glass frame, the result was, as I have stated, from the more efficacious action of the fire-heat as compared with that from

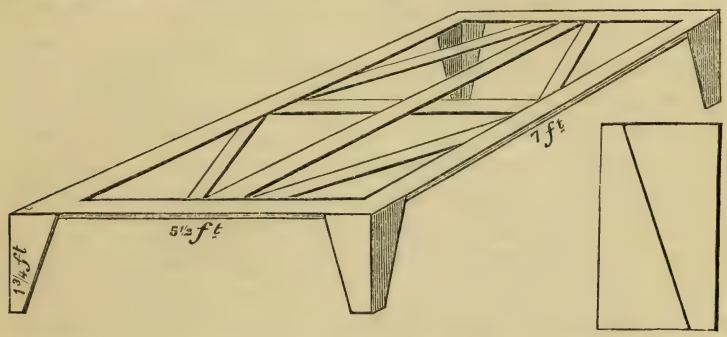
manure. I was also greatly surprised to find that there was no tendency to dryness where the soil rested on the tiles. The drying-process merely went on by evaporation at the surface, whilst the moisture steadily increased towards the bottom.

The floor being the heating power, it is also of importance to know how much of it (inside the house) may be covered with earth for plunging or growing plants, without too great a sacrifice of upper heat. I accordingly constructed temporary borders, enclosed by slabs of wood, before making the permanent arrangements, to try what the house would bear; and I think I may safely say that the half may be covered. I have gone nearly as far as this, without apparently reaching the limit, for general purposes; but of course much will depend, in this respect, upon the precise purpose to which any particular house may be applied. In some cases more upper heat will be required than in others*. I had at first intended trying experiments on the effect of bottom-heat upon the roots of vines; but, after I had finished my house, I found that Lord Eversley had fully ascertained, *by four years' experience*, the beneficial results of heat introduced under his vine-border in very nearly the same manner. He had, in fact, made a chamber by means of tiles about 2 feet square, and had admitted under it the surplus heat of a pine-pit. The earth in a severe winter was never under 60°, and the vines throve admirably. Finding this point so fully decided, I have turned my attention to other things. I have tried French beans, early strawberries, tomatoes *à tige raide*, and early carrots; also mustard and cress and radishes sown in January (and eaten in February) in the outer border. Inside the house I have forced French beans, asparagus, rhubarb; and am trying, with every promise of success, figs, peaches and nectarines, vines in pots, and delicate varieties of oranges, and also a bed of pines which took extremely well. I ripened capsicums of different kinds, and have supplied the house with several of the ordinary kinds of flowers. My house has been inspected both by scientific and practical men, and they express a very favourable opinion of its utility. For myself, I am a mechanic, and not a gardener. I am satisfied

* If a greater amount of top-heat should be required, it may be obtained by making the bottom of the borders higher than the general level of the floor. f the borders be 4 feet wide, and the bottom be raised 2 feet on their side walls, there will be 4 feet of surface capable of radiating heat from the side walls instead of the floor, and nearly or quite as large a quantity of heat will be given out, whilst the plants will be so much nearer to the glass.

with my project as *mechanically* successful, and must leave its horticultural merits to be decided by more competent authorities.

If it is desirable to protect the warm border from frost, frames made after the annexed plan, 7 feet by $5\frac{1}{2}$, and covered with



asphalted felt, are cheap, and have been found effectual. They are very light, and easily removed when dry. The legs are made of $\frac{3}{4}$-inch board, cut diagonally, as in the sketch.

III. Note on Truffles and Truffle Culture.
By C. E. Broome, Esq.

The numerous varieties of Fungi that are exposed for sale in the markets of France and Italy must induce a feeling of surprise that so little attention has been paid to their culture by the horticulturists both of Great Britain and the Continent. The Mushroom is the only species at all commonly made use of in this country; the Blewitt may sometimes, indeed, be seen in Covent Garden, but it is a species far inferior in flavour to many others of our Fungi, and it is certainly not the produce of our gardens. Truffles, which are frequently seen, and so highly esteemed in Continental markets as to command a high price, are comparatively rarely to be met with in our own, and even Covent Garden can boast but of one native kind, and that an inferior one, viz. *Tuber æstivum.* There are, however, various reasons for this neglect of Nature's benefits that operate with us, that do not apply with equal force to our Continental neighbours, such as distressing cases of poisoning from the indiscriminate use of Fungi gathered by persons ignorant of the qualities of the various species, a danger in great measure guarded against abroad by the

appointment of an official person capable of determining the noxious or innocent nature of the species brought for sale. What tends, however, still more perhaps to increase our objection to their use, is the natural inaptitude of our countrymen to acquire the art of cookery, which is a very important element in suiting these plants to human digestion; added to which, there is the difficulty of adopting new customs, or changes of diet. Were a taste for these productions, however, once established, we should soon find numerous species brought forward as valuable additions to our means of sustenance.

Notwithstanding that Truffles have been considered articles of luxury, and have commanded a high price from the time of the Romans down to the present, and that it has ever been the aim of horticulturists to bring them into the number of regular garden crops, they seem hitherto to have defied all efforts to reclaim them, and to resemble, in their intractable disposition, the wild ass, "whose house has been made the wilderness, and the barren land his dwellings, who scorneth the multitude of the city, and the range of the mountains is his pasture." If this, then, be a correct representation of their character, it is a question whether it would not be easier to cultivate them by assisting Nature in her own way, than to restrict her within our limits by forcing these denizens of the forest to occupy a place in our kitchen-gardens. It would seem, indeed, that the amount of shade they demand is such as to be incompatible with the requirements of a garden. But let us see what has been done hitherto in the various endeavours made to grow Truffles by the assistance of art. And here we cannot do better than give the information with which the Messrs. Tulasne present us in their beautiful work on Hypogæous Fungi. They mention four species of Truffles exclusively in use in France, viz. *T. melanosporum*, *T. brumale*, *T. æstivum*, and *T. mesentericum*, of which two, or perhaps three, occur in Great Britain. *Tuber æstivum* is apparently the only species to be met with in a recent state in our shops; *T. mesentericum* may at times occur, but it has not yet been noticed there. *T. brumale*, if our plant be identical with Tulasne's, has hitherto been found in England of too small a size to be worth sending to market. In Italy there are other kinds, one of which, *T. magnatum*, commands a higher price than any other; and in the southern parts of Italy, Sicily, Syria, and Africa, another species, *Terfezia leonis*, is of common use as an article of food.

The true Truffles have rough seeds, which, seen under the older

and imperfect microscopes, resembled somewhat a Truffle in miniature, and early writers concluded that the mature plant was merely one of these seeds largely developed in all directions. The Tulasnes have proved, however, by careful observations that they germinate in the same way as do those of most other Fungi, viz. by giving origin to delicate threads, which spread in the surrounding soil, and that from such threads the young Truffles arise, probably after some kind of impregnation, which is as yet, notwithstanding the researches of recent observers, involved in obscurity. The fact of the existence of a mycelium in Truffles, resembling that of Mushrooms, must be taken into consideration in any attempt that may be made to cultivate them.

The soils in which edible Truffles are found in France are always calcareous or calcareous clays, which accords generally with my own experience. *Tuber mesentericum* occurs, however, in ferruginous sands, as is also the case with another species, *Hydnotrya Tulasnei*, which, or a closely allied kind, is largely eaten in Bohemia, under the name of Czerwena Tartoffle. Messrs. Tulasne describe the soil of a Truffle district near Loudun, Vienne, as composed of rolled fragments of calcareous matter, mixed with fine quartzose sands, lying on a thick bed of compact marly clay, which easily splits up into thin layers. It contains, in 1000 parts, 500 of calcareous matter, 325 of clay and iron, 150 of quartzose sand, and 25 parts, more or less, of vegetable mould. But they attribute a still greater influence in the production of these plants to the presence of trees—a condition necessary perhaps to their growth, in order to keep off the heat of the direct sun-rays. Our authors testify, indeed, that this is not always indispensable; and I have seen Truffles dug up on the bare sloping sides of the Italian mountains.

Some persons have supposed that these Fungi are parasitic on the roots of trees. This the Tulasnes expressly deny, on the strength of observations and inquiries instituted to that end and I can confirm them in this matter, and would remark that the frequent presence of certain galls attached to the small roots of oaks, resembling young Truffles so strongly as often to deceive me for a time, may have given origin to this error.

Some trees appear to be more favourable to the production of Truffles than others. Oak and hornbeam are especially mentioned; but, besides these, chestnut, birch, box, and hazel are alluded to. I have generally found *Tuber æstivum* under beech-trees, but also under hazel, *Tuber macrosporum* under oaks, and *T. brumale*

under oaks and *Abele*. The men who collect Truffles for Covent Garden obtain them chiefly under beech, and in mixed plantations of fir and beech. The Truffle-grounds of France are remarkable for the sterility of the surface, the cause of which has given rise to many conjectures, viz. that Truffles exercise a prejudicial influence on all plants in contact with or proximity to themselves, by appropriating their nutriment in a manner similar to the *Rhizoctoniæ*; but a more probable reason of this sterility is the frequent digging to which the Truffle-grounds are subjected by the collectors; for, as Truffles are not truly parasitic, it would attribute an inconceivable amount of influence to their mycelium to suppose them capable by its means of destroying all the surrounding vegetation. And we may remark, that some species occur in grassy places, as in the forest of Vincennes, according to Tulasne; and so with *T. macrosporum* and *T. brumale*, as I find them. It seems to be a better explanation of this sterility, so generally accompanying Truffles, that they can only succeed well where they find a comparative freedom from other vegetable growth, arising from causes independent of themselves, and that they are the result, and not the cause, of this sterility.

In common with many other Fungi, Truffles do not bear to be disturbed in their early stages; so that the collectors are careful in their researches after the summer species, as *T. æstivum* and *T. mesentericum*, not to stir the ground more deeply than is absolutely necessary, as by so doing they would destroy the winter crop of the more valuable kinds, *T. melanosporum* and *T. brumale*. Any disturbance of the soil in the winter, when the latter are mature, does no harm, but rather aids in their culture, by rendering the mould more suitable for the germination of their spores and the growth of their mycelium. From Messrs. Tulasnes' observations it would seem that three or four months suffice for the development of these plants; they state that they have met with *Tuber mesentericum* about as large as grains of millet in the beginning of October, which must acquire their full size before the end of December; for about that time they find this species in its mature condition alone. And it is supposed that the warm rains of August are highly conducive to the fertility of the Truffle-ground, and that the abundance or scantiness of the crop depends very much on the nature of that period. These plants grow without any special care or tendance; but as they are not unfrequently found, both in France and Italy, on the borders of corn-fields, where they are ploughed up in the cultivation of the land, it

would seem that they succeed as well in ground that has been stirred and manured as in that which has been left to its natural condition.

Some notion may be obtained of the extent to which the trade in Truffles is carried in France, when we read that in the market of Apt alone 1600 kilogrammes (about 3500 lbs.) are exposed for sale every week in the height of the season, and that the lowest estimate of the quantity sold during the winter amounts to 15,000 kilogrammes (nearly 33,000 lbs. weight). According to another account, the Department of Vaucluse yields from 25,900 to 30,009 kilogrammes annually. The vast quantity that must therefore be procured and sold in all the French provinces where they grow, and the large revenue arising therefrom, should be a great inducement to the proprietors of suitable localities to attempt their cultivation in England.

Many trials have been made to subject these vegetables to a regular system of culture, but hitherto without success. We owe to the Count de Borch and to M. de Bornholz the chief accounts of these attempts. They inform us that a compost was prepared of pure mould and vegetable soil, mixed with dry leaves and sawdust, in which, when properly moistened, mature Truffles were placed in winter, either whole or in fragments, and that after the lapse of some time small Truffles were found in the compost. But the result was discouraging rather than otherwise. The most successful plan consisted in sowing acorns over a considerable extent of land of a calcareous nature; and when the young oaks had attained the age of ten or twelve years, Truffles were found in the intervals between the trees. This process was carried on in the neighbourhood of Loudun, where Truffle-beds had formerly existed, but where they had long ceased to be productive—a fact indicating the aptitude of the soil for the purpose. In this case no attempt was made to produce Truffles by placing ripe specimens in the earth; but they sprang up of themselves, from spores probably contained in the soil. The young trees were left rather wide apart, and were cut for the first time about the twelfth year from the sowing, and afterwards at intervals of from seven to nine years. Truffles were thus obtained for a period of from twenty-five to thirty years, after which the plantations ceased to be productive, owing, it was said, to the ground being too much shaded by the branches of the young trees, a remedy for which might have been found by thinning out the trees; but this would not be adopted till all the barren tracts,

called "galluches," had been planted. The brushwood, by being thus thinned out, would be converted into timber-trees, and the Truffle-grounds rendered permanent, like those of Poitou, which are commonly situated under the shade of lofty trees. It is the opinion of the Messrs. Tulasne that the regular cultivation of Truffles in gardens can never be so successful as this so-called indirect culture at Loudun, &c.; but they think that a satisfactory result might be obtained in suitable soils by planting fragments of mature Truffles in wooded localities, taking care that the other conditions of the spots selected should be analogous to those of the regular Truffle-grounds; and they recommend a judicious thinning of the trees, and clearing the surface from brushwood, &c., which prevents at once the beneficial effects of rain and of the direct sun-rays. It is added that this species of industry has added much to the value of certain districts of Loudun and Civray, which were previously comparatively worthless, and has enriched many of the proprietors, who now make periodical sowings of acorns, thus bringing in a certain portion of wood as Truffle-grounds each year. At Bonardeline, for instance, the annual return from Truffles in a plantation of less than half an acre was from £4 to £5. Another case is adduced in the Arrondissement of Apt, where several proprietors have made plantations: the trees are left about 5 or 6 yards apart; and so soon as their branches meet and shade the ground too much, they are thinned out.

The districts of England especially suited to produce Truffles would thus appear to be situated on the great band of calcareous beds which run diagonally across the island from the south-eastern corner of Devonshire to the mouth of the Wash in Norfolk, occupying all the country that lies to the south-east of such a line, including the counties of Somerset, Dorset, Wilts, Gloucester, Hampshire, Berkshire, Kent, Hertfordshire, and parts of Northampton, Norfolk, and Lincoln; and it is to the proprietors of lands in those districts that we must look for any successful attempts to cultivate these Fungi.

A great proportion of the Truffles exposed for sale in Covent Garden comes from Wiltshire and Hampshire, and the opinions of those who make it their business to collect them coincide completely with those of Messrs. Tulasne cited above. I have been informed by one of these men, that whenever a plantation of beech, or beech and fir, is made on the chalk districts of Salisbury Plain, after the lapse of a few years Truffles are produced; and

that these plantations continue productive for a period of from ten to fifteen years, after which they cease to be so. It has been observed that the species most available for culinary purposes with us is *Tuber æstivum*, a species considered in France as of far less value than *T. melanosporum* and *T. brumale*; and it might be worth while to obtain well-matured specimens of these species from France, and distribute them while quite fresh in some locality producing our indigenous kinds, to ascertain if we could not thus obtain a superior race of Truffles. *Tuber æstivum* is commonly worth about half-a-crown per 1 lb. in Covent Garden, whilst in Italy *Tuber magnatum* fetches from fifteen to seventeen francs, and *T. melanosporum* almost as much. Should horticulturists be tempted to try their skill in the artificial production of these Fungi, they should bear in mind the conditions most suitable to their nature as above recorded. They might succeed, for instance, in producing them in filbert-plantations or in gardens thickly set with fruit-trees; and they should plant mature specimens in well-trenched ground on a calcareous substratum, and be careful not to stir the soil to any depth till the autumn or winter of the following year, in order not to disturb the mycelium; and it would be well perhaps, in case they find a successful result, not to take too largely of the crop the first year or two, but to give them time to establish themselves thoroughly in the locality. It would seem, however, that, when once established, deep stirrings of the soil would tend rather to encourage than to check their increase, as giving the mycelium a lighter soil in which to vegetate, and preventing the growth of roots of surrounding trees, &c., which might deprive the Truffles of the requisite nutriment.

It might be as well to try the growth of *Tuber macrosporum*, as it is an indigenous species, and might become a source of profit, notwithstanding its garlic odour. Those who possess woods or plantations of beech in calcareous soils, which are not already productive of Truffles, might succeed perhaps in rendering them so, by trenching patches of ground beneath the trees, so as to clear away the brushwood, grass, and roots for a considerable space, and planting ripe Truffles in the trenched spaces, and then allowing time for them to produce their mycelium. And when the roots of surrounding trees again encroach on the selected spots, they might be checked by deep digging around their margins.

IV. Variegated Plants of the Seventeenth Century. By the Rev. M. J. Berkeley, M.A., F.L.S.

In looking over the manuscripts in the muniment-room of the princely mansion of the Duke of Beaufort, at Badminton, I found a list of variegated or, as the list is headed, "Strip'd and Edg'd Plants," evidently drawn up towards the close of the seventeenth century, and, in all probability, cultivated at Badminton by the first Duke of Beaufort, though this is not a matter of certainty. In the present rage for such productions, it may not be uninteresting to see what forms were then cultivated. It will be observed that almost all are indigenous species, and, with a single exception (the tree-houseleek), not one extra-European. Some of them, moreover, as the species of Pulmonaria, cannot be regarded as diseased varieties, any more than many of the exotic forms which are now so much admired and sought after.

It would be almost an endless task to enumerate these; but I have thought that it would be interesting to append a list of variegated, mostly herbaceous, plants cultivated by the Chief Baron Sir Frederick Pollock, near Hounslow, with some instructive notes kindly forwarded at my request.

It is not necessary here to enter at any length into the question whether variegation is an evidence of disease or not—a question, however, which I think is decided by the fact that a variegated graft has influence on the stock; that when shoots are produced, as in some forms of *Pelargonium* which are quite white, without the least portion of green, it is, as Mr. R. Thompson has proved at the Chiswick Gardens, impossible to strike them; and that when seedlings come up with perfectly bleached cotyledons, they either fail at once or, if they linger at all, produce only chlorotized leaves*. The tendency of plants to become variegated in particular soils, as mentioned hereafter, is perhaps another indication of disease.

I have to thank the Duke of Beaufort for his kindness in allowing me to inspect his manuscripts, and for permitting his librarian to take the copy which is here transcribed; and to Chief Baron Pollock for his list and notes. In either case I have thought it right to follow the order in which the lists are sent,

* A perfectly white and extremely beautiful *Pelargonium* came up from seed at Mr. R. Brown's gardens at Wothorpe, near Stamford, and it was hoped might prove a great acquisition; but after making about six leaves, it shared the common fate of such vegetable albinos.

in the former the arrangement being miscellaneous, in the second alphabetical. In the former, moreover, it has been thought best to follow the original spelling. The few words which are within parentheses are not in the original.

Strip'd and Edg'd Plants (from MSS. at Badminton).

1. Turkish Orreng strip'd.
2. Five sorts of Hollys.
3. Silver Laurel.
4. Gold Laurel.
5. Silver Phyllyrea.
6. Gold Phyllyrea.
7. Plumbe-tree constantly strip'd.
8. Strip'd Beech-tree.
9. Strip'd Ash-tree.
10. Strip'd Mezereon.
11. Strip'd Nightshade.
12. Strip'd Wallflower.
13. Strip'd tree Houseleeke.
14. Strip'd Myrtle.
15. Strip'd Honeysuckle.
16. Edg'd Box.
17. Strip'd Rocket.
18. Strip'd Sellery.
19. Strip'd Mugwort.
20. Strip'd Tansy.
21. Strip'd Ribwort (*Plantago*).
22. Strip'd Marjerome.
23. Strip'd Issop.
24. Strip'd Horminum creticum.
25. Green leaves of Primrose strip'd.
26. Strip'd Lylly.
27. Strip'd Sweet Williams.
28. Ordinarie strip'd Sage.
29. A much finer strip'd Sage.
30. Strip'd Grasse.
31. Silver Rosemary.
32. Gold Rosemary.
33. Pot Time gold.
34. Pot Time silver.
35. Mother Time silver.
36. Citron Time gold.
37. Bloody Time.
38. Strip'd Privit.
39. A small sort of Ivie strip'd.
40. A large leav'd Ivie strip'd.
41. Mint.
42. Strip'd purple flower Vetch.
43. Strip'd leav'd Auriculas.
44. Strip'd Wallflower (probably a different variety from the former).
45. Strip'd Snapdragon.
46. Strip'd Turnep.
47. Strip'd Borage.
48. Strip'd Rew.
49. Elder strip'd.
50. Bramble gold strip'd.
51. Clogweed edg'd (*Heracleum*).
52. Box strip'd.
53. Wing'd Pea strip'd.
54. Peach-leav'd Bellflower strip'd.
55. Wild Bell flower.
56. Filipendula, the leaves one side green, the other white.
57. Hawk Weed strip'd.
58. Garden Bean, all the leaves finely strip'd.
59. Garden Spurge strip'd.
60. Vineyard Thistle.
61. Hawkeweed strip'd.
62. Bramble silver strip'd.
63. Cowslipps of Jerusalem, the greater (*Pulmonaria off.*).
64. Cowslipps of Jerusalem, the lesser (*Pulmonaria angustifolia*).
65. Pennyroyall strip'd.
66. Field Scabious strip'd.
67. Twayblade strip'd.
68. *Campanula Pyramidalis* strip'd.

List of some of the Variegated Plants cultivated by Chief Baron Pollock.

1. Achillæa millefolium.
2. Ægopodium podagraria.
3. Ajuga reptans argentea.
4. —— —— aurea.
5. Antirrhinum majus.
6. Apium graveolens.
7. Arabis alpina.
8. Artemisia vulgaris.

9. Arum maculatum.
10. Barbarea vulgaris.
11. Bellis perennis.
12. Ballota nigra.
13. Brassica oleracea.
14. Carduus marianus.
15. Cheiranthus Cheiri.
16. Convallaria majalis.
17. Cratægus oxyacantha.
18. Cerastium vulgatum.
19. Dactylis glomerata.
20. Daphne laureola.
21. Dianthus deltoides.
22. Epilobium hirsutum.
23. Festuca glauca.
24. Fragaria argentea.
25. —— aurea.
26. Funckia alba (marginata).
27. Galeobdolon luteum.
28. Glechoma hederacea.
29. Hypericum perforatum.
30. Iris Germanica.
31. Iberis amara.
32. Juncus conglomeratus.
33. Lamium maculatum.
34. Leontodon Taraxacum.
35. Linaria Cymbalaria.
36. Lychnis dioica.
37. Medicago sativa.
38. Melissa grandiflora.
39. —— officinalis.
40. Mentha rotundifolia.
41. —— sylvestris.
42. Matricaria chamomilla.
43. Petroselinum sativum.
44. Phalaris arundinacea.
45. Polemonium cæruleum.
46. Pulmonaria sibirica.
57. Potentilla anserina.
48. Prunella vulgaris.
49. Quercus robur.
50. Rubus corylifolius.
51. Rumex sanguinea.
52. Ruta graveolens.
53. Saponaria officinalis.
54. Scrophularia mellifera.
55. Saxifraga umbrosa.
56. Spiræa ulmaria.
57. Stachys sylvatica.
58. Senecio Jacobæa.
59. Thymus citratus.
60. Tussilago Farfara.
61. Trifolium incarnatum.
62. —— repens.
63. Urtica dioica.
64. Veronica chamædrys.
65. —— spicata.
66. —— gentianoides.
67. Verbena officinalis.
68. Vinca major (reticulated).
69. Viola odorata.
70. —— —— plena.

Only eleven of these are contained in the Badminton list, which, however, runs as much on trees as herbaceous plants; but three more are mentioned in the notes which follow.

Chief Baron Pollock remarks that he has observed in his own grounds and those around him, a tendency in wild plants to become variegated (always in a similar way) on their quitting their wild habitats and becoming familiar with the artificial soils produced by cultivation. *Ballota nigra* is a good example. "I found in a tenant's garden a beautiful specimen of this despised plant. I removed it, collected the seed, and sowed it. About 30 per cent. of the plants that appeared were variegated; and now I have plants whose seed generally produces nothing but variegated plants. I have distributed many of them. I believe all came from the same stock. I tried the same with *Phalaris arundinacea foliis variegatis.* I raised several thousand plants: only three were variegated*. One fine summer the sycamore (*Acer pseudoplatanus foliis variegatis*) had conspicuous fruit on its branches. I collected and sowed it, and raised about 2000 young plants:

* I have found this wild at Whittlesea Mere.—M. J. B.

about 120 were variegated, but (as I expected) in all sorts of different ways. There is a part of my pleasure-ground where I raised some score of the *Pinus excelsa* from seed; some of these are variegated, some conspicuously so. I have a deodar with white leaves mixed with the green. I have had the common gooseberry fol. var. I planted one or two score of acorns: one produced a beautifully variegated oak. I have in a plantation one well-grown fol. var. that I observed only a few years ago. I have a common raspberry fol. var. A common holly sent out a shoot fol. var.; I made a layer of it, and, when it had taken root, separated it, and made a beautiful plant of variegated holly. It is now in the Kew Gardens. A field of lucerne always (at least here) yields several, I should say many, plants fol. var.; a field of cabbages, several variegated, sometimes very beautiful; so parsnips, mangel-wurzel, and horse-radish. A variegated laurel is not uncommon; but here they come sometimes (as one would call it) spontaneously."

V. On a Parasitic Fungus which causes Spot in Orchids. By the Rev. M. J. Berkeley, M.A., F.L.S.

Mr. Anderson has recently paid much attention to the spot in Orchids, and has described four different kinds in the 'Gardeners' Chronicle' for February 18, 1865. Specimens of spot on ten different Orchids, illustrating the different forms, were submitted to me, by means of which I was enabled to confirm Mr. Anderson's observations in almost every minute particular. Amongst these one was evidently produced by a parasitic fungus, and, as might be expected from the deleterious action of many kinds of mycelium on vegetable tissues with which it comes in contact, it is one of the most destructive. It begins on the young leaves, causing a brownish ill-defined spot; after a time, this exhibits different shades of olivaceous brown, and the parenchyma of the leaf becomes quite pulpy and semiputrescent. On the underside of the leaf little raised dots are seen which are caused by the cysts of a fungus beneath them. The parenchym is more or less traversed by hyaline mycelium with jointed threads, and each cyst or perithecium, which is of a pale umber, is surrounded by a broad border of hyaline, perfectly colourless, jointed threads, the upper joints of which are more or less swollen. In this condition I have seen no fruit.

Fig. 2.

Fig. 1.

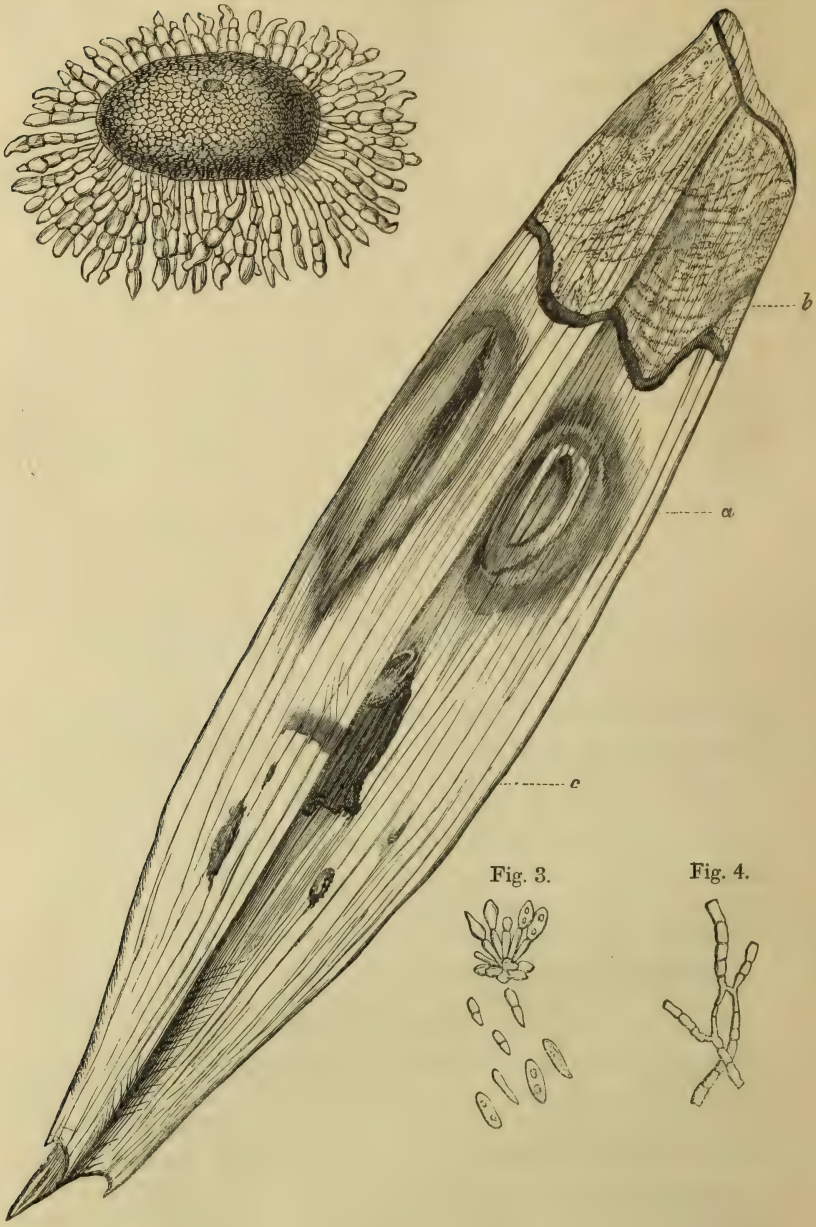


Fig. 3.

Fig. 4.

Sometimes the leaves pass rapidly into a state of decay; but occasionally the parenchym dries up, the spots become bleached, but are surrounded by a dark border, and studded with the concentrically arranged perithecia. In these I have detected spores which are broader at one end and uniseptate. Occasionally, as in the case represented in our figure, the disease commences again in the same leaf; so that the incipient and old stages may be compared together. I have since had an opportunity of studying the fungus in an intermediate condition on *Lycaste Skinneri*, and have seen the spores seated on their sporophores.

It is extremely important that this form of spot should be accurately distinguished from the other forms, and I trust that the figures now given will enable any accurate observer to distinguish it, even without having recourse to the microscope. In the case of such a minute plant the cultivator cannot be expected to verify every point, and the distinction of mycelium amongst tissue is often a matter of considerable difficulty.

Our figure (1) represents a leaf of *Odontoglossum citrosmum* attacked by the fungus in an incipient stage at *a*, and past maturity at *b*. At *c* appears a form of spot which, though unsightly, is not destructive like the form which is characterized by a multitude of pale pits.

Fig. 2 is a magnified representation of one of the cysts surrounded by its broad fringe.

Fig. 3 gives the spores, which are about $\frac{1}{1500}$th of an inch long, seated on their sporophores and free, magnified.

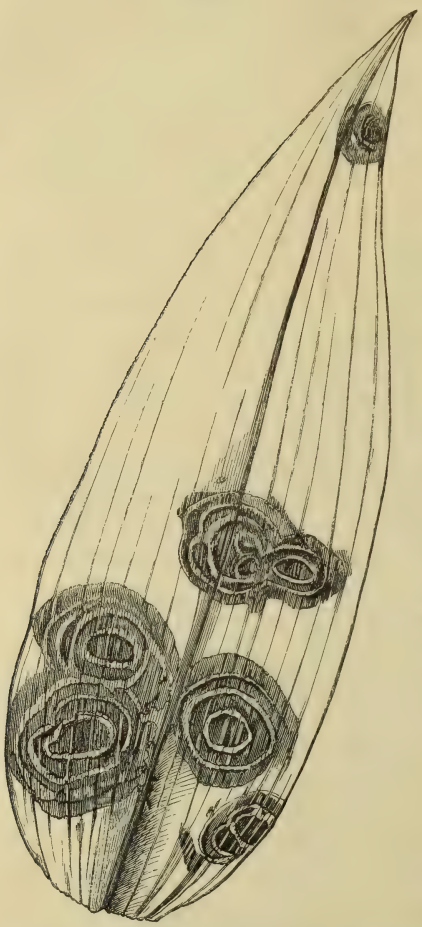
Fig. 4 represents a portion of the mycelium magnified.

The fungus is in all probability merely a condition of some more perfect form; but it may be well, in the present transitional state of the part of mycology to which it belongs, to give it a provisional name, and it may therefore be called *Leptothyrium perniciosum*, and characterized:—Spots at first olivaceous brown, at length bleached; perithecia at first scattered, at length somewhat concentric, depressed, surrounded by a fringe of hyaline articulated colourless threads; spores with two nuclei obovate-oblong, sometimes at length uniseptate.

It is not, however, a very good *Leptothyrium*, though the character in which it departs from the normal form of the genus probably depends merely on the thick condition of the cuticle of the leaves on which it is developed, which prevents the cysts separating at the base as in other species. On the thin leaves of *Lycaste Skinneri* it looks much more like a *Leptothyrium*. In this

case the spots are sometimes 6 inches long and parallel to each other, following the direction of the nerves. On the tip of the leaf the margin is followed, and the colour paler and redder.

Fig. 5.



I take this opportunity of giving a figure of a very curious form of spot, which has been forwarded to me by Mr. Warner, on *Dendrobium densiflorum*. Whether this is really a distinct disease from the common black spot, of which fig. 1 *c* gives the general appearance, I am unable to say. It differs in forming suborbicular spots simulating some old encampment with a central area and three or four concentric trenches. Sometimes the regularity of the lines is deranged by two or more of the spots originally touching each other. The spots do not in general completely penetrate the leaf, though something of the concentric arrangement appears on the other side. This form of spot is exhibited at fig. 5, of the natural size.

VI. Note upon *Cotoneaster Simmonsii*.

By J. Bateman, Esq., F.R.S.

I have much pleasure in bringing before the notice of the Horticultural Society a plant that cannot but prove to be extensively useful for the covering of house-fronts and of garden- or terrace-

walls. Hitherto, after the season of flowering-plants was past, we had nothing but the well-known *Cratægus pyracantha* to lend an air of gaiety to the situations described; but its rich clusters of red berries are rarely to be seen after Christmas, nor are they ever produced except in sunny situations and in warm seasons. *Cotoneaster Simmonsii*, however (for such is the name of the plant to which I am now aiming to direct your attention), while in gaiety of appearance, rapidity of growth, and neatness of habit it more than rivals the *C. pyracantha*, has the great advantage of producing its bright vermilion fruit with the utmost profusion, even in a season as unfavourable as that of 1863, and a climate as inhospitable as that of North Staffordshire. It has stood quite unaffected by the trying winter from which we seem yet to have scarcely emerged, and it is now (March 4) a mass of glowing red, although not a "hip or a haw" nor berry of any description could be found within the confines of this parish. But the birds, though they have made a complete clearance of everything else, have spared the fruit of the new *Cotoneaster*. I should add, that it succeeds perfectly as a standard, though when treated as such it is only sub-evergreen; nor do I think that, standing out singly, it will form a handsome tree. The history of its introduction is involved in some obscurity; but the seeds are believed to have been gathered by Dr. Hooker on the Khasya Hills, and brought by him to Kew.

VII. *Dendrobium hedyosmum* (Sweet-smelling Dendrobium). By J. Bateman, Esq., F.R.S.

Introduced from Moulmein by Messrs. Low, of the Clapton Nursery, to whom it was sent by Mr. Parish under the name of *D. albo-viride*, in allusion to the green and white hue of the flowers at the time of their opening, and for a week afterwards. Had Mr. Parish, however, waited a little longer, he would, like myself, have seen with surprise the green tint disappear from the tip, and a bright orange take its place. This change has now been for three weeks an accomplished fact in the specimen exhibited, and which is still as fresh as at the very first.

As Mr. Parish's was only a MS. name, and was evidently given under a misapprehension, I have ventured to change it for one which alludes to the delicious perfume exhaled by the plant, and which has a striking resemblance to that of the wallflower.

D. hedyosmum belongs to Dr. Lindley's nigro-hirsute section of

this extensive genus. It appears to be a profuse flowerer, and, when more fully established, must become a general favourite.

VIII. A short Note on different Varieties of *Amaryllis*. By James Anderson.

The *Amaryllis*, taken in the popular acceptation of the word, may be esteemed the king of all flowering bulbs, being so princely in appearance when under a proper course of cultivation, and possessing flowers with such a variety of shades of colour so admirably blended. The species commonly called *Amaryllis* belongs really to the genus *Hippeastrum*; but gardeners and lovers of flowers in general, if we except the botanical fraternity, are slow at changing the original nomenclature of plants, however good arguments botanists may adduce for adopting such a change. Amaryllids constitute a large order of highly ornamental plants, which collectors have found and sent home from various parts of the world; but none of them possess the decorative merits of the subject of our remarks. South America, and Brazil in particular, have furnished by far the largest portion of the original species under cultivation; but it is scarcely necessary to say that these species, after having been crossed and recrossed with one another, have produced a wonderful addition in point of progressive excellence.

We are chiefly indebted to *A. vittata*, *A. Solandræflora*, and *A. Organensis* for our present fine race. But how much more interesting would it be to be enabled to hybridize *Vallota purpurea* and *V. formosissima* with either the original or any of the progeny of the species just mentioned! So far as I am aware, attempts at impregnation have hitherto defied the efforts and experiments of all those who have tried them. The *Vallota*, besides having an almost perfect form of petal, sends forth a scape with from six to twelve flowers on each; and if this free-flowering habit could be introduced into the constitution of such a variety as *Ackermanni pulcherrima*, what a great advance in decorative horticulture would be obtained! That last-named variety may be said to be the very finest under cultivation, being of the most perfect velvety crimson, so as to dazzle the eye of every onlooker. The substance of the petal is of the highest order, and its form is in no way objectionable; so that, could we get a scape, which in this instance never, under any circumstances, produces more than four flowers, with

double that number, we could doubtless soon render all the other points of excellence attainable. Again, with reference to *V. formosissima*, which has a striking peculiarity in formation (the lower sepals being gathered together, and the upper petals and dorsal sepal spreading out in the usual way), we have a most brilliant crimson colour, which has no other equal in intensity, not only in the species to which it belongs, but stands unrivalled in the whole floral domain. Need it be said how desirable the introduction of such a splendid hue would be in the other sections which can boast of better formation and free-flowering properties? But, speaking to the point practically, I can say, there seem to be insuperable difficulties in the way; for, were I to relate all the various experiments I have personally conducted with a view to successful hybridization, I could fill several pages. Poor old Donald Beaton (not the least luminary in practical horticulture, and one of the most successful hybridizers that ever manipulated upon flowers) recorded his failure in this particular; and I must also record mine. I have raised thousands of seedlings, many of them not yet proved, the results of careful crossing, but they have all come from the three types first spoken of.

My object in this short notice is to point out the importance of experimenting, and the particular type that it is desirable to breed from in this noble family. Unfortunately, the cultivation of Hippeasters is not so general as it deserves to be, which is so very well attested by the many beautiful sorts now in cultivation. A warm greenhouse temperature is all that is wanted, so that many amateurs in a humble position might have a collection of these for little money. Unlike Dutch bulbs, one does not require to go to market every year. When a collection is once formed, the only thing requisite is to introduce any novelty of first-class character. Their successful cultivation and flowering may be given in few words:—Grow the bulbs in moderate-sized pots, in good loam full of fibre, with so much sand as will render the whole porous. Let the atmosphere during the growing-season be abundantly charged with moisture, especially in the evenings and mornings, so that their succulent leaves may be well provided for; and at the same time keep under thrips, to which the leaves are very subject. Withhold water as the bulbs begin to ripen, and let them have abundance of sunlight. Dry them off under the stage, or anywhere else where the thermometer never falls below 36°, for from two to four months, and there will be flower-scapes and flowers in abundance. Some other day I will return to the subject.

IX. A few Remarks concerning Soil and Climate in relation to the Cultivation of Fruit Trees. By Mr. W. Ingram, Belvoir Gardens.

The marked difference which exists in the quality of the hardy fruits produced in different parts of the country intimates the powerful influence exercised by circumstances of soil and climate. Every gardener finds, in undertaking a new place, that he has many local secrets to unravel before he can succeed in meeting the requirements of the various objects of his care. I may say, parenthetically, that some knowledge of geology and meteorology often proves of great assistance to gardeners, and saves the trials and troubles of that experience which, it is said, at last enlightens the unenlightened.

Admitting, then, that we find a great diversity of soil and some marked climatic peculiarities in this country (not in every case due to the latitude of the position), and recognizing the powerful influence of these circumstances on the fruits we cultivate, the practical and natural inquiry next presents itself, Can circumstances, naturally unfavourable, be so far modified as to enable the cultivation of such fruits as the peach, the apricot, and the pear to be successfully pursued? There can be but little doubt that, in the majority of cases, the skill of the practical horticulturist may overcome difficulties of soil more readily than those of climate; and I am disposed to believe that a very great step towards successful fruit-culture is made when that soil is provided which is suited, by its composition, to the requirements of the tree, and calculated not only to afford pabulum for a healthy development of wood, but also for the prolonged production of fruit. As an illustration of the influence of good soil in the production of fine fruit, we find that the best examples come as often from the north and midland counties as from the south-eastern, where greater climatic advantages are enjoyed. As the circumstances within control, which unfavourably affect local climate, such as extensive tracts of woodland, waste and uncultivated land, stagnant water, &c., are not often placed within the scope of a gardener's improving hand, comment on them is not perhaps necessary. I venture, however, to say that local climate may be improved by high cultivation and drainage applied to waste and neglected land: a well-drained, well-managed garden is always the warmest spot in a neighbourhood. Where superior cultivation is not the rule, one very important climatic circumstance, the fall of rain, may, at all

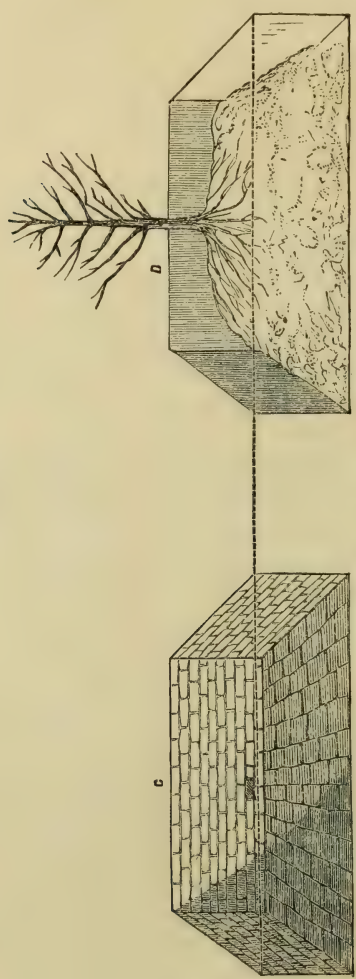
events, be diverted from fruit-borders, should it happen, as it not unfrequently does, that a heavy fall occurs just at the ripening period of, for instance, the peach crop; a provision for turning it from the peach- and fruit-borders should, if possible, be in the possession of gardeners. For two years past (1863 & 1864) the rainfall, with but few exceptions, throughout the country has been below the average, and fruit-crops have been most abundant; this fact seems to suggest what I have hinted above as desirable—the employment of artificial means to restrict the fall of rain to certain choice fruits, to a limited extent: thus, if an annual fall of 18 inches of rain be adequate, let all above that amount be diverted. I have long employed shutters to cover vine-borders, and I am satisfied that I enjoy a great advantage in being able to control the amount of rain upon them.

I may, I think, with propriety supplement these remarks on soil and climate, by a description of two plans I have devised to counteract the ungenial influences of a cold climate and a moist clay soil, and to give the advantages of increased warmth and dryness to such fruit-trees as pears, peaches, and vines. The first was designed specially to keep the roots of dwarf pyramidal pear or other trees, the growth of which it was desirable to restrict within defined limits, to save the necessity of removal for the prevention of growth or severe root-pruning, and also to secure to the tree the exclusive advantage of a suitable compost and exclusion from the chilling influence of a clay subsoil. I excavate a space according to the probable requirements of the tree to be planted, say 3 feet square and 3 feet deep; the bottom of the excavation is paved with stone or brick, or concrete, the sides built up with 4½ in. brickwork; two small holes are left towards the bottom in the brickwork, so that roots at some period may, if requisite, be permitted to seek additional nutriment; the position of the holes being known, the excision of the roots is a matter of easy accomplishment, if found necessary. The bottom of the compartment is covered with drainage or rubble to the depth of 6 inches, so that the bricked-in space is like a well-drained flower-pot. Two boards, the size of the space, will be effectual at any time in turning off excessive or undesired rain.

The next contrivance for fruit-trees may be connected with the foregoing with advantage. It consists of a series of hollow brick pillars, 4½ in. brickwork, raised to the height of 5 feet, and 2 feet square, giving 40 feet of exposed surface for each tree; each pillar is connected with an underground flue, thus connecting in one

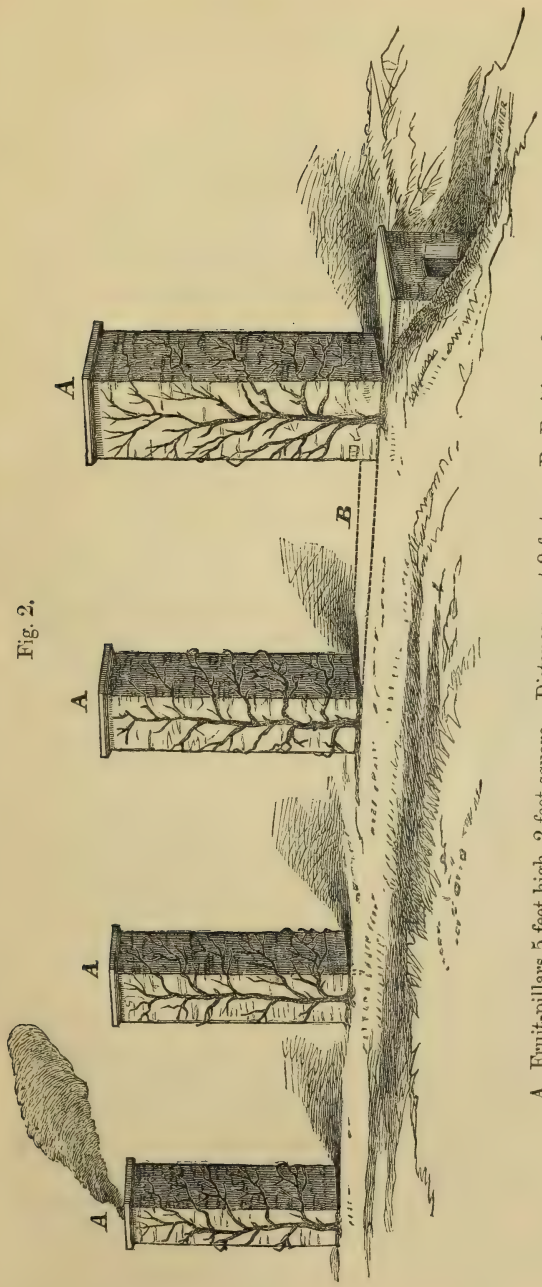
heating-system the whole of the pillars. These fruit-pillars may be made ornamental, and surmounted with a vase; covered with closely-trained fruit-trees, their appearance is by no means unsightly; and I fully anticipate that fruit of the highest excellence may be obtained by their use. To those who cannot command a fruit-wall, and who desire well-ripened peaches or pears, these pillars afford every advantage. The accompanying sketches may help to convey an idea of my inventions.

Fig. 1.



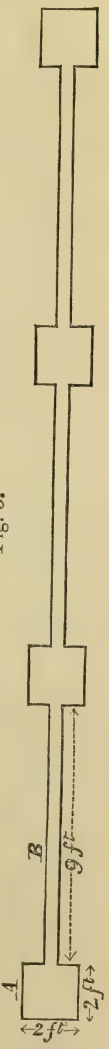
Brick compartments for fruit-trees, the front wall being omitted; C without soil, D partially filled.

Fig. 2.



A. Fruit-pillars 5 feet high, 2 feet square. Distance apart 9 feet. B. Position of connecting-flue.

Fig. 3.



Ground-plan of fruit-pillars and connecting-flues.

X. On Variability in the Pear-tree, the result of Experiments made at the Museum of Natural History from 1853 to 1862. By M. J. Decaisne*.

The almost unlimited and still increasing number of varieties in fruit-trees, pulse, and all economical vegetables in general, is a phenomenon to which science has hitherto paid little attention. There is the greater reason to be astonished at this, since it has been remarked even by persons most unaccustomed to the study of plants, and since, from the earliest times, it has been an object of importance on the part of cultivators.

Writers of antiquity—Theophrastus, Pliny, Columella, and others, like those who have succeeded them in ages nearer to the present, the brothers Bauhin, Ch. Estienne, T. Dalechamp, &c.—have described a tolerably large number of these varieties, especially in fruit-trees, where they were the most apparent; but one would in vain search for their origin in their writings: though they let us vaguely suppose that they are, or may be, the produce of cultivation, none of them say positively that any particular new variety sprang from any other; none of them explains why they have gone on multiplying from age to age. Are these new forms, then, as has been recently alleged, real species, which remained unrecognized up to the time when it was proposed to submit them to cultivation? or are they only modifications of long-known species, endowed with the faculty of assuming different habits, according to circumstance of place and climate? It may seem astonishing that such a question should be brought before the Academy, so natural does it seem to believe that species are subject to variation; but we shall see presently that this question is not one of those which we ought to leave without examination: if it is important as regards practical agriculture, it is not less so as regards science itself.

Two schools, or I should rather say, two different hypotheses divide botanists at the present moment. The most ancient, which I may call that of the Linnæan school, admits the variability of species within limits, which, to say the truth, it is not always easy to define; hence those large, polymorphous, and sometimes vaguely-defined species, though in general easily characterized by a short specific character. The other school, which is more especially modern, and which, I believe, may be called the school of immuta-

* Translated from 'Annales des Sciences Naturelles,' 4 série, vol. xx. p. 188 (1864).

bility, denies, in the most formal manner, variability in the vegetable kingdom. In its opinion, specific forms are never in any degree modified, and if two congeneric plants present appreciable differences, however feeble they may be, these two plants are from the origin of things species radically distinct. From this point of view, which has found in M. Jordan of Lyons a very eloquent and conscientious defender, all races and all varieties admitted by the other school become so many species; and so local floras are immensely increased when they have for their authors men of this stamp.

That Linnæan botanists have made species of too great latitude, by uniting under the same specific name forms which are really distinct, is what I am far from contesting; but these are errors of detail which are inevitable in a first review of the general flora of the world, inconveniences which experience corrects every day. But we should be wrong, in my opinion, if we concluded from thence the condemnation of the principle which has directed them, viz. the variability of specific types. We must, however, acknowledge that their opponents have a right to require a proof of this variability, which is almost always more hypothetic than matter of demonstration. It is here, in fact, that we have the point of the question; for if what we have considered as simple alterations of a more general type which is really immutable, if our supposed varieties are species, in spite of their apparent affinities, we must allow that our adversaries are right, and admit into our descriptive catalogues all these slight species, whatever may be their number, and however embarrassing a too extended nomenclature may become. But is it in this direction that we really have improved? above all, is this the truth? Many good authorities doubt it; not only are they afraid of seeing descriptive botany degenerate into a science of words, but they ask besides, if, after all, the immutability of forms is better proved than their variability? One way alone is open of solving the difficulty; it is useless any longer to argue, we must observe and bring forward facts; and it is with this view that I have undertaken the experiments with which I have to occupy the Academy.

In the eyes of M. Jordan* all our races and all our varieties of fruit-trees, and amongst others pear-trees, are distinct invariable species, remaining always identical through all possible genera-

* Alexis Jordan, "On the Origin of different Varieties or Species of Fruit-trees and other vegetables generally cultivated for the necessities of Man," 1853, Paris, Baillière, p. 30, &c.

tions, from which it follows that these trees do not spring, as is commonly believed, from a single or even from a small number of specific types which cultivation has caused to vary, but from as many primitive types as there are discernible varieties*. Thus, to confine ourselves to the pear-tree, of which nurserymen already reckon more than five hundred varieties, we must admit at least five hundred primitive species, and as these exist nowhere in a wild state, logic induces M. Jordan to conclude that their domestication ascends to the antediluvian period of man, and that we only possess them now because they were preserved in the ark which saved Noah and his family†. Strictly speaking, the fact may be conceived as possible; but how many suppositions must we heap up, one on the other, to render it probable! Is it not more simple to explain this always-increasing multitude of congeneric varieties by the principle of the variability of species, if this variability can be demonstrated? But I believe that this has been done. The Academy knows already the astonishing transformations which have been observed recently at the Museum in the group of gourds and melons, where the varieties are counted by hundreds; the facts which I have to describe in the pear-tree are of the same order, and lead to perfectly similar conclusions, which are, on one side the contemporary appearance of new races, on the other their instability by crossing, and particularly the specific unity of all the races and varieties of cultivated pears.

In 1853 I sowed numerous seeds of pears, chosen the previous years from four varieties, reckoned as very distinct by all nurserymen, viz. the old, universally-known Poire d'Angleterre; the Poire Bosc, whose form is that of an elongated calabash, and the skin uniformly cinnamon; the Belle Alliance, short, and shaded with yellow and red; and the Poire Sauger, a wild, or almost wild variety, so named because the leaves of the tree remind one, by their white down, of the Common Sage. For this last sowing I employed all the crop of a tree which grows by itself on the road from Marcoussis to Gué. The seeds of these pears sprouted the same year in which they were sown, with the exception of those of the Poire d'Angleterre, which did not do so till the following year; and this was the case in two different sowings in 1853 and 1854, without my being able to discover the cause.

A small number only of these trees has begun to bear fruit, which I regret, because the results which they would have yielded, if all had borne fruit, would have been much more varied and, in

* Jordan, *op. cit.* p. 32, &c. † *Ibid.* p. 89, &c.

consequence, more conclusive than those which I have to submit this day to the Academy. We may see, nevertheless, at the first glance, on an inspection of the coloured figures, how much the fruit, in each of these categories, has been already modified in the first generation.

Thus, in the variety Sauger, four trees which have fructified have yielded four different forms of fruit; one ovoid and entirely green; a second short and almost apple-shaped, coloured with red and green; a third still more depressed; and, finally, a fourth, regularly pear-shaped, twice as large as the foregoing, and uniformly yellow. From the Belle Alliance nine new varieties arose, of which not one reproduced the mother variety, in form, size, colour, or time of ripening. There were two especially which I shall mention; one for its size, more than twice that of the Belle Alliance, the other for its short major axis, calling to mind the apple-shaped pears or bergamots. The Poire Bosc produced three new fruits different from the type; one of the three so like one of those obtained from the Sauger, that one could scarcely distinguish it. The variations were not less in the Poire d'Angleterre, where six trees yielded six new forms, so different from each other and from the mother form, that there are amongst them most of our old varieties; one of them has even yielded winter fruit similar to the Saint-Germain.

It is not only in the fruit that the trees from the same variety have differed, but also in their various precocity, in habit, and in the shape of the leaves. These differences are striking when the trees are near each other in the same beds of the garden; each tree has a different aspect. Some are thorny, some thornless; these have slender wood, those are thick and stubby; in some specimens of Poire d'Angleterre, the variation has proceeded so far as to produce the first year from seed, lobed leaves like those of Hawthorn, or *Pyrus Japonica*. Nothing, indeed, would have been easier than to make of these young trees almost as many new species, however slightly one might have adopted the ideas of the modern school, without knowing from whence they were derived.

It is not possible to doubt that cultivation is a great source of variation in plants, and this from the complexity of the elements which it brings into play. The transformations which they undergo in our gardens are rapid in comparison with what takes place in nature; thus, for example, the poppy, the cornflower, and the larkspur always remain very uniform in a wild state, while in our flower-beds they are modified in the most remarkable degree.

The flowers of the poppy pass from a bright red to pure white, or even black, by the extension of the deep-coloured spot which exists at the base of each petal; at other times they are shaded with two colours; or, finally, they become extremely double instead of single as they were in the normal state. The flowers of the cornflower, and those of the larkspur, so uniformly blue in the fields, almost always change their colours after some years of cultivation; they become white, rose-coloured, tinged with violet, or wholly violet; it is rare that they preserve their primitive tint. I may remark that we cannot attribute these variations to crossing with other species, since the flowers are fecundated by their own pollen some time before the expansion of the blossoms, and since these variations in the end become hereditary, like the specific characters. The inheritance of forms is not, then, the exclusive privilege of species; it belongs likewise to varieties, or to races whose origin is well known, and in consequence it is not an indisputable criterion by which to decide that any particular form allied to some other, found in a wild state and recognized as hereditary, is on this account a different species from this last.

The theory of Van Mons is very frequently at fault: witness an example taken from amongst a hundred others, and which naturally takes its place here. According to this pomologist, we may anticipate the quality of the fruit of a young seedling tree by the inspection of its wood. If the wood resembles that of known good varieties, the fruit will be of good quality. The Chaumontel, Crassane, Archduke Charles, Bergamotte de Pentecôte, the Urbanist, are universally esteemed as first-rate fruit; nevertheless the trees differ strangely from each other, some having long slender shoots, others thick and firm, &c. This little group of trees, which I take by chance, offers almost all the variations in size, habit, and wood which are known in the pear-tree. The experiments quoted above—experiments which show that from the same sowing we have thornless and thorny trees, straight and divaricate, smooth and downy, &c.—come even more closely to the point. There is no truth, then, in the assertion of Van Mons, when he says that the appearance of the wood of the Passe-Colmar is reproduced in the Frédéric de Wurtemburg, that the Saint-Germain has given its form to the Urbanist, that the Rance exactly resembles the Gracioli, and the Doyenné the Poire de Pentecôte, &c.

Everything is variable in the pear-tree, even the nature of the sap. The proof of this latter circumstance is found in the very different success of grafting according to the choice of stock. All

races and varieties of pear-tree take on the pear-tree, but all do not succeed on the Quince; for example, the Rance*, Clairgeau, Bosc, Duchesse de Mars, &c. When we wish to multiply these varieties, and for want of the wild pear we are obliged to employ the Quince, the last is grafted on the Jaminette, the Sucré-vert, the Crassane, the Abbeville, very vigorous species, which are suited to this sort of stock; and when the grafts have taken, they receive in their turn varieties whose sap does not sympathise with those of the Quince. It is an operation known and practised by all nurserymen.

The relative size of the flowers and appearance of the foliage offer no less striking variations. Certain varieties, as the Catillac, St. Gall, Epargne, de Vallée, &c., together with wide, rounded and undulated petals, have blossoms 5 or 6 centimetres (from about 2 to $2\frac{1}{3}$ inches) broad; and their trees, in the early stage of foliage, are as white and cottony as the Sauger. Others, like the Héric, Sylvange, Fortunée, &c., with oval or lanceolate petals, have flowers half the size, their diameter not exceeding 3 centimetres ($1\frac{1}{5}$ inch). Finally, we possess at the Museum a pear-tree wrongly named Chartreuse, whose linear-lanceolate petals are scarcely 3 millimetres (scarcely $\frac{1}{5}$ inch) broad and 9 millimetres (about $\frac{3}{5}$ inch) long. It is vain, therefore, to seek for specific characters in the proportions of the flower or the parts of which it is made up.

Can characters, however, be found in the size and form of the fruit? We have already seen these elements vary in the experiments detailed above, and these were confined to four varieties, of which a few trees only have borne fruit. The variations would have been far greater had I been able to try all the known varieties of pear-tree. We may judge of the enormous differences which occur in respect of size, when I call to mind that the wild pears, which botanists have somewhat prematurely called *Pyrus longipes* and *Pyrus azarolifera*, do not exceed the size of a pea, while our enormous pears called Poires d'Amour and de Livre equal in volume a middle-sized melon—that is, twelve or fifteen hundred times as much. Analogous remarks may be made as to the colour of the flesh, which is green, yellow, salmon-coloured or red.

But perhaps it may be said these are precisely characters

* At least, if they do succeed, though they may bear abundantly, the fruit is extremely small, as, for example, in the Beurré Rance, and scarcely to be recognized when compared with well-grown samples.—Ed.

which show a specific distinction in these different kinds of pear-trees. Assuredly I should ask nothing better, for nothing is so pleasing to the mind of a botanist as definite characters, those gaps in the series of congeneric forms, which at the same time facilitate his labour and furnish a fulcrum to his nomenclature. He is satisfied when these specific, well-defined divisions agree with his ideal notions of nature; but unhappily it is not so in the group of pear-trees: from the microscopic *Pyrus azarolifera* and *longipes* we pass by an insensible transition to the Mille-au-godet, a pear cultivated in the neighbourhood of St. Brieuc, which is scarcely larger; from this we arrive at the Sept-en-gueule, or little Nutmeg, another variety, or rather assemblage of varieties, in which the fruit varies from the size of a woodnut to that of a walnut. At the same time a multitude of races and subraces, varieties and variations of wild pears of all sorts of forms and magnitudes, from that of the Mille-au-godet to that of our common cultivated pears; and in these we pass from the smallest to the most gigantic by an indefinite series of intermediates, in which every difference of form and colour, from the Musette and Cornemuse, which are so curiously elongated*, to those depressed pears which have been justly compared to apples.

How then, I say, can we lay hold of a specific character of any value in an assemblage in which all the most extreme forms are united by insensible and numberless gradations? It is looking for what nature has not done, and forcing her to enter into an artificial category.

To whatever hypothesis we may lean, as regards the notion of a species, we cannot help seeing that it presents itself under different aspects, sometimes restricted within narrow limits, strictly characterized, and not varying sensibly, but sometimes also prodigiously broad, polymorphous, and, so to speak, divisible *ad infinitum*. Pear-trees form no exception; and many other genera of plants offer the same profusion of secondary forms, and are an equal source of perplexity to classifiers.

Almost all pomologists, at least those who are worthy of the name, have tried to classify pear-trees; but all have failed, in so far at least as they have never been able, in consequence of the inter-

* These modifications of form in the fruit of the pear-tree recall in the most striking manner those which occur in the esculent pumpkins, melons, and gourds, where we see equally the fruit elongated till it becomes quite serpentine, while others, on the contrary, are abbreviated and flattened at either extremity. (See Naudin, Ann. des Sc. Nat. t. vi. 1856.)

mixture of characters, to make an arrangement in the least degree natural, and which would embrace all the known varieties. At the commencement of my studies, like my predecessors, I thought that I might undertake this work with some chance of success; now I am disabused of this hope, and I do not fear to declare that every classification will be purely artificial. The only useful principle which can be adopted here will be, I think, the time of the ripening of the fruit, because in an economical point of view this consideration predominates over all others; and even here, again, we must assign very wide limits to these seasons of maturity.

Neither the form of the fruit, nor their size, nor their colour, nor their flavour, any more than the habit and appearance of the trees, the colour of the wood, the size of the leaves and flowers, &c., can afford any base for a classification, because all these characters are purely individual, which they do not transmit faithfully by way of generation, and which, as there are not wanting examples to prove, change soon in one and the same individual in consequence of local circumstances which one cannot always explain.

The partisans of the plurality of species may object, in the group of trees with which we are occupied, that if in this multitude of intermediate forms we are unable to recognize distinct specific types, this depends on the fact that the primitive species have intercrossed thousands of times; that their fertile hybrids have increased in an enormous degree the number of crosses, and that from thence have sprung these innumerable forms which are the despair of classifiers. I am far from denying the fact of these crosses or of their influence; I say even that nothing appears to me more probable; at least it is not possible to doubt it, when we see what takes place in a pear-orchard when in flower, where the bees, attracted from a distance of a league, pilfer from morning till evening, mingling the pollen of all the varieties, and disseminating it on stigmas for which it was not destined by nature. But we may remark that these impregnations, which are supposed to be unnatural, are always fruitful, that all the flowers which receive pollen from any kind of pear whatsoever, set their ovary, and that the fruit when developed always contains fertile seed*.

* I know no apparent exception to this fertility, except in the Poires sans pepins and Comte de Flandre, whose fruit contains no seeds; but this does not prove a want of power in the pollen, which, besides, might as well be that of its own parent tree as of a tree of any other variety. In fact, I have ascertained

But, I ask, will this constant fertility after all possible crosses, afford a proof of the difference of primitive types? Precisely the contrary conclusion is suggested; and when we have seen the same fact produced in other species, at the same time well characterized, and quite as polymorphous as the pear-tree, for example in the potiron (*Cucurbita maxima*), the pumpkin (*C. Pepo*), the musk gourd (*C. Pepo*), the bottle gourd (*Lagenaria vulgaris*), and the melon (*Cucumis Melo*), where likewise the strangest differences of form, size, colour, consistence, and taste are seen in the fruit, one is forcibly led by analogy to admit in the pear-tree only a single natural species. Besides, we may remark, in all specific groups which are so polymorphous, it is the fruit which varies the most, and also that in all these the fruit is inferior, that is to say, formed by a receptacle in which the ovaries are immersed. The adherence of the ovary should seem then to be the organographic condition which has the greatest tendency to variability in the fruit. What we know of Umbelliferæ, Cupuliferæ, and the genera Medlar and Rose, in which equally the fruit is inferior, certainly does not weaken this kind of view.

Does grafting, as some maintain, modify the character of varieties? For my part I do not think so; I have never at least observed anything to confirm this opinion. Duhamel, for example, remarked a century ago that the Imperial Oak-leaved Pear (a curious variation of foliage which I might have indicated before) had never more than three cells in the ovary instead of five. This is the case still; the fruit has only three cells, notwithstanding it has been propagated by grafting only since the time of Duhamel. Many other facts of the same nature might be brought forward in support of the inability of the graft to modify the characters of varieties,—those, for example, which the flavour of fruits, so remarkably different from each other, affords.

It is, then, an error against which it is well to protest, viz. the belief that the degeneration of our races of fruit-trees in a consequence of the constant practice of grafting for their propagation. Not a single authentic fact can be adduced in its favour; those which have been alleged depend on entirely different causes,

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that this defect of seed depends, in the first of these varieties, on the more or less complete abortion of the ovaries, and in the second on an absolute want of ovules. —J. D. In *Cucurbita moschata*, the fruit of which, at least in the Courge pleine de Naples, closely resembles the pear in many respects, there is sometimes a total abortion of ovaries, and the fruit beneath the rind consists merely of a mass of parenchymatous tissue.—Ed.

amongst which we must place in the first line that of climates, or of soils incompatible with the peculiar exigencies of the variety' and very frequently also bad cultivation, or the abuse of pruning so frequent in our days, which would fain pass for perfection. Our old pears, so justly esteemed one or two centuries ago, are still the same as when they were more in request; they ripen at the same seasons, and keep also as perfectly. It suffices, in fact, to quote the Epargne, Crassane, St. Germain, Doyenné, Chaumontel, Winter Bon Chrétien, and Easter Beurré, known now as the Doyenné d'Hiver, to be convinced that our old varieties have lost nothing of their good qualities. If we neglect them, it is not because they have degenerated, it is only because the nurserymen are interested in sending out their novelties. This degenerating of old races, accepted without opposition, is in reality nothing more than one of those works of industrial acuteness so easily excused in our days.

Is it then more true, as Van Mons has asserted, and as most pomologists believe, that the seeds of good kinds of fruit produce crabs with harsh fruit, reverting to what are supposed to be the specific types? I do not hesitate to affirm the contrary; and I defy anyone to quote a single example of a fruit of any quality impregnated with the pollen of its own flower, or of others of the same race, whose seeds have given rise to a crab. If a variety of merit is impregnated by a variety with harsh fruit, there will certainly spring from its seeds new varieties, which for the greater part, if not altogether, will be inferior in quality; there may even be found some whose fruit shall be as bad as that of the wild plant which has furnished the pollen; but this degeneration, if we may give it the name, is nothing more than the consequence of an ill-assorted crossing. We may consider it certain that every distinguished variety of pear-tree, and I may say of all our fruit-trees, if it is fecundated by itself alone, will give birth to good fruit; it may and will probably differ, sometimes by one character, sometimes by another from the mother variety, but no one will assume the characters of the wilding, any more than our Cantaloup Melons resume, by sowing, the form, size, and taste of the little wild melons of India, or our cauliflowers or cabbages revert to any of the wild kinds so different in habit and quality which grow on the cliffs of the Ocean and Mediterranean.

Whatever then the partisans of immutability may say, species in the vegetable kingdom are endowed with great flexibility; and it is not a vain hypothesis which refers to the same specific type

races and varieties, sometimes very different in appearance, but having the same morphologic organization and capable of breeding with each other by crossing as members of the same family. I allow that there will always be doubtful cases, even after the proof of fertile crossing in the whole series of possible generations; but this is no reason for separating, as so many primordially distinct entities, what so many observed facts and so many analogies prove to be able to proceed, by way of evolution, from a single primary specific type. If we transport any one of our race of pear-trees into all the regions of the globe wherein it is able to exist, it will tend to place itself in harmony with the media, and we may be sure that after some generations it will have given rise to new and numerous varieties. This fact, which is realized in the sight of man in all the economical plants which are spread through the globe, affords the key to those polymorphous species, so embarrassing to the botanist, and which have become so only because nature has itself spread them over immense extents of country.

XI. Note on the Floral Organogeny of the Pear-tree. By M. J. Decaisne.

M. Decaisne had already expressed his opinion on the value of certain specific characters in a paper addressed to the Société Botanique de France, and which was published in the 'Bulletin' of the Society, April 3, 1857. The former part of this communication touches on the topic which is discussed at large in the preceding paper. He states decidedly his opinion that botanists ought rather to condense species in referring them to types which are really natural and stable, instead of multiplying them, as has been the fashion for some years past, and supports his views by a reference to Dr. Hooker's introductory essay in the 'Flora Indica'; and he does not hesitate to assert that some of his work, as that of the Plantagineæ in the 'Prodromus,' if it were to be done over again, would be done on a wider principle.

It is not necessary to quote more from the former part of the paper, but there is a part at the close which will form a fitting appendix to the valuable memoir of which a translation has been given above, as it treats on the nature of the parts of fructification in the pear-tree; and there is more reason for reproducing it here as it is not very generally accessible.

"When we examine very young flower-buds of the pear towards

the month of October, that is to say, in shoots which will not be developed till the following year, we find that they are ovoid, sessile, scarcely as large as the head of a pin, and crowned with five appendages converging towards each other, which are the rudiments of the sepals. On dividing them vertically, we remark at the base and on the walls of the cup which is circumscribed by the nascent calyx, slight protuberances or papillæ, of which five, more interior and arranged symmetrically round the ideal centre of the cup, are presently distinguished from the rest by their more rapid development. These are the carpels, which at first are independent of each other, and free from any adhesion with the surrounding organs. Almost from their first appearance a slight channel is marked on their interior face, an indication of the line of juncture of the borders of the carpellary leaf. A little later the cell or cavity which each of them forms between its folded edges becomes visible, and still later two ovulary papillæ are discernible, springing at the base of the cell from the very borders of the carpel.

"I have just said that at first the carpels are free in the receptacle of which they occupy the centre; nevertheless, when the fruit is perfect, they are deeply imbedded in the parenchymatous and succulent tissue of the fruit. How then does this take place, which seems in contradiction with what we had observed at first? This is what I am going to explain in a few words.

"Almost at the time that the young ovaries spring from the base of the receptacle under the form of obtuse cones, a new cellular tissue is produced on the walls of the receptacle, which has daily become deeper and more bell-shaped. This tissue gradually thickens the walls, and forms what is called the perigynal disk of the flower. This new parenchym reaches presently the central whorl, moulds itself upon it and agglutinates the carpels, penetrating the little interstices which are left between them. Nevertheless it does not completely cover them, for their interior borders, those which correspond to the suture, always remain free. This additional tissue is easily recognized even in ripe fruit; it is what is called the heart of the pear; it is always situated within the inclosure traced by the stony granulations which characterize the fruit. I have no need to add that at the time when this phenomenon is accomplished, the summit of the carpellary cones is elongated into the style, and that the disk, increased in height as well as thickness, carries the stamens and the petals very far from the point at which they had originated.

"But these are not the only changes which have taken place in the flower and very young fruit, there is another which is not less worthy of attention, and without which the fruit would remain incomplete. We have seen that at first the bud was sessile, or nearly so; gradually the rudimentary peduncle is elongated and assumes the well-known form, but at its upper extremity it passes insensibly into the young fruit, which in fact is only a continuation of it. It is in reality in this dilated part of the peduncle, which we have called the receptacle of the flower, and which is situated below and around the disk of which we have just spoken, that the principal increase takes place, at least in the greater number of pears. It is then the peduncle itself which is here transformed into the fruit, if we mean by this word the succulent and esculent tissue, absolutely as in *Anacardium* and *Hovenia*. If any doubt could remain about the matter, it would be removed by the examination of those abnormal fruits, like that represented by M. Naudin in his "Note on the Structure of the Flower in Cucurbitaceæ," which are real pears formed entirely at the expense of the peduncle, since having neither heart nor carpels, nor vestige of calyx leaves, they have never been terminated by a flower.

"If I have made myself understood, we shall see that the structure of the ovary in the pear differs in nothing from that of the ovary in other vegetables, and that it is altogether conformable to the general plan of organization explained by our illustrious masters, R. Brown, DeCandolle, and Jussieu. It is not then necessary to bring forward the axis, to which appeal is made at the present day so often and so willingly, when it is required to explain the structure of flowers or fruit. I go further, and if I am not deceived, it is not impossible to refer to the common plan of organization, ovaries with a central free placenta, of which the differences from ordinary ovaries would in this case be more apparent than real. A strong presumption in favour of this mode of view, if not an absolute proof, is afforded by the very homogeneous family of Melastomaceæ, in which the most opposite modes of placentation are found*. Thus, for example, in the suborder of Melastomeæ, properly so called, whose ovary has from two to twenty cells, the placentæ are axillary, that is to say, altogether adherent to the central columella which results from the line of junction of the carpellary leaves; in *Ewyckia*, where there are four cells in the ovary, they are, on the contrary, parietal, or if the phrase is preferred, fixed on the middle of the cells. Between

* See 'Rumphia,' in which I published in 1834 the analysis of this family.

these modes of placentation we find that which characterizes the Astroniæ (*Astronia* and *Microplacis*, Bl.), in which the placentæ are situated at the bottom of each of the two cells of the ovary at the base of what may be called the columella. There is but a step therefore from the unilocular ovary to the free central placenta of Memecyleæ. If the carpellary leaves of *Astronia*, instead of being inflexed towards the centre of the ovary, were simply soldered by the margins, remaining ovuliferous at the base, we should reconstruct the unilocular ovary and the central placenta of the Memecyleæ and Spathandra. The great affinity which exists between the different members of the family of Melastomaceæ does not allow us to admit amongst them differences of placentation so radical as those which would result from the prevailing theory on the organogenic nature of the free central placenta—to suppose, for example, that in this same family of Melastomaceæ the placentæ grow, indifferently, sometimes from the carpellary leaf, sometimes from the elongated axis of the floral whorl. It seems to me more natural, and at the same time more probable, that in all the plants of this vast and beautiful family, the placentation, in spite of appearances, is always a dependence of the ovarian leaves. I might bring forward precisely similar modifications in the different groups of the family of Aroideæ, Caryophyllaceæ, Portulaceæ, &c.; and if the hypothesis is just in the families which I have just quoted, why should it not be equally so for Myrsineæ and Primulaceæ."

XII. Note on the effect of crossing some of the Southern Vines of France with the variety Le Teinturier.

Monsieur Henri Bouschet has addressed to the Royal Horticultural Society a short pamphlet, of which the full title is given below*, with the request that a report of it should be prepared, with a view to making more generally known the curious fact which is the result of his experiments. The pamphlet, it may be remarked, has already been presented to the French Academy, and inserted in the 'Comptes Rendus,' tome lx. p. 229.

* Collection de vignes a suc rouge obtenues par le semis après le croisement des cépages Méridionaux avec le Teinturier, par M. Henri Bouschet, Membre de la Société Centrale d'Agriculture et Secrétaire de la Société d'Horticulture de l'Hérault. Montpellier, 1865, 8vo. pp. 11.

Few experiments in comparison have been made towards improving the vines of France by intercrossing, notwithstanding their great importance.

One of the main objects with French vine-growers, is to obtain as deep a tint in their wine as possible, since it is usually mixed with water. For this purpose, about forty years ago the father of M. Bouschet introduced very extensively into his vineyard the variety known as Le Teinturier. Though, however, the introduction answered so far as improvement of colour went, the increased value in this respect did not compensate for the comparatively small produce of the variety in question. Unwilling, however, to give up the matter as hopeless, he determined to try if he could cross some of his more productive varieties with the Teinturier. There was some difficulty about this, as the Teinturier flowers eight or ten days earlier than most of the more generally cultivated varieties. By some means, however, which are not detailed, the flowering was retarded, and crossing at length effected successfully with the varieties l'Aramon, la Carignane and le Grenache (Alicant de l'Hérault).

The bunches on these artificially fertilized plants consisted of grapes of two kinds, the majority of which had the normal white juice, but mixed with a few berries, which had coloured juice like the male parent Le Teinturier. The seeds of these berries were carefully set apart and sowed, and after seven years one of the young vines which came from the seed of an Aramon when grafted on a vigorous stock yielded fruit, with the coloured juice of Le Teinturier. Other plants fruited the next year, and amongst them one which yielded fine and abundant fruit, with the requisite character of coloured juice; this was chosen for propagation, and ultimately many acres of the variety were set out with grafted plants.

Such was the result of the experiments of our author's father. The son in his turn took up the subject with similar results. The process of grafting enabled him to obtain fruit at an earlier period than he would have been able to do had he waited for the result in the simple course of nature. Ten years or more in general pass by before fruit is obtained, whereas M. Bouschet reduced the time to five or six.

The most important point, however, in a scientific point of view, which resulted from the experiments was the effect of crossing on the fruit the first year. The berries which were fertilized with the pollen of Le Teinturier yielded coloured juice, while

others on the same bunch retained their original character. It is generally supposed that the effect of crossing is confined to the embryo of the seed which has received an impression from the strange pollen. It has indeed been asserted that the colour of the seeds of peas and kidney beans has been immediately modified the first year by crossing; but Mr. Darwin, after a careful examination of the point, did not find the supposition confirmed; so that the facts related by M. Bouschet are without parallel.

Amongst the numerous varieties which he has raised, it is stated that some are so early as to make it always possible to have the vintage in the South of France in August. The wine, too, which they produce is of excellent quality, and in consequence obtained the Silver Medal at Avignon in 1858.

XIII. Vineyard Culture in France.

By the Rev. M. J. Berkeley, M.A., F.L.S.

The source from which our information on this subject is derived, is the Comte Odart's 'Manual of the Vine Dresser' *, a small volume, but containing a vast mass of information. We shall, however, confine ourselves to that part of it which more immediately concerns the objects of the Royal Horticultural Society, entirely neglecting all that relates to the mode of preparing or preserving wine. The intelligent gardener may perhaps be able to pick up a few useful hints, though he will now and then be surprised at practices which contradict his preconceived notions, and which he could not perhaps copy in his more limited area without almost certain loss of credit, if not of produce.

It is not necessary to dwell on the particular varieties of vine which are grown in different districts, the choice of which sometimes depends upon caprice, but frequently on the necessities of particular soil, climate, and aspect, or of the requirements of the special kind of wine which it is the vine-grower's object to produce, or for which his vineyard is best calculated. It may, however, be observed that, with very few exceptions, notwithstanding the well-known fact that they are almost if not entirely exempt from the mildew which has been so disastrous for nearly twenty years, he avoids the American grapes, which belong to an entirely different species of the genus *Vitis*. The greater part of them have a foxy

* Manuel de Vigneron, 8vo, pp. 358, Troisième édition.

taste, which does not suit the European palate. Some two or three, however, are cultivated; and perhaps amongst these the Isabelle is the greatest favourite, which yields a grateful wine remarkable for a taste resembling that of raspberries. It was indeed proposed a few years since to send over some well-informed person to the United States, to examine on the spot the particular varieties which afford the best American wines, some of which command a price almost equal to that of Lafitte or Château Margout; but, notwithstanding their exemption from the mildew, it was thought that the prospect of producing first-rate wine from them in Europe was so small that it was not worth while making the experiment. And there is the less reason for doing it, as the French vine-dresser is now in a great measure master of the disease, by a proper application of the sulphur treatment. He at least, whatever may be the cause, has been too wise to follow the example of Madeira, and root up his vines in despair.

The circumstances under which vines are grown in England are so different from those of the vineyard, that we can scarcely hope to learn much from a consideration of the climatic conditions which affect the vine-growers in France. He has greater extremes of temperature to contend against; the young shoots of his vines are often cut off by severe frost, a circumstance which very rarely happens to us even in open-air culture; and, according to the degree of moisture in the air, especially if there be a high state of the hygrometer combined with a great degree of heat, his grapes will mould and become useless. As in every other branch of cultivation, where particular plants have been subjected to very different modes of treatment and climate, the varieties are extremely numerous, and experience has shown which are best adapted to the purposes of the cultivator. In our grape-culture, where the number of varieties is more restricted, I have often thought that sufficient attention is not paid to the selection of the kinds which suit the situation best; and in consequence where one never fails, others are always complaining of some disaster or other, during the whole period of growth, from the first pushing of the buds to the gathering of the last gleaning-grapes. The mode of cultivation may be the same, but yet from local circumstances the result may be very different.

Nothing perhaps so greatly affects the quality of the produce as the soil. Thence it is that the principal part of the nourishment is derived; and even supposing it to contain nothing deleterious, the necessary constituents will be taken up in such differ-

ent proportions as greatly to affect the chemical condition of the sap, and consequently of the produce. It would scarcely be possible to meet with two plots of any extent where the soil is precisely the same, but it is found that, provided the situation and climate are suitable, but few are utterly unfit for cultivation, provided the ground is well mixed with stones or gravel, the only points which it is necessary to avoid being extreme tenacity or lightness. If the constituents of the soil are bound together by tenacious clay, which is easily beaten down by a shower, or, on the other hand, hardened by drought, it is what is called in France "terre battante." Such soil is also called cold, because the fruit arrives slowly at maturity. A rich and deep soil is not generally thought to be calculated for the vineyard, but rather for field culture. If, however, the soil is light, but not sandy, as is the case with that which produces the best Tokay, and if it effervesces violently when treated with acids, even though it may approach the term of extreme lightness, it may be considered an exception to the general rule. The soil which is best calculated for corn is seldom fit for the vineyard; while, on the contrary, the admixture of stones, and frequently the too great inclination, makes the best vine-ground unfit for corn. It does not seem to matter greatly, as far as fertility is concerned, whether the stones are quartzose, calcareous, or ferruginous, though doubtless the peculiar nature of the soil and its constituents may make a great difference in the character of the produce. It is believed, for instance, that the wines of the Côte-d'Or owe their beautiful ruby tint and sweetness to the ferruginous nature of the soil, while some white clays are equally famed for the white wines. In a few instances good wine is obtained from sandy soils, but the produce is in general small; where, however, the texture is extremely coarse, as in land which is called "graves sables" at Bordeaux, the vine succeeds perfectly, and the produce is sometimes first-rate.

It is not only a mistake to clear the ground entirely of stones, though for various reasons it may be well to remove those which are of such a size as to interfere with culture, but it is absolutely necessary in some cases to introduce them, where they are not already present. Even in some corn-land in our own country, fertility is greatly impaired if the stones are entirely removed, as they always retain a good deal of moisture, and the plants find it to their interest to cling to them by their rootlets as a certain refuge in time of drought.

As regards site and aspect, neither a narrow valley nor an ex-

posed hill are fit for vines; in the former case the grapes are apt to rot before they arrive at maturity, and in the latter the skin hardens in consequence of exposure to the air, and the berries never arrive at their full perfection,—facts which may teach our artificial cultivators to account for a good deal of the spot and rust about which they complain so bitterly. It seems certain that many of the best wines follow the course of rivers, and that the quality becomes inferior in proportion as the vineyards become more distant. It is said, too, that they are more subject to frost, a circumstance which is contrary to the experience of our own country; for in the same parish, within two hundred yards, fruit-trees are often materially impaired by frost on the low ground near a stream, while with the difference of some twenty feet or more of elevation they are safe. Our author is content with stating the fact very decidedly, confirming the statement by various instances, without, however, attempting any explanation.

It seems almost self-evident that a southern aspect must in general be most favourable to vines, and, indeed, is the only one in which they can be expected to do well in our own country; but there are many examples of valuable vineyards which have a northern exposure, which is indeed preferred for some vines. In such a situation they are less injured by spring frosts; and there is a prejudice in favour of some beneficial influence of north winds, in addition to their power of drying soil which is too moist, and dispelling general humidity.

Amongst the various methods of propagating the vine, none seems more efficacious than grafting, a method which may be employed advantageously in our artificial cultivation, where the varieties under cultivation are not suited to the situation or where the produce is bad, provided the roots are in a proper soil and in a healthy condition. It is extensively practised in France, and is a very ready method in cultivation, on a large scale, of altering in a very short time the character of a vineyard. Added to which the produce from recent cuttings is always at first inferior, whereas the full perfection of the variety is at once attained by grafting, while the old stools seem frequently to acquire fresh vigour from the young blood.

Omitting the whole of the chapter which treats of the different modes of cultivation employed in different countries, I pass to that of manures, which is of more immediate interest. It is well known that for the more delicate wines coarse manures are avoided as much as possible, though they are useful enough where

the object is to secure an enormous crop of grapes for the manufacture of brandy. The experience of different countries in this respect, indeed, is different. Mr. Mumm, so celebrated for his Rudesheimer, informed me that in many vineyards on the Rhine large quantities of manure are employed; but this practice, though suitable for Germany, might be extremely prejudicial in Southern France or Spain. In our own country, where it was once the fashion to bury putrid animals and other abominations in the ground prepared for vines, the voice of almost every experienced cultivator is now raised against the disgusting practice.

Nothing is so much deprecated in the vineyard as a soil which sets hard after the first heavy rain, a point which is sometimes neglected in garden practice. Something must be done to alter the texture; and where lime does not exist in the soil already, a dressing of marl, or of a compost made with alternate layers of quicklime and stable-manure, may be employed with advantage, while in some cases, where lime is already present, an addition of sand will be sufficient. The manure must, however, be in very thin layers, as a large proportion would confessedly be injurious. Our author gives some directions towards the determination of the chemical nature of the soil from the natural vegetation; but if the matter were of any importance to us as vine-cultivators, the information would fail of its proper effect, since the plants he mentions are by no means so certainly indicative of the absence or presence of calcareous substances as he supposes. Marl is said to be an effective remedy against a tendency to decay, from which our cultivators often suffer so severely.

Herbaceous vegetables are next recommended, either sown in the vineyards and ploughed in, as lupines, rye, or tares, or collected in marshes, as reeds mixed with Potamogeton, and buried in the soil so deeply that the plough cannot reach. The reed decays very slowly, and the effect, therefore, is only gradually produced, and is carried on for some years. Sometimes these and other aquatic plants are cut up into a kind of chaff, and used after the fashion of mulching. The truly aquatic weeds, such as Potamogeton, contain an enormous quantity of water, and when decayed leave a very small residuum; but they abound in animal matter, as the eggs of Mollusca and the animals themselves, and in consequence are not a bad manure for general purposes, though they contract so much, that, as I know from experience, they hardly pay the cost of carriage.

A practice, however, prevails in many vineyards, and one which

is highly approved, though it would surprise many of our grape-growers, viz. of burying in the ground branches of shrubs, such as heath, broom, cistus, juniper, and box, especially the latter, which is said to give out during decay a larger proportion of azote than any other vegetable. The danger in my own apprehension would be of infection from fungus-spawn developed on the decaying branches; and I suspect that mischief sometimes arises from this cause, which is attributed to other circumstances which are in all probability harmless. Seaweed is sometimes used on the coast, but is said to communicate a very unpleasant flavour to the wine. The prunings or thinnings of the vines themselves, again, are often used with good effect,—a practice similar to that which prevails in some of our best hop-grounds, where no manure is used in soils abounding with phosphates, except the old plants cut up into chaff.

Burnt earth, especially when mixed with lime-rubbish from old buildings, appears to be an excellent dressing, and is said to increase greatly the strength of the wine, while plaster mixed with dung seems to have a very powerful effect in producing vigorous shoots. As for animal substances, such as horns, raspings of hoofs, bones, &c., if used at all, they should be used with caution, as the grapes sometimes become perfectly detestable after an overdose. As regards what may be called purely chemical or artificial manures, our author, who sets his face against everything in the shape of chemistry, gives us little or no information.

There is a great deal of information upon other matters in the volume, but I have selected those only which are likely to be suggestive. There is certainly great room for improvement in our grape-culture, notwithstanding the perfection at which we have arrived in some of our best establishments. What is wanted in many of our cultivators is a thorough knowledge of the principles of cultivation, and a power of adapting these to peculiar circumstances. A great deal of the unhealthiness of our vines, of the failure or blindness of the flowers, of the early decay of the fruit, of intense rust, and other misfortunes might be avoided, and we should not see remedies for vine-mildew applied where no mildew exists, or half-a-dozen nostrums employed, one of which is quite sufficient to induce mischief. Above all, we should not have artificial manures applied of the composition of which the cultivator has no knowledge; and if their market-price bears no proportion to their real fertilizing powers, the mere loss of money is a trifle, compared with the fact that they may contain an overwhelming proportion of sulphate of iron or some other chemical which is

positively injurious, as I know to have been the case in one instance which has come before me.

XIV. Abstract of Max Wichura's Observations on Hybridization*. By the Rev. M. J. Berkeley, M.A., F.L.S.

In the former series of this Journal I gave an abstract of Gærtner's important work on vegetable hybrids; and a translation of Naudin's more recent observations appears in the present volume of the New Series, together with some interesting remarks of M. Decaisne's on the effects of intercrossing amongst different varieties of pears. Very recently a most instructive memoir appeared at Breslau, by Max Wichura, which contains so much weighty matter that a copious abstract cannot fail to be acceptable to our readers. I am indebted to Mr. Darwin for the loan of the book, and have profited by his marginal notes pointing out the principal points of interest.

Herr Wichura informs us in his preface that he was led to the subject by the fact of his friend Dr. Wimmer having arrived at the conclusion, from numerous observations, that a great part of the doubtful forms in the difficult genus *Salix* were hybrids. From a desire to confirm the correctness of this conclusion, of which he was, however, already convinced, he determined to institute a series of experiments with a view to find out what would be the actual results of artificial impregnation in this perplexing genus. These experiments were commenced in 1852, and continued uninterruptedly till 1858; but unfortunately, partly from illness and partly from a long absence in Japan, they were discontinued, and as there seems no probability of their being resumed, he has thought it best to publish at once the results of his experiments, comparing them, where requisite, with those of Kœlreuter and Gærtner, and pointing out their connexion with Darwin's views on the origin of species.

In all experiments on hybridization, the one great desideratum is to exclude the possibility of access of every kind of pollen except that which is the subject of experiment. As willows have a singular propensity to form hybrids, and are, at the same time,

* Die Bastardbefruchtung im Pflanzenreich, erläutert an den Bastarden der Weiden: von Max Wichura. Mit zwei. Tafeln. 4to. Breslau, 1865.

diœcious, a circumstance which obviates all difficulties about doubtful extirpation of anthers in the female parent, they are peculiarly fitted for the purpose, and as their pollen is so heavy that it falls at once to the ground when ripe, instead of floating in the air, and is, moreover, covered with a raised delicate network, it is peculiarly adapted to adhere to the hairs of insects, without whose help it scarcely ever reaches the female plant, which is often at a great distance from the male. Multitudes of insects, however, greedily search out the blossoms of either sex, and in consequence impregnation seldom fails in wild plants.

In this appetency for the flowers, it is of the greater importance in the course of experiments to find some effectual way of preventing the access of insects. For this purpose cylinders were made of thin tarlatan, 2–3 inches wide, and 6–12 inches long, furnished with a string at either end to tie them closely to the branches, and strengthened in the centre with two or three bands to prevent them collapsing. To show that the insulation was perfect some flowers were left to themselves; and not a capsule set. In the case of those flowers which were artificially impregnated, so soon as the stigma dried and the ovary began to swell, the cylinders were removed as no longer necessary, and replaced when the seed was nearly ripe, to prevent its being carried away by the wind. The spikes having the male blossoms, moreover, were separated as soon as the anthers began to burst, and placed in water to prevent the access of insects. The pollen was applied with a camel's-hair pencil, and a separate pencil used for each kind of pollen, which was always taken from the same individual and, as nearly as possible, normal plant.

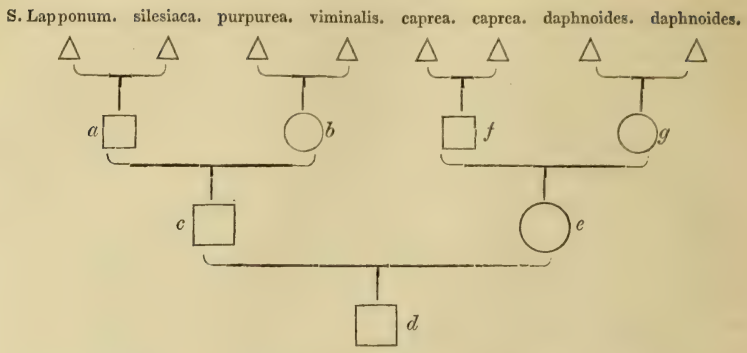
For the impregnation of early flowering species with those which blow later in the season, the fact was of great importance that the pollen of willows retains its potency for some time. In some cases pollen ten days old was efficient, while the vitality was still further prolonged by steeping it in a solution of honey, made of as much as will lie on the point of a knife, mixed with two ounces of water. Fresh pollen, placed in this mixture, frequently began, in the course of ten or twelve minutes, to put forth its tubes. Pollen of *Salix silesiaca*, eight days old, seemed almost as potent as ever; in twenty-eight days the traces of vitality were very slight, while that of *Salix cinerea* had become weak in sixteen days, though still capable, after immersion for three hours, of slowly developing its tubes. On the whole it should seem that pollen kept in a dry, cool, shady place, may,

under favourable circumstances, be still efficient after fourteen days, while that eight days old may be trusted implicitly.

The seeds of willows germinate very rapidly, and lose their vitality with proportional rapidity. The pollen-grains, indeed, sometimes preserve their vitality longer than the seed. This quickness of germination arises from the fact that the embryo is already richly supplied with chlorophyll, and that the testa is very thin and transparent, while there is not a trace of albumen. They soon dry up if they are not in contact with moist earth; they should therefore be sown as soon as they are ripe, and in from twelve to twenty-four hours the cotyledons make their appearance. Care must be taken not to water the young plants too heavily, or the delicate seedlings may be washed away. Our author's plan was to raise the plants in pots, which could be supplied with water from below, and easily protected from the access of any strange seed. They were allowed to remain in this situation till they were some inches high, and then transplanted into the open air; and thus plants sown in May obtained a height of two or three feet by the end of summer. The smaller kinds generally flowered in three years, the larger, but not arboreous species, in about four. Scattered catkins, however, sometimes appeared on two-year-old plants, and in one instance a plant sown in June produced flowers when ten months old.

Our author adds a remark on the use which he made of natural hybrid willows during the course of his experiments. They seemed to be of the greatest importance as regards hybrids composed of more than two factors. By their help he was enabled to raise two hybrids (of which admirable nature-printed figures are given at the end of the volume) compounded of six different species, which he believes, after seven years' experience, to have been impossible with artificial hybrids.

An example is added of the composition of hybrids of more than two species, the parents being a spontaneous hybrid of *S. Lapponum* and *S. silesiaca*, a spontaneous hybrid of *S. purpurea* and *S. viminalis*, with an artificial hybrid of *S. caprea* and *S. daphnoides*. The circles in the following scheme indicate the male, the squares the female, and the triangles the father and mother plants of the free hybrids or species indifferently.



His notation to exhibit the whole history of the hybrid is expressed thus, ♀ indicating female, ♂ male, spont. spontaneous, art. artificial

♀ *S.* (♀ (♀ (*Lapponum* + *silesiaca*) spont. + ♂ (*purpurea* + *viminalis*) spont.
+ (♂ ♀ *caprea* + ♂ *daphnoides*) art.),

which, expressed at length, denotes that the senary hybrid was raised between a female parent derived from the intercrossing of two spontaneous hybrids, of which the female parent was derived from *S. Lapponum* and *silesiaca*, and the male from *S. purpurea* and *viminalis*; while the male parent was derived from an artificial cross of *S. caprea* impregnated with the pollen of *S. daphnoides*. In the names of artificial hybrids, the female parent always comes first, while in spontaneous hybrids the parents are placed in alphabetical order.

A complete list of the author's experiments follows, giving in one column an account of those which proved successful, and in another those which did not succeed, with the date of the experiments. The former, comprising binary, ternary, quaternary, quinary, and senary hybrids, amount to thirty-five; the unsuccessful, amounting to eighty-one, include the three first heads; no unsuccessful experiments were made in the fifth and sixth; but an attempt to obtain an octonary with two quaternary hybrids did not succeed. Both lists are well worth the study of every one engaged in the scientific determination of willows. The proportion of successful experiments is far more unfavourable in binary than in more complicated combinations. Nothing, however, can be concluded from this; for in binary hybrids an endeavour was made to effect heterogeneous combination, or certain unions already existing in free nature, and that with old pollen, while in

complicated combinations the object was to combine as many species as possible; the species, therefore, most nearly related to each other were chosen, and fresh pollen was used. It is not to be doubted, moreover, that the more favourable results amongst complicated hybrids depended on the more favourable circumstance selected for their production; besides, it should seem that willows have a great tendency towards the production of complicated hybrids, which must be regarded as a very peculiar circumstance. Exceptional cases doubtless often depend upon unfavourable accidents; for combinations which failed one year succeeded the next, and it is only after a large continuous series of observations that we can arrive at any perfectly satisfactory result.

Wichura does not consider it necessary to repeat in willows the experiments of Kœlreuter, Gærtner, and others, which show that plants have a superior appetency for their own pollen to that of any other species. This depends probably on the circumstance that the strange pollen does not push forth the pollen-tube so rapidly as that which is native, so that if both kinds of pollen are applied together, the tube of the strange pollen, supposing it to be properly protruded, finds the micropyle occupied on its arrival. Gærtner informs us that in different plants a different number of generations must pass by to secure the conversion of one species into another. In willows, it appears from Wichura's experiment that it requires only four years.

A small-leaved form of *S.* (*purpurea* + *viminalis*) was used for this experiment, which was continued for two generations. A female hybrid between *S. purpurea* and *viminalis* was impregnated by *S. viminalis*, the result of which was a hybrid scarcely distinguishable from *S. viminalis*. Again, a female hybrid, the result of a hybrid between *S. purpurea* and *viminalis*, impregnated by *S. viminalis*, impregnated in its turn with *S. viminalis*, produced a hybrid still more near *S. viminalis*, and a further crossing would in all probability have perfected the change. It was a matter of interest to observe how far the peculiar smallness of the leaves would be recognizable in the result of the first-mentioned experiment. This was distinctly the case, and it seems clear that the propagation of individual peculiarity may be effected in a hybrid.

A hybrid fertilized with its own pollen produces plants the same as or resembling both the parents. The peculiarities of the parents are moreover repeated in the hybrid. Quaternary hybrids fertilized with their own pollen, produced seed which germinated, but the young plants soon failed.

Gærtner believed that in such combinations, amongst many individuals resembling the hybrid, some plants would occur which reverted very nearly to the maternal, or less frequently to the paternal type. No such reversions, however, occurred in the course of Wichura's experiments. Particular individuals showed indeed many variations, but no reversion. He believed, therefore, that the pollen of either parent must have had access without Gærtner's knowledge; and Mr. Darwin thinks it probable that the instances alleged by Naudin were due to the circumstance of his plants being cultivated. Wichura had no opportunity of examining the truth of the fact asserted by both Kœlreuter and Gærtner, that hybrids prefer the pollen of one of the parents to their own, or that the pollen of some strange species may make the pollen of the hybrid powerless, though he thinks both statements quite probable. He remarks, moreover, that his quinary and senary hybrids are quite new in the history of hybridization. He believes that the possibility of still higher combination is only prevented by the constantly increasing sterility of the produce. The senary hybrid whose formula is given above was still so fruitful that it would scarcely refuse union with an heterogeneously combined senary, ternary or quaternary hybrid, while the other senary hybrid, between a quaternary of *Salix Lapponum* and *silesiaca* □ and *purpurea*, *viminalis* ○, and fertilized with an artificial hybrid of *caprea* □ and *daphnoides* ○, and then finally fertilized with pure *daphnoides* ○, did not give an opportunity of carrying the experiment further, inasmuch as all the plants perished before they produced flowers.

Impregnation between two quaternaries failed as stated above, in consequence of the far advanced sterility of the female plant. He doubts, moreover, whether it is possible to raise a hybrid of the sixteenth degree between two octonaries. He has nothing to say as regard willows in confirmation of Gærtner's remark, that while species will not combine with some other species, they will do so with a hybrid of that species, as, for example, *Nicotiana glutinosa*, *Tabacum*, and *Langsdorfii*, will not combine with *N. rustica*, though they will do so with a hybrid of *N. paniculata* and *rustica*.

We now come to a very important chapter on the imperfect nature of hybrids. Our author divided his experiments into two series, successful and unsuccessful. There are, he says, certain degrees of success, which, however, cannot be used as the stepping-stones for a new division, since they pass into each other,

but deserve mention as characteristic phenomena in hybridization.

The following degrees of failure may be noted:—

1. The catkins submitted to hybridization wither as soon as the flowering is complete, like those which have not been impregnated, and fall off.

2. The ovaries swell and ripen, but do not contain a trace of seed.

3. The ovaries are quite filled with the silky hairs which clothe the umbilical end of the seed, but contain no embryo.

4. Seeds are present, but small, languid, and incapable of germination.

5. Seeds apparently perfectly developed, but do not germinate.

6. Seeds germinate, but the young plants are weak and wither in a short time without further development.

The gradation in the number of seeds next demands our notice. The results of different experiments were very various. Sometimes the seeds were few, but fertile and active; sometimes, on the contrary, numerous, but with only a few fertile mixed with a number of abortive seeds; sometimes tolerably numerous, without any such admixture; but in general hybrids yielded on the whole a smaller number of seeds than plants impregnated with their own pollen.

This imperfection depends on the nature of hybrids, which, according to our author, are never so active as pure plants—a position which is perhaps doubtful. This weakness he believes to arise from a comparative want of potency in the pollen, though hybrids often exhibit a peculiarly luxuriant but rank growth.

It is not necessary to describe the structure of willow-pollen. It is sufficient to observe that in hybrid willows many modifications occur.

The imperfection of the pollen in hybrids is often adduced as a decidedly distinctive mark between them and pure species, but this is incorrect. There are hybrids whose pollen is scarcely less regular than that of the parents, as for example in *Petunias*, and there are pure species which have more irregular pollen than many hybrids. It is, however, true that in the greater number of cases the pollen of hybrids is less regular than that of pure plants.

In willows this is a law without exception. Amongst pure species, only *S. fragilis* (though not the nearly allied *S. alba*) and single individuals of *S. triandra* had a large number of irregular

grains in their pollen. The pollen of all other European willows is remarkable for its great regularity. One grain is almost perfectly like another in size, colour, constitution, and form; and pure species are peculiarly distinguished by this character from hybrids, in whose pollen, amongst a greater or less number of large, regular grains, there are always some which are abnormal. Moreover the various hybrids differ greatly from each other in this respect.

Hybrids whose pollen contains no perfectly developed grains, and hybrids which amongst normal pollen-grains contain only a small percentage of irregular grains, stand at the two extremities of a series which numbers almost as many intermediate links as there are hybrids. It may be asked of what nature is the irregularity of hybrid pollen? How do the differently formed grains comport themselves with respect to potency? How are they developed? In what relation do the different degrees of irregularity which we recognize in hybrids stand to their composition?

These irregularities are of six kinds.

1. Linear elongated bodies, about the size of an anther-cell, which contain within a membrane a large number of dark, dirty-yellow, round pollen-grains of somewhat more than the usual size.

2. Irregular bodies, consisting of from two to four full-grown grains, sometimes light, sometimes of a dark dirty yellow, which contain a great mass of oil.

3. Grains nearly twice the usual size, of a dark dirty yellow, scarcely transparent, otherwise of the regular orbicular form, and containing much oil.

4. Globular bodies, three, four, or ten times smaller than the normal grains, colourless and almost translucent.

5. Grains which differ only in a small increase or diminution of size from normal grains, with which, moreover, they agree in the pale colour, semitransparent aspect, and in the regular development into a ball when placed in watery fluids.

6. More or less regularly plicate, dark, impellucid bodies, of the normal size or smaller, which, placed in water, are unaltered and do not assume a spherical form.

The last form is the most common, and exists in pure *S. fragilis* and *triandra*; 4 and 5 often occur together. No. 3 is uncommon, and 1 and 2 very rare. No. 1 has occurred only in a spontaneous hybrid between *S. cinerea* and *incana*, and No. 2 only in a very few instances.

Imperfections in the sexual organs of hybrids have, however, been shown by Gærtner and others to go further in other plants

than amongst hybrid willows. But what most concerns us at present is the remark of Gærtner, that in the anthers of all fertile hybrids, as for example in *Nicotiana rustica paniculata*, *Malva mauritiana sylvestris*, *Aquilegia atropurpurea canadensis*, *Lychnis diurna vespertina*, larger and smaller grains are mixed in different proportions, besides small grains of different degrees of irregularity, as elongated, shrivelled, or mere arid sacs; and this is the case especially with those which are the least fertile, a fact which was observed also by Kœlreuter. A tolerably correct opinion, therefore, may be formed of the comparative fertility of hybrids from an examination of the pollen, as appears also very distinctly from Wichura's observations.

Pollen-grains of willows were treated with the above-mentioned solution of honey; and it appeared, on microscopical examination, that the normally formed grains of hybrids, of a light colour and semitransparent aspect, constantly developed pollen-tubes; those like No. 5 usually did so; the irregular grains like No. 2, if of a light colour, occasionally; while the confluent grains, of a dark, dirty yellow hue, with those comprised under Nos. 1, 3, 4, and 6, never made pollen-tubes, and must be regarded as absolutely sterile.

It appeared also, on comparing the activity of the pollen-grains of hybrids with those of pure species, that there was a difference. The defect in hybrid pollen in some hybrids, and probably in a great many, though not in all, was twofold. The number of tube-producing grains is far smaller than in pure species, while the potency of these grains is comparatively weak.

The study of the pollen-grains in willows is comparatively easy, as the contents of the anthers in every stage are easily squeezed out on the stage of the microscope by the covering glass, so that they are ready for examination without any further preparation. Willow-branches, moreover, are readily developed in water, and the different stages of development of the pollen observed without much trouble.

In pure willows the mother cells of the anthers are of equal size, and divide, with almost mathematical precision, into four tetrahedric pockets, in which the contents form yellowish shining pollen-grains of exactly the same size; while in hybrids the course of development is far less regular, and subject to the above-mentioned derangements.

The first form arises from the fact that the component cells of the substance of the anthers (*Collenchymzellen*), contrary to the established rule, do not dissolve, but still hang together, and thus

prevent the separation of the mother-cells. In mature anthers these confluent pollen-grains form yellow linear bodies; when pressed out of the immature anther they have an appearance like that of frog-spawn.

The four next forms arise from an irregular division of the mother cells. In hybrids in which these forms occur, sometimes we find the mother cells only uniseptate, and in consequence two large pollen-grains are formed instead of four half the size. Sometimes, though the cells are quadriseptate, the division is irregular, and one larger grain with three smaller ones is often the consequence. A further cause of irregularity arises from the fact that the dissepiments of the mother cells are so imperfect that the pollen-grains of the different component sacs are confluent with each other. In this way the compound grains of No. 2 arise, consisting of two or more confluent individuals. More rarely the cells divide into a larger number, from sixteen to twenty, and the grains are consequently minute. In No. 6 the division of the mother-cell is at first apparently normal, as are also the pollen-grains, and the malformation first appears when the pollen-grains begin to contract. The triple folding does not take place. One half of the globe remains convex, the other is pushed in, so that a purse-like body is formed, or, if the triple folding takes place, it is very irregular. In either case, the dark colour and want of transparency show that the fluid contents of the grains are more or less deficient.

It is worthy of remark that the irregular division of the mother-cells does not necessarily induce sterility. On the contrary, the pollen-grains of a greater size than usual, which arise from the irregular division of the mother cell, are frequently fertile. Sterility attaches rather to those recklings which are below the normal size and which are generally colourless and transparent, to those which are not expanded when in contact with fluids, or, finally, to those which are extravagantly large and confluent, if of a dark brownish yellow. This change of colour depends probably upon some anomalous composition of the fluid contents.

It is scarcely possible to classify hybrids according to this imperfection of the pollen, because the gradations are so gentle; certain laws, however, seem to prevail.

1. The anomaly of the pollen increases with the succession of generations arising from the fertilizing of hybrids with their own pollen. This is the case with hybrid willows; and Gærtner has shown that, with respect to hybrids of *Aquilegia, Dianthus, Lava-*

tera, and *Geum*, there was a perpetual decrease of fertility and a general decrepitude, though he does expressly state that this depended on imperfection in the pollen.

2. Different individuals of the same hybrid generation nearly resemble each other in the degree of imperfection in the pollen. This was found to be the case in all experiments with artificial hybrids which for the most part yield a large number of male plants. In wild hybrids, especially of the formula

$$♀ (♀ (a+b) + ♂ (a+b) + ♂ (a+b), \text{ \&c.},$$

it is very probable that individuals may be found in which the different degrees of imperfection of pollen may be found in one and the same hybrid. It is possible also that different individuals of the same two species, when hybridizing, may yield different kinds of irregular pollen.

3. Distantly related species of willow, when combined in hybridization, give a more irregular pollen than nearly allied species.

4. The anomaly of pollen increases with the number of intermingled species.

♂ *S.* (♀ (*Lapponum* + *silesiaca*) spont. + ♂ (*purpurea* + *viminalis*) spont.) has far more sterile grains than *S.* (*purpurea* + *viminalis*) and *S.* (*Lapponum* + *silesiaca*) spont., which has proportionally regular pollen, while even some ternary hybrids are quite sterile though the parents are fertile. Again, the quinary ♀ *S.* (♀ (*purpurea* + *repens*) + ♂ *aurita*) art. + (*caprea* + *viminalis*) art.) has by far a greater number of sterile pollen-grains than all the binary hybrids which are known of its five parents.

We now arrive at the female flowers of the hybrids; but unfortunately this part of the subject has engaged Wichura's attention much less than the former. It is indeed overwhelmed with difficulties, and would require immense patience to follow it out properly; for the contents of the embryo-sac could not be observed so easily as those of the anthers. Professor Henslow went as far as could be expected in this direction when he wrote his model treatise on a hybrid *Digitalis*; but more is required to satisfy the existing state of science, and a thorough examination of any differences that may exist in the more intimate characters of the ovules in hybrid plants is one of our great desiderata.

Wichura, however, remarks that the female sexual apparatus suffers in many cases a certain degree of imperfection. The ovaries of certain willows, which appear to be binary hybrids of *S. viminalis*, *alba*, and *cinerea* with *S. triandra*, or ternary hybrids of *S. viminalis*, *caprea*, and *cinerea*, are perfectly sterile. They

do not show the slightest trace of any development of the seed though abundant opportunity was afforded, either in the way of artificial application, or through the natural agency of insects in the open air. The female catkins of the above-mentioned hybrids of *S. triandra* wither quickly after expansion, and fall off prematurely, those of *S. longifolia*, on the contrary, are apparently luxuriant, ripen and burst, but they contain no seed. As the male plants of *S.* (*triandra*+*viminalis*) and *S. longifolia* are distinguished by a far advanced irregularity of pollen, a certain connexion between the imperfect formation of the male and female organs of this hybrid is not to be mistaken. Other examples might be adduced. In the greater number, indeed, of female hybrids of willows there is, in comparison with the pure species, a less degree of fertility, which appears only in the diminished number of seeds; while many hybrid willows, examined superficially appear to be quite as fruitful, if attention is paid only to the woolly contents of the capsules. Even in these, Wichura believes that an attentive examination would show a diminished number in confirmation of Gærtner's assertion "that even the most fruitful hybrids yield constantly a smaller number of seeds than the parent species fertilized with their own pollen."

But not only in the organs of reproduction, but also in their vegetation, hybrids exhibit many phenomena by which they are more or less decidedly distinguished from pure species. Kœlreuter and Gærtner both agree that the greater number of the hybrids which they raised artificially were distinguished by rankness of growth. The plants were taller than their parents, spread more on every side, had a longer duration (being biennial or perennial when the parents were annual or biennial), were more capable of withstanding cold, and blossomed more freely, luxuriantly, and precociously than the parents; something of which appears also from Naudin's experiments, so far as extreme luxuriance is concerned, as witness his hybrid *Mirabilis*. On the contrary, Gærtner speaks of other hybrids which succeeded only in very favourable weather, and were intolerant of cold. These were hybrids whose parents were only slightly related, and whose seedlings were delicate from the first.

Similar examples occur amongst hybrid willows; but luxuriant growth is by no means the normal character. It is doubtful whether the hybrids of *S. caprea* and *viminalis*, *S. cinerea* and *incana*, with their tall and spreading habit, are to be reckoned as examples, since they are to be explained by the union of tendency

to an arboreous habit in *S. caprea* and *incana* on the one side, and to a fruticose habit in *S. viminalis* and *cinerea* on the other. The rank growth of the senary hybrid from *S. viminalis, purpurea, Lapponum, silesiaca, caprea, daphnoides* was indeed very striking; and in this case, at the age of ten months a single catkin was produced—a circumstance which agrees with Gærtner's instances of the early blossoming of hybrids.

Traces of a defective feeble development are far more frequent amongst willow hybrids than rankness of growth. *S.* (♀ *arbuscula* + ♂ *purpurea*) art., a union it is to be observed of distantly related species, put forth every year a strong shoot, which, however, in the course of the summer began to wither. Not one of the numerous plants which were raised from the intercrossing came into blossom, and all gradually perished. A senary hybrid impregnated with the pollen of one of its parents afforded a quantity of plants. Three of these, $6\frac{1}{2}$ years old, had attained a height of six feet, forming miserable little trees. Buds were formed every autumn which promised well for the following spring, but the wood did not get ripe enough to give strong shoots, so that they always remained weak; and though they had the best place in the garden, they never produced any blossoms; and the result even of a hot summer was the same. *S.* (♀ *viminalis* + ♂ *daphnoides*) art., in itself a tolerably strong hybrid, had a rather unfavourable place near the garden fence. Of fifteen plants, eight were alive on Wichura's return from his travels, and all of these sickly. A plant of pure *S. viminalis*, which had sprung up with the hybrids, and had the same difficulties to contend against, was healthy, a proof of its steady enduring nature. *S.* (♀ *caprea* + ♂ *daphnoides*) art. grew vigorously to a height of from ten to twelve feet, but, though planted in a favourable spot, gradually failed, so that out of six original examples only one was left.

S.(♀ (♀ (*Lapponum* + *silesiaca*) + ♂ (*purpurea* + *viminalis*)) + ♂ *druinosa*) art. was from the first weak and miserable, and all the specimens were overgrown by other stronger hybrids. Fries remarks of *S. rubra*, that is *S.* (*purpurea* + *viminalis*), Wimm., that in Sweden all the branches freeze, while this is not the case with *S. purpurea* or *S. viminalis*. He concludes, therefore, in contradistinction to Wimmer, that it cannot be a hybrid. Wichura proved that it is so by actual experiment. The circumstance, therefore, mentioned by Fries is exactly applicable to what has been said of the comparatively feeble nature of hybrids, and is so much the more interesting since *S.* (*purpurea* + *viminalis*),

Wimm., independent of the imperfection of the pollen, exhibits no symptoms of weakness in its outward appearance. The possibility must therefore be allowed that the vegetative growth of other seemingly strong hybrids (as, for example, by far the greater number of hybrid willows) is essentially weak, so as to prevent them in the Darwinian struggle for life from competing with their parent species.

If all these circumstances are combined with the imperfection of the pollen and the partial sterility of the ovaries, the comparative defect of vital energy in hybrids may be considered as proved. Nor does the luxuriant growth of some contradict this, as we know that it often accompanies suppressed fertility. Kœlreuter's views seem then to be confirmed, that the luxuriance of hybrids arises from sterility. The most fruitful hybrids are always less so than their parents. The weakness of the generative organs in very luxuriant hybrids induces an increase of vegetative growth, while this is not the case in others which are too weak to exercise such a reaction.

The relation of the sexes is modified in hybrids. The proportion between the male and female plants is different from what it is in pure species. This indeed requires further proof, the confined limits of his garden not allowing the author to make as many experiments as he otherwise would have done with pure species. His observations were therefore confined to the proportions which exist respecting hybrid willows in free nature, where the difference in the proportion of the sexes in hybrid and pure species is very striking. Pure species, however, are not quite equal in the number of their male and female plants. *S. fragilis*, *alba*, *pentandra*, and *triandra*, which are so strikingly distinguished from other European willows by the double nectary of their male blossoms, bear, at least in the neighbourhood of Breslau, a greater number by far of male individuals than the species with a single nectary, as *S. cinerea*, *viminalis*, *purpurea*, *repens*, &c. In the former the males are more numerous than the females, in the latter this is not the case. Males and females are in nearly equal proportions in these, though with a slight preponderance of females, while in the other the females are far more numerous. In artificial hybrids with one nectary, there are about ten females to one male; but when more than two species are combined, it should seem that there are great differences; but observations are at present not sufficiently numerous to establish any decided law. Wichura considers his observations on this matter to be quite

isolated, and not apparently to agree with those of Girou de Buzareingues on the proportion of male and female individuals in *Cannabis sativa*, *Rosa cinnamomea*, *Rumex acetosella*, *Spinacia oleracea*, and *Lychnis dioica*.

Since willows have no petals, they will teach us nothing respecting the different variations of colour which are so striking in many hybrids. We must therefore look rather to the different forms which they assume. When we consider the form of a hybrid with reference to that of its ancestor, we must distinguish three categories of characters.

1. Constant characters in which the parent species agree. These enter unaltered into the hybrid.

2. Constant characters in which the parent species are distinguished from each other. These enter only by halves into a hybrid, so that it is intermediate between them.

3. Variable characters. In these the hybrid is equally variable. If the parents agree with each other in their variable characters, these are not necessarily inherited by the hybrid; and if they differ in their variable characters, the hybrid is not always intermediate.

As regards the first and second, the following may serve as an example. *S. purpurea* has two stamens whose threads and anthers are so intimately united that they seem to have only one thread and a four-celled anther. The stamens in the other European willows are free, *S. incana* only being exceptional, in which the threads are united halfway up. If a hybrid is formed between *S. purpurea* and another willow, the threads are confluent below in accordance with the first rule, while they are free above and divergent. *S. purpurea*, moreover, has sessile stigmas. The style of other species, as for instance *S. viminalis*, is rather long. The hybrid has the style about half as long as that of the second species. Similar examples may be adduced as to the position of the stigma, the leaves, the pubescence, the rough under surface of the leaves, the bark, the stature, the time of blooming, and finally the quantity of salicin in the bark. Wichura has seen only a single exception to this law in *S.* (♀ *arbuscula* + ♂ *purpurea*) art. As regards foliage, it was exactly intermediate; but it had nothing in common with the upright habit of *S. purpurea*, but rather lay completely prostrate on the ground, being in this respect an exaggeration of *S. arbuscula*. It is possible, however, that this was only a sign of the weakness inherent in hybrids, and so the exception is only apparent. More complicated hybrids exhibit the same law,

but it is of course more difficult to indicate the points of resemblance and difference.

Gærtner indeed supposes that in genera which are rich in species, there are some which have a prepotent influence when hybridizing, so that in some hybrids the type either of the male or female parent prevails. Amongst the various hybrid willows, though the genus is so rich in species and so prone to hybridizing, Wichura has never seen a prepotent type, and doubts Gærtner's statement, especially as he makes it in very qualified terms. With respect to the critical examination of types—whether, for example, a hybrid is more like the mother or father—the perfect distinction is subject in many cases to great difficulties, since very much depends on the subjective view of the observation; for in consequence of the frequent intermelting of both characters, the one observer finds in a hybrid the maternal type, while another thinks the paternal type prevalent.

The question is of more importance whether the paternal or the maternal parent has most influence on the form of the hybrid. Gærtner has made many experiments in this direction, and says, "The most important and interesting phenomenon in the intercrossing of plants is the perfect equality of either production; seeds arising from the impregnation of either parent produce plants of the most complete resemblance; so that the different origin, on the most careful examination of either kind of hybrid in respect of formation and type, does not induce the slightest difference." Slight differences were said to occur in the genus *Digitalis* only, but it is doubtful whether these depend on intercrossing or on some other conditions. *S.* (♀ *caprea* + ♂ *viminalis*) and *S.* (♀ *viminalis* + ♂ *caprea*) did not present the slightest difference in the number of normal pollen-grains or in their outer form, but their resemblance was so perfect that they might be taken for products of one and the same crossing.

Since the variable characters of species maintain their peculiarity as such in their progeny, a wide margin is left for the formation of varieties in hybrids which comprise the variable characters of two species, notwithstanding the law of intermediation. The most remarkable examples are afforded by those hybrids which exhibit the prevailing characters in different parts of the same individual. The occurrence of such types is placed beyond doubt by such productions as *Cytisus Adami*, a hybrid of *C. Laburnum* and *purpureus* *. Mixed types are, however, very rare, and nothing of the kind has ever occurred amongst willows.

* It is very doubtful, however, whether this be a hybrid at all. It is believed

Wichura confirms Gærtner in the assertion that where hybrid pollen is used for the impregnation of simple or complicated hybrids, as also in pure species, there is a great predominance of individual forms, while hybrid ovules impregnated by the pollen of pure species, even in the most complicated combinations, give very uniform products.

On the whole, our author's experiments have far more generally exhibited variety of form in the produce where the pollen of hybrids, and, on the contrary, uniformity where the pollen of pure species was employed. We may therefore attribute to the pollen of hybrids a tendency to produce varieties, while, since the ovules of the same, if fertilized with pure pollen, yield as uniform produce as those of true species, there does not appear in general to be any inherent propensity in them to produce varieties. There is but one observation of Gærtner's which gives any support to the assertion that the varieties from the ovules of hybrids with pure pollen may be more numerous than from those of pure species. Tolerably constant forms arose from a hybrid fertilized with the pollen of the male parent, if the female hybrid was fruitful, but variable forms if the productive powers were weak. This could not, however, depend upon the pollen, which in either case was the same, but on the incipient sterility of the female, which induced a malformation of the ovules; so that the rule that the product of hybrid pollen is more polymorphous than that of pure pollen remains unshaken.

The circumstances which favour the spontaneous production of hybrids in willows, seem to be nearly the same as those which facilitate artificial intercrossing. Diœcious plants, which are subject to fertilization by insects, must necessarily produce hybrids, if they comprise, like willows, a great number of nearly related species, which grow in company with each other, and which have the same or nearly the same time of flowering.

Wimmer believes that there are thirty-four undoubtedly pure European species of willow, or perhaps thirty-five if *S. helvetica* is not a hybrid. If, however, *S. pedicellata*, Desf. and *S. arctica*, Br., whose hybrids in the extreme southern and northern latitude of Europe have not yet been studied, be excluded, we have

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to be an accidental variety produced by grafting *C. purpureus* on *C. Laburnum*; and it is conjectured that a portion of the cells of the one plant must have become so intimately connected with the cells of the other, that when cell-division took place part of the plant assumed the type of *C. Laburnum*, another of *C. purpureus*, while others were exactly intermediate between the two.

thirty-two species which may concur in the formation of hybrids. From these sixty-six indubitable binary hybrids are known which occur here and there mixed with their parent species. Of these a complete list is given, which deserves attentive study. Ternary hybrids also are said to occur in nature, of which nine are enumerated; but these must be considered doubtful unless reproduced artificially.

Hybrids are distinguished from pure species, as regards their occurrence, by certain peculiarities. They can only arise where the parent species are associated. This is especially observable with respect to widely distributed species hybridized by species of rare occurrence. The intermediate form of *S. Lapponum* and *myrtilloides* is peculiar to northern swamps, where both species grow together. The hybrid *S.* (*aurita*+*myrtilloides*) is confined to Silesia and the few places where *S. myrtilloides* grows.

A second more important difference consists in the comparative number of individuals.

1. As plants prefer their own pollen to that of strange species, and willows often grow in groups, there is a much greater chance for the success of their own than of strange pollen, especially when the times of shedding of the pollen do not coincide. Hybrids must therefore be comparatively rare*.

2. Hybrid willows are generally in a position for self-impregnation; and as this induces a gradual decay of vitality, hybrids have not the same chance of propagation by seed as pure species.

3. Hybrids, however, take the pollen of the parent species more readily than their own. The male plants are rarer in hybrid willows than the female; the pollen, moreover, of hybrids, when fertile, contains a certain number of impotent grains. The hybrid therefore has a greater chance of being fertilized with parent pollen, and, as this process is repeated, it is more probable that the hybrid should revert to one of its parents than that it should be preserved unaltered for any considerable time.

4. The difficulty is scarcely less with the female hybrid. Some hybrids have perfectly sterile ovaries and cannot be propagated by seed; others produce only a few seeds; and even the most fruitful are not so fruitful as pure species. Here, then, is another ground for hindrance of their diffusion.

5. Others, finally, are weak as regards vegetative power. If,

* Wichura's opening observations as to the peculiar facility for hybridizing in consequence of the agency of insects being requisite to carry the pollen to the females, often situated at a considerable distance, must be regarded as modifying this observation.—Ed.

then, they grow in company with their parents, they are soon overgrown, and so gradually die out.

From all these circumstances it is clear that spontaneous hybrids must be rare. If we except those which, like hawkweed, sedges, or brambles, are propagated in certain localities by suckers, they are of rare occurrence. In Silesia perhaps there is one hybrid amongst 500 individuals. There is perhaps of *S.* (*alba*+*fragilis*) one per cent. of the parent species, $\frac{1}{3}$ per cent. of *S.* (*purpurea*+*viminalis*), $\frac{1}{5}$ of *S.* (*aurita*+*repens*), $\frac{1}{10}$ of *S.* (*purpurea*+*repens*), $\frac{1}{50}$ of *S.* (*cinerea*+*purpurea*), $\frac{1}{500}$ of *S.* (*triandra*+*viminalis*). These are, it is to be observed, only rough approximations. Complex hybrids are so rare that no estimate is made respecting them.

In some confined localities, as in swampy wastes, sandbanks, river-beds, &c., certain hybrids sometimes grow together in considerable numbers. This is the case with *S.* (*purpurea*+*viminalis*) on the Breslau river-banks, and with *S.* (*aurita*+*repens*) and *S.* (*purpurea*+*repens*) in swamps. According to Andersson, *S.* (*Lapponum*+*myrtilloides*) (*S. versifolia*, Wahl.) surpasses its parents in number in some parts of Lapland. This depends probably on a little-noticed biological peculiarity in willows. They cannot bear being overshadowed, but become sickly, while the young plants perish, even amongst herbs of small stature. Moist places in districts bare of vegetation, either from artificial or natural circumstances, are the favourite places of the development of the light seeds. All therefore in a particular spot have vegetated in the same year; and so it may happen that, if these have come from some hybrid, the hybrids may surpass the pure parents in number. In other spots of the same locality not a single hybrid can be found.

Finally, hybrids have been widely cultivated in some districts by means of cuttings, as *S.* (*alba*+*fragilis*) and *S.* (*fragilis*+*pentandra*), which are used for enclosing the roads, and *S.* (*pupurea*+*viminalis*) for basket-work.

We pass over the systematic chapter, which, however excellent, is not especially suitable to the objects of this Journal. It is, however, remarkable that the great similarity between *S. caprea*, *cinerea*, and *aurita* is rather apparent than real. Though they do not absolutely refuse intercrossing, like the *Cucurbita Pepo*, *maxima*, *melanosperma*, and *moschata*, they comport themselves differently towards different species. Hybrids of these three species are by no means more frequent than other hybrids; and while many hybrids of *S. caprea* and *aurita*, with other uninectariferous wil-

lows, have a tolerably regular pollen, there is in hybrids of *S. cinerea* a marked irregularity which reaches its maximum in *S.* (*cinerea*+*incana*). While *S. caprea* rather combines with *S. viminalis*, *Lapponum*, and *silesiaca*, *S. aurita* does so with *S. livida* and *repens*, and *S. cinerea*, as *S. incana* and *purpurea*, seems to occupy a somewhat isolated position.

We come now to the general conclusions. After first very briefly stating Mr. Darwin's theory of the origin of species by variation and elimination, our author proceeds to some general consideration of hybrids. The habitual weakness, however, which he supposes in males is not universal, though perhaps in every male there is some weak point, however strong it may be in some particulars. The hybrid then comes with no new peculiarities into the world; it has those of its parents, and generally in a decidedly less complete degree. It is a perfect whole, so far as the peculiarities of the parents agree with each other; so far, however, as they differ it is intermediate, so that no speciality is completely reproduced; and since the differing parts are combined in one intermediate whole, since these require different conditions, the hybrid can never be perfectly accommodated to outward circumstances*. A hybrid between a fish and a bird, were such a creature possible, would never either swim or fly well with its imperfect fins and feathers; and something of the kind must be the case with all males. We cannot, however, go so far with the author as to say that no hybrid can be exactly fitted for its place in nature, because, though it may not suit the circumstances of either of its parents, its intermediate nature may be suited to some intermediate conditions, as species of different climates form hybrids.

As no two parent species agree entirely with each other, though the hybrid may be equally strong with the parent as regards one or more characters, there will always be characters in which it is weaker, and therefore as a whole it will be less perfect. This is quite the case with willows.

The most imperfect simple hybrids are those which *S. viminalis* and *S. cinerea* form with *S. triandra*; and if we compare their peculiarities, we find that they differ from each other more than all other willows which form hybrids in free nature. *S. arbuscula* an alpine willow of low stature, with the leafy stem of the catkin is very different from *S. purpurea*, a low-ground species. Th, ,etificial hybrid between them is so imperfect, that it dies every

* This view is distinctly stated in Darwin, Or., p. 288, ed. 3.

year down to the ground, and never bears blossoms. *S. purpurea* with confluent stamens, and *S. viminalis* with free stamens, form a hybrid with very irregular pollen. On the contrary, the pollen of *S.* (*caprea*+*viminalis*), both of the parents of which have free stamens, has much more regular pollen. The more different the parent species, the more imperfect the hybrids. Examples might, moreover, be adduced of more complicated hybrids in confirmation of this position.

It follows that those species only can combine to form hybrids which agree in a proportionally large number of peculiarities and the relative biological conditions, which accords with the fact that only cognate species or nearly allied genera can combine.

Were it necessary to prove by experiment that every species, in order to maintain itself in certain vital conditions, requires all the peculiarities with which it is endowed, one could think of nothing more appropriate than hybridizing, which calls into action in a weak and impaired intermediate condition all the constant differences of the parents. Were the hybrid as vivid and vigorous it would be a contradiction to this hypothesis.

The constantly increasing sterility in hybrids, and their dying out when fertilized with their own pollen, belongs probably to another class of phenomena. It is notorious that families which have the seeds of disease in them, and yet intermarry, die out after some generations; and the raisers of varieties are well aware that all abnormal peculiarities in plants and animals increase, if attention is paid to them in successive generations, so that propagation is confined to these abnormal individuals. If a hybrid is fertilized for successive generations with its own pollen, individuals come together which have the same weak point, viz. that of reproduction. The increase of weakness and sterility, and the rapid dying out of hybrids by continual impregnation with their own pollen, agrees perfectly with the above-mentioned circumstances. This is exactly Darwin's view of interbreeding causing sterility in successive generations.

Ægilops speltæformis, Jordan (♀ (♀ *Æ. ovata*, L.+ ♂ *Triticum vulgare*, L.)+ ♂ *T. vulgare*) is an apparent exception to this rule. Esprit Fabre raised in 1858, from a spontaneous hybrid (*Ægilops ovata*+*Triticum vulgare*), *Ægilops triticoides*, Requien, and at a later period Godron bred an artificial hybrid from the same parents, and fertilized this again with the pollen of *Triticum vulgare*, which is now commonly multiplied in gardens, under the same of *Ægilops speltæformis*, while the primary hybrid is very

unfruitful. In this second hybrid it is to be observed that there are three parts of *Triticum vulgare*, and in consequence it is nearly accommodated to the vital conditions of *T. vulgare*. We must remember, however, that it is propagated only artificially. The hybrid has not yet been found wild, and is therefore rare, if it exists at all, and of no great power of endurance.

So long as hybrids, like stars, were regarded as freaks of nature, they added nothing to our knowledge; but when it was ascertained that the same laws existed in the formation of monsters, though differently directed, they became a fertile source of information respecting morphology; and so hybrids, if looked upon as products of a normal fertilization under extraordinary circumstances, may teach us important lessons respecting the generation of plants. When both parents belong to the same species, we cannot tell what part the male and female parent take respectively in the formation of their progeny. But dissimilar factors are united in hybrids, and an intermediate form is the consequence. The products which arise from reciprocal crossing in plants, unlike those which are formed amongst animals, are perfectly alike. It is of no consequence which is the male and which the female parent. It is therefore a mathematical necessity that the pollen-cells must have just the same part in the act of generation as the ovules. The following observations in the form of aphorisms are to be considered conjectural, and require to be submitted to proof:—

1. Setting out from the fact that every branch, with a few exceptions, repeats perfectly the type of the plant from which it springs, and that the origin of every branch is referable to the development and division of a single cell, it must be allowed that the cells of plants partake of their specific peculiarities, so that, under favourable circumstances, they can reproduce new individuals.

2. Embryo-cells and pollen-tubes are cells. They must contain therefore the type of a certain form, which will appear pure and unmixed on the growth of the cells into new branches.

3. The secret of reproduction depends on the combination of two different cells into a common whole. Accepting this as an axiom, it is natural and necessary in the union of two cells if they belong to differently constituted individuals, that a more or less perfect intermediate form should arise, whose form is not altered, whether *a* or *b* supply the pollen; for each of the two cells, whether embryo-cell or pollen-tube, bears in itself the type of the

individual from which it was taken, and each of the two species gives to the new structure a numerically equal part, namely one cell. Both united in opposite crossing must give the same intermediate form, in which both species have entered in equal proportions.

4. Embryo-cells and pollen-tubes give exclusively the subsequent peculiarities to the product in consequence of their containing within them the type. The relation of the mother plant to the embryo after the completion of impregnation is that of the stock to the graft. Both nourish a strange individual, and are intimately connected with it, without exercising any influence whatever on its typical peculiarities.

5. If the remaining cells, on their growth into branches, reproduce as a rule the same individual of which they are the essential part, experience teaches, on the contrary, that in the process of production many individuals of abnormal structure—that is, varieties—make their appearance.

6. Since the sexual union of differently constituted individuals (that is, hybridizing) always produces a being intermediate between the type contained in the ovule and that in the pollen-tube, we may regard it as a law which has equal weight in the origination of varieties.

7. The existence of a variety is therefore a proof that the ovule or pollen-tube from whence it sprung, or both, must have had a type departing from that of the normal species.

8. The embryo-cells and pollen-tubes have therefore not merely the function of reproducing the individual, but also of new abnormal forms.

9. In hybrids the power of forming varieties exists especially in the pollen, in a less degree in the ovules; and this is probably also the case in pure species.

10. If we reflect that the new individual arising from impregnation is intermediate between the type of the pollen of the male and the embryo-cell of the female, we must, in order to explain the form of the variety, assign to the variety-producing sexual cells a tolerably wide departure from the ancestral type.

11. If a variety-forming ovule combines with a variety from pollen-grain, so abnormal a form may arise from the union that we may perhaps explain in this way the origin of Gærtner's exceptional types, assuming the correctness of his observation.

12. It is doubtful whether the variety-forming power of the pollen can be seen from outward inspection; this certainly is not

possible in all cases. There are very variable plants with regular pollen, as *Salix nigricans*, *S. Lapponum*, and the bistigmatic Carices. On the contrary, we have plants with irregular pollen, like hybrids, which are distinguished by the greater or less stability of their productions, as *Salix fragilis*, *Trifolium montanum*, *Barbarea vulgaris*, but not *B. stricta*, *Potentilla incana*, *Hierochloë*, and many others. But in the greater number of cases, as, for example, amongst hybrids, in many cultivated plants, in many indigenous plants conspicuous for white or light-coloured blossoms, and finally in a great part of the very variable wild plants, as hawkweeds, roses, the shrubby brambles (but not *Rubus cæsius* and *idæus*, which yield no varieties and have regular pollen), multiformity in the pollen and great variability are combined. It is also possible that in the multiformity of the pollen of these plants, we see the variability of their offspring pointed out as it were in embryo, or in other words, the increasing variability of the progeny of hybrid pollen must be referred to an irregular division of the mother pollen-cell as its proximate cause. Mr. Darwin believes that there is some connexion between sterility and variability; and there is suggestive matter in these observations in other directions.

Finally, a parallel may be drawn between hybrids and many cultivated plants. A common point in both consists in the fact that they are not fully accommodated to the conditions under which they live. Hybrids are not so because, in consequence of their abnormal generation, they have inherited only a portion of the peculiarities which belong to their accommodation, and cultivated plants because, from artificial treatment, they are kept in climatic and local conditions for which they were not destined*. The history of all our cultivated plants, so far as it is known, shows this. Transported from free nature into the garden, from a warm into a cold climate, the plant at first preserved its peculiarities for a time; then slight changes crept in; more followed, till at last, by repeated generation, scarcely one of the individuals from seed is like the other. In this state the pollen of many

* It should be observed that in a state of nature plants are very frequently found under conditions which are not the most suited to their nature, but in places where they are able to maintain the struggle of life against others by which they would be overwhelmed. This is a fact which is too little attended to by cultivators. Some excellent observations on this subject by the Dean of Manchester will be found in the first volume of the former series of this Journal, p. 44.—Ed.

plants is quite like that of hybrids, and all the forms are found in it which have before been adduced as phenomena in the pollen of hybrid willows. Most cultivated varieties of *Primula auricula*, *Hyacinthus orientalis*, *Tulipa Gesneriana*, *Solanum tuberosum*, *Brassica oleracea*, *Mathiola incana*, *Antirrhinum majus*, *Cineraria cruenta*, and Verbenas have very strikingly irregular pollen. In a white variety of *Cineraria cruenta* a tetrahedric confluence of the pollen-grains was found like that in *S.* (*cinerea*+*incana*). Kœlreuter therefore says rightly, "The nature of plants and beasts is in a certain degree like that of hybrids, as soon as in any way they are removed from that destination for which they are especially fitted." Where culture and hybridizing concur, the consequences of disaccommodation are naturally quicker and more extensive than where only one of these is at work. Thus we find in the Fancy Pelargoniums, the Giant Pansies, the Calceolarias, and the Fuchsias, variability and multiformity of pollen in the highest degree. All these plants have irregular pollen, and in many individuals to a surprising extent. It is probable, though it has not yet been proved, that, as in hybrids, irregularity of pollen in cultivated plants favours variability. If gardeners, in the raising new varieties, would have recourse to the microscope, and let those individuals remain for seed which have the most irregular pollen, or if they would use the most irregular pollen in artificial impregnation, they would in all probability materially expedite the accomplishment of their wishes.

At all events this remarkable position arises from our discussion, that imperfect accommodation gives to an organism an increased tendency to form varieties. Does, then, the same law prevail in nature? Plants are subject to the most different local and climatic conditions. Organisms which at any former time were adapted to climate and locality, must, when change of condition takes place, gradually cease to be accommodated. Had they in this state of transition possessed only the degree of variability which the greater number of wild plants now exhibit, their persistence would have been placed in question. If variability, however, increased with increasing disaccommodation, there might well be one among the many varieties which, suited to the new condition, would have full scope, while the other less adapted forms would be displaced, whether change in combination with "natural selection" be the agent, or whether matter endowed with life, in consequence of an inherent necessity, accommodates itself to a law of conformity suited to outward circumstances.

Teleologically considered, there is, in the variability of unaccommodated species arising from generation, a struggle to produce a new form suited to the altered conditions; and hence it follows that the dying out of species and the origination of new forms are links of the same conditions, just as when an individual dies to perfect and mature the seeds from which it arises with new life in a numerous offspring.

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XV. Note on *Adiantum Farleyense*. By Thomas Moore, F.L.S., Chelsea Botanic Garden.

In the Report of the exhibition held at South Kensington, on the 29th of July last, will be found a brief notice of this fine novelty, in the following terms:—"A magnificent vigorous-growing fern, with the fronds of the size and form of those of *A. trapeziforme*, but pendent, and the large pinnules deeply crenato-lobate. One of the most beautiful of the Adiantums." A subsequent examination of specimens of the plant, shows that these hasty memoranda are by no means too laudatory.

Viewed in the mass, as seen on the occasion of the show in question, the affinity of this *Adiantum* appeared to be with *A. trapeziforme* as mentioned above; but the fertile fronds, which are, it seems, but sparingly produced, bear a much closer resemblance to *A. tenerum*. It appears, however, to be distinct from both, and may be characterized and described as follows:—

A. Farleyense: fronds supra-decompound; pinnules chartaceo-membranaceous, slightly glaucous beneath, rhomboid; the terminal ones cuneate at the base, those of the sterile fronds large (1–1½ inch), dilatato-rhomboid; the posterior margins recurvo-falcate, the anterior deeply lobate; the lobes dichotomously inciso-laciniate, with blunt entire (without serratures) segments, those of the fertile fronds smaller, rhomboid-oblong, slightly lobed; sori approximate, terminal on the lobes, oblong; indusium entire; stipes and rachides glossy ebeneous.

Stipes 12–15 inches long, black, shining, terete, with a shallow groove in front. *Fronds* of pendent habit, everywhere smooth, quadripinnate or decompound, of a bright light-green colour, somewhat glaucous beneath; the sterile more abundant than the fertile, densely leafy, their lamina about 20 inches long by 24 inches broad; the fertile with the pinnules smaller and less crowded. *Pinnules* chartaceo-membranaceous, petiolate, the terminal ones more or less cuneate at the base, articulated; the fertile about ¾ inch long, rhomboid-oblong, divided into shallow lobes along the anterior soriferous margins; the

sterile larger and more crowded, 1–1½ inch long, dilatato-rhomboid, the posterior margins recurvo-falcate, the anterior deeply lobate, the lobes inciso-laciniate in a dichotomous manner with the ultimate divisions linear, obtuse, and quite free from serratures. *Sori* numerous, crowded, oblong, variable in size, terminal on the shallow lobes; indusium oblong, entire. *Rachides* and petioles everywhere glossy ebeneous.

Hab. Barbados.

It will be seen that, although evidently related to *A. tenerum*, this beautiful novelty differs from it in the larger size of its pinnules, and in the regularly dichotomo-laciniate condition of the margin of the sterile pinnules, which are also entirely free from the small serratures which occur so distinctly on the sterile portions of the fronds of *A. tenerum*. To these differences may be added the dimorphous development of the plant, so entirely different are the elegantly-fringed sterile pinnules from the more contracted fertile ones. As a garden plant it is far more beautiful than either of the species with which it has been compared. It is, in fact, one of the most charmingly graceful species yet known of perhaps the most lovely genus of the pre-eminently lovely family of ferns.

Adiantum Farleyense was, I am informed, introduced to this country by T. D. Hill, Esq., of London, by whom it was received from his friend T. G. Briggs, Esq., of Barbados, West Indies. Mr. Briggs's residence in that island being called Farley Hill, the fern has been christened as a memento. The magnificent specimen exhibited at South Kensington was presented by him to Col. Miles of Burton Hall, Malmesbury, to whose gardener, Mr. J. Green, I am indebted for the material whence the foregoing description has been derived. Mr. Green states that the sterile fronds are very numerous in comparison with the fertile ones, and that they are always deeply cut; moreover, that the young fronds are of a beautiful pink colour, which they retain until they acquire their full size. This variation in colour adds very greatly to the beauty of the plant.

P.S.—Since the above has been in type, I have learned that this fern is a seedling raised at Farley Hill, by which I infer that it is of garden origin, and not *feræ naturæ*. It is probably therefore a well-marked sport of *A. tenerum*, or it may possibly be a hybrid between *A. tenerum* and *A. trapeziforme*, as it bears a certain degree of resemblance to both.

XVI. Provisional account of some observations proving that *Podisoma Sabinæ*, which grows on the branches of *Juniperus Sabina*, and *Rœstelia cancellata*, which attacks the leaves of Pear-trees, are alternate generations of the same species of Fungus. By A. S. Orsted*. Copenhagen, June 10, 1865.

As long ago as 1862, I suspected the existence of the above-mentioned relation between these two fungi, which have hitherto been classed in different genera and different families. In that year I noticed in a garden, for the first time, specimens of *Podisoma Sabinæ*, which spread their beautiful tongue-shaped tremelloid orange-red tufts in great abundance over some plants of *Juniperus Sabina*; and in the course of the same summer I observed, also for the first time, in the same place, *Rœstelia cancellata*, which up to that time had not occurred there. In the interval I caused a Savin infected with the *Podisoma* to be planted in the Botanic Garden, so as to be able another year to make observations upon this interesting fungus. The next year *Rœstelia cancellata*, which had never been seen before in the Botanic Garden, appeared there for the first time, but, as is worthy of remark, only upon the pear-trees nearest to the juniper.

The simultaneous appearance of these two fungi in two different places attracted my attention, but at first I thought it was only an accidental occurrence.

However, as M. de Bary had shown that alternations of generations occurred in analogous fungi (subject, no doubt, to the condition that the two generations should grow upon the same species of plant, or at least upon a species of the same family, as is the case, for instance, with the sporidia of *Uromyces Fabæ*, which, on the leaves of the bean, produce *Æcidium Leguminosarum*, the spores of which in their turn reproduce, upon the same plant, *Uromyces Fabæ*), and as I had learnt that in other places gardeners were of opinion that *Rœstelia cancellata* was never seen except after the appearance of *Podisoma Sabinæ*, I no longer doubted that these two fungi were the product of an alternation of generations; but the point was to prove it experimentally. This is the object of the little experiment which I have just undertaken, and by which it has been for the first time demonstrated that the two alternate generations of one and the same species of fungus grow upon two plants belonging to very different families.

On the 18th of May I placed some sporidia of *Podisoma*, already

* Translated by F. Currey, Esq., F.L.S.

full-grown and ready to germinate, upon the leaves of young pear-trees, the leaves being placed under bell-glasses so as to keep them in a moist atmosphere. On the 25th yellow spots were already formed at the points where the mycelium had begun to spread, and two or three days afterwards the first traces of spermogonia appeared in the form of little transparent vesicles. The number of these spermogonia continued to increase for several days, and they have now almost all discharged their mucilaginous spermatia.

Thus we find amongst parasitic fungi relations which (so far as regards the totally different aspect presented by the two generations and their entirely different habitat) are completely analogous to those which exist in certain parasitic animals; for the *Podisoma* comports itself with regard to *Rœstelia* precisely in the same manner as *Cœnurus cerebralis* (which attaches itself to the brain of sheep and causes the staggers) does with regard to *Tænia serrata*, which infests the intestinal canal of the dog.

In considering the result of this experiment in connexion with those afforded by other experiments made by me upon *Æcidium Berberidis*, the following conclusion is arrived at—that it must now be considered as proved that *Æcidium Berberidis* bears the same relation to *Puccinia graminis* that *Rœstelia* does to *Podisoma*; or in other words, that the opinion entertained for a length of time amongst cultivators that the parasitic fungus of the leaves of the barberry is the true cause of rust in the *Gramineæ* is now shown to be correct, and that, according to all appearances, this disease in cereals will henceforth be preventible—a disease which, in the time of the Roman Empire, caused such ravages that there were temples consecrated to the god of rust (Robigus) in which, upon certain feast days, sacrifices were celebrated, and which disease, in our days, has such an effect that here in Denmark it is not unusual for the produce of the harvest to be diminished to the extent of many millions of rix-thalers.

As it may very easily happen that the above experiment may be repeated many times without success, for those who are occupied in this kind of work know that a certain amount of good fortune is necessary for success. I have called in aid as witnesses many of my scientific friends, amongst whom I may mention MM. Japetus Steenstrup, Lütken, Th. Fries, Areschoug, Hoffman, Dybdal, Th. Rothe, &c.

This notice had already been sent to press, when I learnt

that M. de Bary had succeeded in showing that *Puccinia graminis* produces on *Berberis*, *Æcidium Berberidis*—a result which affords an additional confirmation of the correctness of my conclusions*.

XVII. Additional Note on Hypocaust-Heating. By C. Wykeham Martin, Esq., M.P.

Since my last communication a greenhouse has been built on the hypocaust principle, with a floor of the cement there described as being manufactured by Mr. Bow, of Maidstone, and it is found to answer in every respect. The cost of the pavement is $5\frac{1}{2}d.$ a foot, and the expense of erecting the building, so far as the floor and heating-apparatus are concerned, is as follows:—

	£	s.	d.
Seager, builder—			
$4\frac{3}{4}$ days bricklayer; $3\frac{3}{4}$ days labourer, building brickwork, steps, &c., for greenhouse.	1	12	3
$4\frac{1}{2}$ days bricklayer and labourer at furnace	0	17	0
$7\frac{1}{2}$ days bricklayer and labourer laying floor, &c.	1	8	4
$1\frac{1}{2}$ load of lime, 3 loads of road-sand and cartage	1	5	1
2700 stock-bricks at 30*s.*	4	1	0
Cartage at 8*s.* per 1000	1	1	10
125 fire-bricks and cartage	1	0	0
1 large size damper and frame	0	4	0
$3\frac{1}{4}$ cwt. 8 lbs. of cast-iron furnace bars at 15*s.*	2	10	10
Cartage of ditto	0	2	6
	£14	2	10
Bow's bill for paving—			
96 feet super. of Portland paving, $2\frac{1}{2}$ inch, at $5\frac{1}{2}d.$	2	4	0
Straw for packing	0	1	0
54 ditto	1	4	9
	£17	12	7

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* Dr. de Bary's paper, which is of considerable length, is to be found in the part for January 1865 of the 'Monatsberichte' of the Prussian Academy at Berlin. An abstract is given in the present number of this 'Journal.' In the 'Sitzungsberichte' of the Academy of Vienna (vol. li. part 1, 1865) is a paper by Reichhardt (on a new species of *Æcidium*), containing some observations on the connexion between *Æcidium* and *Rœstelia*.

Thus it will be seen that the entire cost of constructing the foundation of a greenhouse equal to 15 × 10, including the heating-apparatus, amounted to £17 12*s.* 7*d.* In this case the building was entirely new, and had no assistance from walls already existing to which it could be attached. Hence a pit 2 feet deep had to be lined with brick to that depth all round, and a stoke-hole of brick with neat brick steps to be constructed. In most cases an existing garden-wall will save largely, and in many cases so ornamental and well executed a building will not be required; but it is satisfactory to know what is the probable cost when all has to be done, and well done.

The same fire-place would serve for a much larger building, but the brick wall and pavement would of course increase in proportion to the size. The brickwork includes the whole of the foundation on which the plate rests that carries the framework for the glass, and the floor is equal in appearance to a smooth pavement of Portland stone.

XVIII. On a Plan for Lifting Fruit-trees. By George Lee, Clevedon.

My method of fruit-tree-lifting, which, I think, may be practised on forest and ornamental trees and shrubs (previous to removal) with perfect success, is as follows:—

The soil is cleared off in a circle round the tree, 5, 6, 8, or more feet in diameter (according to the height or size of the tree), down to the roots, a trench is then dug sufficiently deep, three-fourths or more round, leaving only about two or three roots on one side undisturbed. The trench is dug round with a spade to cut off any roots which may have gone beyond, and the soil is worked from between the roots into the trench with a fork (this should be done with some care not to bruise or cripple the roots), and thrown out of the trench with a spade as it becomes full. In this way you get with comparative ease at any roots which may have gone perpendicularly, and are able to dig sufficiently deep to get them up long enough to turn horizontally, which is of great importance, for if these roots are cut short off they are almost certain (except they are very large ones) to strike perpendicularly again. The soil thus cleared out and the roots all free (except

those which have been left undisturbed), the tree is turned over on the side on which the roots are left.

The next time they are lifted, the roots thus left are cut-off, and the tree is turned the opposite way. Thus, if the roots are left on the west side this time, they will be left on the east next, and so on alternately.

I find on lifting a large tree, which has not been previously lifted, that some regard should be paid to the prevailing strong winds. Thus if the prevailing strong winds are from the west, the roots should be left the first time of lifting on the west side; but it does not much matter if we begin with small trees, supposing the trees are in single rows, running north and south; the best way then would be to turn them east and west; but suppose there are double, or treble, or more rows, and they run north and south, then it will be necessary to turn them at some other angle, so that the tops and branches may be as free as possible from coming in contact with other trees, say N.E. or S.W.

The greater part of my trees, which have been lifted several times, would, if taken entirely out of the ground, stand on the surface without any support, and it would take quite a strong breeze to upset them, and, I think, the labour is amply compensated by the superior crop of fruit, both as to quality and quantity. Perhaps I ought to speak more strongly than this, for I consider the crop pays several times over the expenses. But for my experience in lifting (for which I am indebted to Mr. Rivers; for although my method differs materially from his, yet it has been suggested by it, and but for his I should never have thought of mine) my trees, more than 2000 in number, would have been almost valuless, from my having to clear off my present garden for building purposes; whereas now I might sell many of them for from 10*s*. to 40*s*. each. I said last year, when I wrote a very short paper for 'The Journal of Horticulture,' that I was indebted to Mr. Rivers, yet I found from Mr. Rivers's very excellent little book, 'The Miniature Fruit-Garden,' that he quite mistook me, as his note in the eleventh edition will show, and I thought I was plain in what I wrote, as far as it went; therefore, if I have not been sufficiently plain here, I shall be most happy to answer the inquiries of any Fellow, or their gardeners, through the post at any time.

I will now first give the dimensions of a few trees of my own working, which have been practised upon from their second or third year.

I begin early in the season and continue till the spring, as I lift many hundreds every season; but I begin with the ripest first, generally cherries, always choosing the mildest, but especially moderately dry weather (I find the trees suffer if lifted in very wet weather), and in filling-in, I never tread down the soil, and rarely have one blow over, not more than one in eighty or ninety.

I begin on very young trees, say the second year after planting, and I generally plant maiden or sometimes two-year old trees; and if we begin so early there are no large roots taking a perpendicular direction. Great care is taken in pruning the roots while the tree is on its side and laying them carefully in, keeping them as directly out from the tree as possible, so as eventually to form a circle, and the soil is carefully worked over and levelled with a fork. The depth of the hole must be regulated as well as the width by the size or height of the tree; but none of the roots, even of large trees, are above 15 or 16 inches deep, and of those which have been commenced with young (although they may now be large) not more than about 10 or 12 inches. They do not require any support in any one season to prevent their getting blown over—a circumstance which I consider of great importance. If trees are begun with when young and lifted carefully, they soon have an abundance of roots, and their lifting is very little check to them, except in making wood, and even this can be regulated at pleasure.

In the following list of trees which I have lifted successfully, it will be observed that, though the process was commenced when they were very young, their growth was not much hindered. The height is given from the surface of the soil.

The spread is taken at about 3 or 4 feet from the ground.

The age is reckoned from the time of working (the stocks, which are what are termed free stocks, being generally three years old at the time of working).

I perhaps ought to say that I find quince and paradise-stocks lift quite as well as crab or pear, but it is not so with *Cerasus mahaleb*. This I do not find lift at all well in any soil. After the trees get large, every bruise or scratch in the roots becomes attacked by a fungus, which always produces bad health and frequently death. The following are—

Pyramid Pears.

"Doyenné d'été," age ten years, height 19 ft., spread 8 ft., diameter of stem near the ground 6 in.

"Broom Park," age nine years, height 15 ft., spread 9 ft., diameter of stem 6 in.

"Urbaniste," age nine years, height 16 ft., spread 7 ft., diameter of stem 4 in.

"Doyenné Robin," age nine years, height 17 ft., spread 6 ft., diameter 4 in.

"Soldat d'Esperen," age nine years, height 13 ft., spread 5 ft., diameter 4 in.

"Beurré Diel," age ten years, height 14 ft., spread 8 ft., diameter 5 in.

"Doyenné Boussoch," age eight years, height 13 ft., spread 7 ft., diameter 5½ in.

Apples.

"Gravenstein," age nine years, height 13 ft., spread 6 ft., diameter 6 in.

"Golden Pearmain," age eight years, height 13 ft., spread 6 ft., diameter 4 in.

"Mannington's Pearmain," age eight years, height 11 ft., spread 6 ft., diameter 4 in.

"Irish Peach," age nine years, height 12 ft., spread 7 ft., diameter 4 in.

"Rymer," age nine years, height 11 ft., spread 5 ft., diameter 3¾ in.

"Sturmer Pippin," age nine years, height 12 ft., spread 5 ft., diameter 3½ in.

"Waltham Abbey Seedling," age nine years, height 11 ft., spread 7 ft., diameter 5 in.

"Keswick Codlin," age nine years, height 10 ft., spread 6 ft., diameter 4 in.

I will now give a list of a few removed last season to a new garden about three miles distant, *and doing well.*

"Jargonelle," age ten years, height 17 ft., spread 10 ft., diameter 6 in.

"Gansel's Bergamot," age ten years, height 18 ft., spread 8 ft., diameter 5 in.

"Urbaniste," age nine years, height 14 ft., spread 9 ft., diameter 4½ in.

"Thompson's," age 10 years height 15 ft., spread 5 ft., diameter 4 in.

Passans de Portugal," age ten years, height 16 feet, spread 7 ft., diameter 4½ in.

"Louise Bonne of Jersey," age ten years, height 16 ft., spread 6 ft., diameter 5½ in.

"Shobden Court," age ten years, height 17 ft., spread 7 ft., diameter 5 in.

"Gravenstein," age nine years, height 12 ft., spread 8 ft., diameter 6 in.

All these have been very much pruned so as to bring them into shape.

The other apples removed last season cannot be strictly called "pyramids," they are more properly "bush trees;" many varieties of apples I find rather difficult to keep leaders to, so as to form pyramids. I will, lastly, give a few lifted last season, to be relifted this, for removal next to the new garden.

These are some which have not been regularly lifted, and therefore require two liftings to insure their doing really well after removal; they are all standards, with stems from 4 to 6 ft. They were *not* commenced with young.

"Orange Bergamot," age twenty-five years, height from ground 25 ft., spread 20 ft., diameter 1 ft.

"Catillac," age fifteen years, height from ground 25 ft., spread 15 ft., diameter 10½ in.

"Glou Morceau," age eighteen years, height from ground 23 ft., spread 13 ft., diameter 10 in.

"Broom Park," age sixteen years, height from ground 19 ft., spread 14 ft., diameter 9 in.

"Knight's Monarch," age sixteen years, height from ground 17 ft., spread 13 ft., diameter 7 in.

"Eyewood," age sixteen years, height from ground 23 ft., spread 13 ft., diameter 8 in.

With many others sixteen to eighteen years old with large spreading heads.

If it is necessary to lift a large tree which has not been previously lifted, a somewhat wider circle must be taken, and perhaps one-third of the roots, or nearly so, be left undisturbed. The turning over will be a little difficult, but not so much so if the soil is cleared some little distance further on that side, so as to allow the roots more space to bend; and as the roots will most likely be grown very irregular, to keep them properly spread and in their

places it will be best to have some strong fork pegs well pointed, inserted with a small iron bar, and afterwards driven firmly in with a wooden mallet. These will not only keep the roots in their places, but will help to secure the tree from blowing over. But in addition to these, *very* large trees will require some other support to keep them quite safe. I use long forked poles, about three or four of which are inserted at angles; but of course none will be needed on the opposite side to that on which the roots are left. But as these would look very unsightly on a lawn or any conspicuous place, tar-ropes may be fastened, say, at two-thirds the height of the tree, previously placing a good bandage round it to save it from being wounded. The ropes will of course be fastened at angles to sufficiently strong pegs, and by means of such ropes, the trees may be far more easily lowered and raised upright again. I must be permitted to say again, if I have not been sufficiently plain in any of the above remarks, that I shall be most happy to answer through the post, or in any other way, any questions any Fellows or their gardeners may ask.

As I have practised this mode of tree-lifting for many years, and on many hundreds of trees, I can confidently recommend it as a most successful method, and I know that no one will regret giving it a trial if it is done carefully. I perhaps ought to say a few more words about pears on quinces, apples on paradise-stocks, and cherries on cerasus. As to their producing fruit earlier, there can be no question. I find many cherries bear even a much better crop than on the free stock; but, as I said before, they do not lift so well when they become large as they do on the free stocks, and quince-stocks do not do in very sandy soil. I will give the dimensions of a few pears on quince-stocks.

"Gratioli of Jersey," age ten years, height 12 ft., spread 5 ft., diameter 3 in.

"Conseiller de la Cour," age ten years, height 13 ft., spread 8 ft., diameter 4½ in. (This is a most handsome tree.)

"Beurré Hardy," age ten years, height 14 ft., spread 5 ft., diameter 4½ in.

"Beurré Bretoneau," age ten years, height 12 ft., spread 5 ft., diameter 4 in.

"Pius IX.," age ten years, height 12 ft., spread 5 ft., diameter 3 in.

"Prince Albert," age ten years, height 13 ft., spread 6 ft., diameter 4 in.

"Nouveau Poiteau," age ten years, height 13 ft., spread 6 ft., diameter 3½ in.

I find apples on paradise-stocks bear well; but they are difficult to keep upright if lifted when the trees get large, from the extreme smallness of the roots.

I will, in conclusion, state a few particulars in which my method of tree-lifting differs from Mr. Rivers's, yet not so much in the mode of operation as in the results. Mr. Rivers's plan is intended for small gardens where a large variety may be grown in a small space, mine for those of trees of any dimensions, however large; Mr. Rivers's partly as a source of amusement, mine more as a source of profit; Mr. Rivers's only for the fruit-garden, mine may be applied to ornamental trees and shrubs, previous to their removal by waiting two years, and with almost the certainty of success. How much has been written about the removal of large hollies, and other large trees and shrubs, both as to manner and the particular time, *too*; and what a cumbrous affair it has been in removing many cwts. and sometimes tons of soil in the operation, and then, after all, a frequent risk as to their growing; whereas, in this way, there is no occasion to remove any larger proportion of soil than in the case of a tree or shrub 2 feet high. In this way they are almost certain to grow, at least I have only lost one out of many hundreds, and that was more through carelessness than default in the method.

What valuable trees are, after many years growth, found to be in the wrong place; what a desire that they should occupy a more conspicuous or a more favourable place; but what a risk in their removal! Consequently, they are allowed to remain where they are, rather than run the risk of sacrificing them; but by treating them as I have mentioned in reference to large trees, not previously lifted, there is great prospect of success.

But after all I have said, and however much my method differs from Mr. Rivers's, either in its application or its object, I must again say I am indebted entirely to him for it. My attempts to apply his method to rather large trees, proved suggestive of that which I now recommend.

I am a market gardener and very fond of fruit-growing, and of course want to get something by it (that is, make it pay), and I find that my attention to lifting, as I have described, answers admirably, both as to quantity and quality. I beg to refer you to 'The Journal of Horticulture,' vol. iii. p. 635, and 'The Florist and Pomologist,' as also to a few remarks in the "Report of the International Show" in the 'Journal of Horticulture'; but both the quantity and quality, by careful attention to thinning, are

improved. I often cut out two-thirds and sometimes a very much larger proportion.

I have not given the sizes of plums or cherries; but they are quite as large in proportion.

March 19, 1864.

XIX. On *Podophyllum Emodi.* By Mr. Thomas Shortt.

Podophyllum Emodi, Wallh.* (*P. hexandrum*, Royle), is found in Sikkim, Kumaon, and Cashmir, at an altitude varying from 6000 to 14,000 ft., and is one of the earliest spring flowers of the Himalayas. Particular interest is attached to this plant from its first appearance above the ground to its decay. The first growth of the plant is very curious, the centre of the leaf appearing first; the leaflets or segments of the leaf are plicate and folded downwards on the petiole in bud, and the whole plant has much the habit of *Eranthis hyemalis*†. After two or three leaves are developed, the flower appears in the axil of the upper leaf, and, to a casual observer, is much like that of *Helleborus niger*, though smaller. When first opened it is of a delicate blush, and when fully developed is of a pure white.

The flowers are rather fugitive and, if fruit (which is both interesting and ornamental) is required, must be carefully watched and artificially impregnated as soon as the pollen is exposed. This generally takes place on the morning of the first day. A very few days will show when the fruit is set, as rapid increase of size indicates success. The fruit remains green to within a few days of ripening, when it is suffused with a delicate pink, which gradually changes to a deep scarlet, covered with a delicate bloom. A well-matured fruit is drooping, egg-shaped, and flattened, $3\frac{1}{2}$ inches long and $1\frac{1}{2}$ inch thick, the stalk being inserted at the broad end. It is pulpy, tasteless, filled with numerous seeds about the size of wheat when in a milky state, and of somewhat the same form, which are attached to a broad fleshy lateral placenta which occupies the centre of the fruit.

The fruit is eatable, like that of *P. peltatum*, whose leaves, however, are poisonous and the root a drastic purge; it will hang

* Beautiful specimens of this plant in fruit were exhibited at one of the scientific meetings by Mr. Shortt.

† This and one or two other sentences are borrowed from Hooker and Thomson's 'Flora Indica.'

one or two months. That of *P. peltatum*, which is known in the United States under the name of May Apple, is of a peculiar light green colour, and is intensely acid. It is occasionally used as a substitute for lemon.

No plant that I am acquinted with is more impatient of removal or division than *Podophyllum Emodi*. I was some years before I discovered the cause. On potting some seedling plants two years old, I found only two thread-like roots from two to three feet long, and when these were shortened before repotting, no progress was made by the plant that year. When, however, the roots were unbroken, rapid increase of size took place.

To grow the plant in perfection, it should be planted in good peat and loam in an open but sheltered situation and never disturbed. If moved, it will not bear fruit the following year. It is perfectly hardy, and was introduced in 1845.

XX. On *Chytroglossa*. By H. G. Reichenbach, fil.

On looking back to my past life, there is nothing in it that I value more than the intercourse I have enjoyed with so many distinguished naturalists and travellers. Amongst my most cherished *souvenirs*, I regard the opportunities I have had of seeing my lamented well-wisher and friend Dr. Lindley at four various times of my life. I enjoyed for more than six weeks his company. During the whole of that time I was at work on his collection of dried Orchids, allowed to make copies of all his drawings, and even to take flowers where they could be spared. The fruits of this activity have enabled me to work with great security, knowing pretty well the Lindleyan materials.

When I met with anything remarkable, I always wrote to Dr. Lindley, who, notwithstanding all his numerous occupations, was ever ready to render justice to any Orchid. I remember very well one foggy November morning, when I made an analysis of a most curious Orchid, of which Dr. Lindley possessed a single zigzag raceme with a few pellucid flowers. The plant had been gathered at Novo Friborgo near Rio Janeiro by the Chevalier Pinel, and Mademoiselle Marie Léonie Pinel had prepared for the Doctor a nice coloured sketch. One flower, the best, was sacrificed for an analysis, and Dr. Lindley attended and watched my dissection. I have just now before me my own sketch. There

was no anther, there was no pollinarium, there was no free rostellum to be found, and regarding the plant as a neighbour of *Ornithocephalus*, we wanted a long beak or proboscis as of an elephant. There was, moreover, no stigmatic cavity. At the place where it should have been I noted "foveam non reperio," and at the base of the column I added "in fovea adest mucus."

It was the first Orchid we had ever seen with a very long dorsal sepal and very small lateral ones added to all the deficiencies noted above, and we looked at each other as two companion generals after a lost battle, and for the whole of the remainder of the day Orchids appeared to us less agreeable than they used to do.

It was in the spring of 1862 that Mr. H. Low sent me, amongst other Brazilian Orchids, a little zigzag inflorescence with green buds and green herbaceous glaucous bracts, very remarkable for not being at all scarious. Mr. Low spoke most disrespectfully in his letter of the little thing which I could not recommend sufficiently to his care. Much later I got the expanded lovely flowers, and both Mr. Low and Mr. Day were full of admiration at the pretty little plant. Imagine a few distichous fascicled lanceolate acute leaves two or three inches long, a quarter of an inch broad, with a few thin aërial roots from the base, and a single zigzag glaucous raceme full of green and yellow flowers of an ætherial texture, the base of the column and the lip spotted with purple; the dorsal sepal and the white petals forming a kind of helmet over the column, the obtus-angular retuse toothletted lip excavate and expanded, with a transverse callus at the base, the two lateral sepals very short and spreading at right angles; the anther-bed denticulate, the long caudicle with a toothless process under the pollen masses (toothletted, as observed by Mr. Fitch); the anther beaked, the rostellum slightly prominent, but with no free end, and the stigmatic hollow, indeed, at the base of the column. I described the plant as *Chytroglossa aurata* in the 'Hamburgh Gartenzeitung' of M. Otto, 1863, p. 545.

The species observed in Dr. Lindley's 'Herbarium' I named *C. Marileoniæ*, in just and due acknowledgment of Mademoiselle Marie Léonie's merits as regarded the plant. I distinguished it by its three-lobed lip, and a two-starred callus at its base. Not much later I received it also from Mr. Low, his excellent collector, Mr. Blunt, having gathered it at the same place where it had been first discovered.

There are two very nice representations prepared for this

Journal by Mr. Fitch. All I have to observe respecting them, is that I did not see the two divisions of the callus of the second species so connate as they have been observed by our excellent artist. Had I known of these beautiful drawings, I would not have prepared the far inferior representations of both species for my *Xenia Orchidacea*, tab. 148, from wretched specimens.

I add the Latin technical descriptions and diagnoses, of which a translation by the Editor will be found below.

Chytroglossa, Rchb., fil.

Otto, Hamb. Gartenzeitung, 1863, 545.

Perigonium membranaceum hyalinum. Sepalum superum impar cuneato-oblongum; sepala lateralia ovata duplo breviora. Petala sepalo impari subæqualia. Labellum expansum excavatum basi callosum. Columna clavata androclinio descendente, membranâ cingente humili, foveâ stigmaticâ in imâ basi. Anthera oblongo-spathulata. Pollinia quaterna per paria incumbentia; caudicula linearis triangularis. Glandula minuta.

Chytroglossa, Rchb., fil.

Otto, Hamb. Gartenzeitung, 1863, 545.

Perigonium membranaceous hyaline. Upper sepal unequal, oblong wedge-shaped; lateral sepals ovate, twice as short. Petals equal in length to the upper sepal. Lip expanded, hollowed out, callous at the base. Column clavate, with a descending androclinium, surrounding membrane slight, stigmatic cavity at the base. Anther oblong spoon-shaped. Pollen masses quaternate in pairs, incumbent; caudicle linear triangular. Gland minute.

1. Ch. Marileoniæ, Rchb. fil., Xenia, ii. tab. 148, 11–13; labello cordato trilobo retuso, callis divergentibus duobus clavatis in basi. Folia cuneato-ligulata acuta subbipollicaria. Racemus capillaris fractiflexus pauciflorus. Bracteæ ochreatæ acutæ ovariis pedicellatis subæquales. Sepala apice minute serrulata, lateralia bene acuta. Petala cuneato-oblonga sursum, denticulata. Labelli lobi laterales semiovati, nunc subintegerrimi, nunc denticulati, lobus anticus ligulatus acutus seu retusus, serrulatus apice inflexus. Columna clavata, superne circa antheram denticulata. Flos flavus, labellum maculis duabus magnis sanguineis additis maculis minoribus pluribus. Prope Novam Friburgam Brasiliæ, Marie Leonie Pinel! Blunt! (Tab. 4.)

1. Ch. Marileoniæ, Rchb., fil. Xenia, ii. tab. 148, 11–13: labellum cordate three-lobed, blunt, with two divergent clavate calli at the base. Leaves strap-shaped, somewhat wedge-shaped, acute, about two inches long. Raceme capillary, zigzag, few-flowered. Bractes

sheathing acute, about equal to the pedicellate ovaria. Sepals minutely toothed above, the lateral decidedly acute. Petals oblong somewhat wedge-shaped, toothed above; the lateral lobes of the lip half ovate quite entire or denticulate, the front lobe strap-shaped acute, or blunt, serrulate inflexed at the tip. Column clavate above, denticulate round the anther. Flower yellow, lip marked with two large blood-coloured spots, with numerous specks. Near New Friburg in Brazil, Marie Léonie Pinel! Blunt! (Tab. 4.)

2. Ch. aurata, Rchb. fil., *l. c.* Xenia, ii. tab. 148. i. ii. 1–10: labello cordato-triangulari vix trilobo, callo depresso emarginato in basi. Folia cuneato-ligulata acuta glauca, bipollicaria et ultra. Racemus validior fractiflexus pluriflorus. Bracteæ ochreatæ acutæ, ovariis pedicellatis haud multum breviores. Sepalum dorsale cuneato-ligulatum obtuse acutum nunc parce denticulatum. Sepala lateralia duplo breviora, ovata acuta. Petala spathulata obtuse acuta, denticulata seu fimbriato-denticulata, omnia prasino-hyalina. Labellum flavidum, lobi laterales aurantiaci, maculæ multæ purpureæ. Columna clavata, basi tenuis, apice retrorsum gibba. Androclinii limbus denticulatus. Caudicula flexa. In Brasilia legit Blunt. (Tab. 3.)

2. Ch. aurata, Rchb. fil., *l. c.* Xenia, ii. tab. 148, i. ii. 1–10: lip cordato-triangular, scarcely three-lobed, with a depressed emarginate callus at the base. Leaves strap-shaped, somewhat wedge-shaped, acute, glaucous, two inches long or more. Raceme stouter, zigzag, many-flowered. Bractes sheathing, acute, not much shorter than the pedicellate ovaries. Dorsal sepal strap-shaped, slightly wedge-shaped, with an obtuse point, sometimes sparingly denticulate. Lateral sepals twice as short, ovate, acute. Petals spoon-shaped, with an obtuse point, denticulate or with a denticulate fringe, all of them of a hyaline leek-green. Lip yellowish, lateral lobes orange; spots numerous purple. Column clavate, thin at the base, retrorsely gibbous at the apex. Margin of the anther-bed denticulate. Caudicle bent. Brazil, Blunt. (Tab. 3.)

The type of *Chytroglossa Marileoniæ* and a good specimen of *C. aurata*, accompanied by an interesting letter of J. Bateman, Esq., are to be found in Dr. Lindley's Orchid collection, now happily at the Royal Herbarium at Kew. That the genus is allied to *Ornithocephalus*, Hook., and *Zygostates*, Lindl., probably also to *Phymatidium*, Lindl., every one will feel who is accustomed to look at Orchids. But who will give us the character of the little group? The difficulties of giving mean characters for the groups of Vandeæ are frightful. Happy he who knows little about them. He will retain a gentle hope.

XXI. On Judging New Plants.

By Thos. Moore, Esq., F.L.S. &c.

The laws or rules which regulate the bestowal of awards on new plants, intuitively familiar as they are to those who have had experience in their application, are for the most part unwritten, and hence unknown and unappreciated by a great majority of those who nevertheless take an interest in the exhibition of this class of subjects. That they are unwritten, is no doubt mainly owing to the infinite variety of subjects which in these days is comprised under the term new plants, in consequence of which it becomes necessary that special rules should be devised for each kind of plant, if we would define exactly the characteristics which should be presented, in order that it may appear in the much desired form which constitutes ideal perfection.

The more popular and commonly cultivated flowers, however, especially the class known as florists' flowers, are not in this position. Being comparatively few in number, and having long engaged the attention of growers, there have been framed for many, if not for most of them, certain intelligible rules by which those who have the knowledge necessary to apply them can ascertain with ease how near respectively they approach the standard of perfection which has been set up. These rules are printed in a shilling volume, entitled 'Glenny's Properties of Flowers,' and are received with little question as floral law in respect to the features which constitute perfection in the particular flowers to which they apply.

Notwithstanding, however, that the points which in these cases make up this idea of perfection are very carefully, and in most cases very judiciously, laid down in the book to which reference has just been made, there has, I believe, been no attempt made to work out the comparative merits of plants and flowers—whether it be the relative merits of the different varieties of the same flower as compared amongst themselves, or whether it be the intrinsic merits of individual species as compared with any standard that may be set up—by assigning marks in proportion to a given scale for the separate features of merit they present, so that the total number of marks gained should indicate absolute merit. And yet this is obviously the only exact way of arriving at a correct estimate of the true merit of each.

It is something of this kind—some general scheme for judging plants and flowers by means of the points which can fairly be

scored in their favour, according to a fixed scale of numbers—which I have been requested in the present paper to sketch out for the information of the uninitiated in the mysteries of floriculture, so that they may gain at least some faint idea of the grounds upon which especial honours are assigned to particular subjects. They can perhaps hardly be applied in practice, since the practical man—that is, the official judge—necessarily adopts a more rapid estimate of merit; but they are, in the main, the principles on which his more rapid judgment is based.

The object of the grower is to secure in the new plant or flower which is accepted as meritorious, the greatest amount of good qualities, represented by its beauty and utility as an object of ornament; and this mode of judging by the aid of numerical points must show exactly how far such qualities are or are not possessed. The subject can, indeed, be sketched out here only in a very general way, and in general terms, being far too comprehensive to be dealt with in detail within the limits of a brief paper like the present.

Assuming, then, the desirableness of regulating awards upon the principle now indicated, it is proposed to regard the highest state of excellence in a flower or plant, that is to say, IDEAL PERFECTION, as being represented by 100 marks. This somewhat high number is taken because, as it admits more readily of subdivision than a smaller one, a more exact result is obtained by its use.

What, then, are the particular features most to be desired in an ornamental plant? This is the first question that arises, and being answered, it gives rise to another: What is the particular value in parts of 100 that should be assigned to the several features of merit met with in the subjects under judgment? These two questions have to be regarded in their application to the three classes of—

I. FLOWERING PLANTS.
II. FOLIAGE PLANTS.
III. FLORISTS' FLOWERS.

It should here be observed, by way of parenthesis, that Stove plants, Greenhouse plants, and Hardy plants, require to be judged independently of each other. Stove plants must be viewed as stove plants, and greenhouse and hardy plants as such. At first sight it might appear as though hardy plants stood at an advantage, inasmuch as it might be said (and said very truly), that they are suited to the means of a larger number of persons than hot-

house plants, owing to the more costly nature of the conditions necessary to the successful production of the latter, while to some cultivators, who cannot command costly appliances, they will, of course, be all in all. But, on the whole, the several classes may be placed on an equality so far as concerns the judgment of their merits; for whilst an advantage must be admitted to accrue in the case of the hardier subject, on the ground of its more general applicability, an advantage must certainly be accorded in the other case on the ground of intrinsic value. Hence may be deduced this rule, that plants of the several classes, denominated stove, greenhouse, and hardy, should be compared only among themseves. This idea of limitation may indeed be carried further, for Annuals, Perennials, and Shrubs or Trees should in the same way only be compared amongst themselves. Deciduous plants and Evergreens can only be fairly compared with plants of corresponding character; and the same may also be said in reference to plants of any specially marked group, such as Agaves or Orchids.

Further than this, plants adapted for blooming in the Winter, or Spring, or Summer, or Autumn seasons, must be viewed as flowers of those particular seasons, and must not be rigidly compared except with those of their own season, because, in order to avoid a scarcity of flowers at any period of the year, it is necessary to cultivate those of every season. A plant may thus be valued and really valuable on account of its blooming in winter, which would be regarded as comparatively worthless in summer, for the mere fact of producing blossoms during winter is sufficient to outweigh a multitude of minor defects. Hence may be deduced another conclusion, namely, that the rules by which a plant is judged must be relaxed in inverse proportion to the supply of flowers obtainable at the particular season in which it blooms. These general considerations must be allowed their full force in applying any set of rules for the determination of the merits of plants.

I. Flowering Plants.

The features which appear to be most desirable in a plant cultivated for the sake of its flowers, as a decorative object, that is to say, in an ornamental flowering plant viewed as a whole, may be grouped under these principal heads:—

1. *Free and Symmetrical Habit of Growth.*—It is necessary that a plant, whether it be slender or robust, should be free in the development of its parts, and at the same time should present some-

thing like regularity in its development, so far as that can be realized in conjunction with its natural habit. The plant should neither be of a stubborn character; nor must it be of a delicate constitution, such as gardeners call "miffy." In a general way it should be compact and bushy, or at least, so far as is compatible with its natural character, the opposite of straggling and lanky in its mode of growth. Sometimes, it is true, a bad habit may be overcome by the skill of the cultivator, but it is better that a good habit should be inherent. Even in a climber open long-jointed growth is not desirable.

2. *Profusion of Flowers well displayed.*—There should not only be an abundance of flowers produced, but they should be so disposed as to be effective; that is, they must not be hidden amongst the foliage, nor, if their beauty depends upon a view of their face, must they hang about loosely so that the face cannot be seen. If they are pendent, it should be with natural grace. They should not be crowded by foliage, nor crushed among themselves by being over numerous or disadvantageously set on.

3. *Healthy Leaf-development.*—No plant can be really beautiful which has not well-grown and well-coloured healthy foliage; but the leaves should generally be subdued in comparison with the flowers, and must not be disproportionately large or numerous. If the foliage is handsome, it is all the better, but it *must* be healthy and wholesome-looking.

4. *Bright, pure, dense, or pleasingly-contrasted Colours.*—All dull dingy colours stamp a flower with inferiority, though they may sometimes be permitted as curiosities, especially if the flower is of some very remarkable form.

5. *Form and Substance of Flowers and Endurance.*—Unless flowers put on some of the best forms, which their particular type may be capable of yielding, and are stout and durable in texture, they neither present the highest beauty of which they are capable, nor do their beauties of whatever order continue. Flimsy flowers soon perish, and are hence much inferior to those of stout enduring substance.

6. *Succession of Bloom.*—It is a greater merit, to produce a succession of blossoms in order that the blooming season may be prolonged, provided they are not thereby rendered scanty and scattered, than to give a flush of flowers, the beauty of which is fleeting, and then not to bloom again for a considerable season. Next in merit to a plentiful succession of flowers, comes a good head of bloom; and those plants are of the least merit which only bear a few scattered blossoms at long intervals of time.

7. *Grateful Odour.*—This is a great advantage, and must have its full weight in every award.

8. *Distinctness.*—If it were not for the development of this characteristic, our flowers would lack half the charms they now have owing to the almost endless variety they present; and hence this feature of distinctness should be made a *sine quâ non.* A new flower which shows distinctness has at least one prominent merit.

9. *Size of Flowers* is an advantage, all other points being equal; but size is apt to degenerate into coarseness, and hence it is not a feature to be too highly estimated.

10. *Novelty.*—A decidedly new character is worth recognition in the absence of any other merit; for if the plant presenting it does not in other respects give us exactly what we desire, the new feature, if at all a promising one, is to be valued as the first step towards obtaining a new race; and to produce a new race is equivalent to the addition of a new province to the kingdom of Flora. When, moreover, it is made an aim to develope, in connexion with the novel character, the elements of beauty or utility, in which it may be deficient, this aim will in almost all cases be sooner or later realized, such is the plasticity of vegetable development.

To these several features, then, may be assigned the marks in the following ratio, it being understood that 100 marks represent the highest degree of excellence, and that any lesser number will indicate the degree in which good qualities may be possessed below the point of perfection. Practically, therefore, those plants which had gained 75 marks or upwards, would be held to be 1st class in merit; those which had gained over 50 up to 75 would be 2nd class; and those which had gained only from 30 to 50 would be 3rd class. The full number assigned to each meritorous feature is only to be awarded to the perfect condition of that feature, and any lesser number according to the lower degree of merit shown in that particular feature. The marks or points awarded in the case of the highest merit are—

	Points.
1. Freeness of habit	15
2. Profuseness and display of flowers	15
3. Healthiness of leaf-development	15
4. Purity, brightness, or contrast of colour	10
5. Endurance, substance, and form of flowers	10
6. Succession of bloom	10

	Points.
7. Gratefulness of odour in leaves or flowers	10
8. Distinctness of character	5
9. Size of flower	5
10. Novelty of a decided kind	5

Glaring defects amongst ornamental flowering plants would be presented by the undermentioned peculiarites, each of which should reduce the award by 10 :—

Straggling habit.
Flimsy flowers.
Muddled or dingy or fleeting colours.
Fetid odour.

II. Foliage Plants.

The most desirable features to be sought after, in plants grown for the sake of their foliage—in many points the same as those in flowering plants—appear to come under the following heads :—

1. *Free and Symmetrical Habit of Growth.*—This feature is even more essential here than in the case of flowering plants, as great part of the beauty of the specimen depends on its presence.

2. *Healthy Leaf-development.*—The foregoing remark is equally applicable under this head.

3. *Gracefulness or Nobility of Aspect.*—Most of the plants grown for foliage alone are prized on account of one or other of of these peculiarities of aspect. Hence a common-looking plant which does not possess either, and does not yield showy flowers, as a compensation, must be held to possess little merit from the floricultural point of view, however curious or interesting it may be in other respects.

4. *Endurance of Foliage.*—When the beauty of the plant depends on the appearance presented by the foliage, it is obvious that the more enduring the character of the foliage, the longer will the plant retain its beauty. Hence endurance in the foliage becomes a very important quality. A deciduous plant is on this ground less valuable *per se* than an evergreen, although it may be good in its way, or in its season. But, then, evergreens and deciduous plants, as already intimated, are not strictly comparable.

5. *Distinctness.*—When the beauty of a plant has to be sought in its leafage alone, there is much less scope for variety than when flowers are superadded ; but it becomes all the more essential to

avoid the sameness of aspect which must prevail, if distinctness of character is not made a *sine quâ non.*

6. *Pleasing and Well-marked Colour.*—The leaf, that is to say, should, if green, be of a good pleasant healthy-looking green, and if of any other colour, it should be of some decided and agreeable tint or tone.

7. *Well-defined Colours or Markings.*—This is an essential part of beauty in the case of variegated leaves, and variegation is a condition commonly presented by what are called ornamental foliage plants. A cloudy intermixture of colours in leaves (indeed in flowers) is seldom or never effective.

8. *Novelty of Character.*—Though only to be valued as the stepping stone to the production of new races, as in the case of flowering plants, yet when combined with other elements of beauty, or as indicating features which may be improved upon and worked up to greater perfection, this is a property much to be desired. These several features may be formulated thus, as regards their highest degree of development:—

	Points.
1. Freeness of habit	15
2. Healthiness of leaf-development	15
3. Gracefulness or nobility of aspect	15
4. Endurance of foliage	15
5. Distinctness of character	15
6. Agreeableness of colouring	10
7. Definition in markings	10
8. Novelty	5

As glaring defects which may occur in this class of plants, may be mentioned the following pecularities, each of which should reduce the award by 10:—

Straggling habit.
Flimsy, tender, rapidly-perishing leaves.
Indistinct or fleeting colours or markings.

III. Florist's Flowers.

Though various in character these admit of more ready and exact comparison than the two preceding classes; for the number of organs to be adjudicated on are fewer, and hence the requisite features admit of more exact comparison and definition. This definition has been worked out, and on the whole well worked out, in the little book already referred to; but this does not adopt the

plan of assigning to each quality a numerical value. The features to be specially sought, and their relative value, are these:—

1. *Form.*—In most single flowers this should be circular, or, where this will not apply, symmetrical. In double flowers there should be a semiglobular outline. Compound flowers follow the same law as double flowers. Tubular flowers and some others of peculiar form offer exceptions, which can only be dealt with individually.

2. *Substance.*—This must be dense if the flower is to be durable, for if flimsy in texture the blossom soon gives way both as to form and colour.

3. *Smoothness and Flatness of Edge and Surface.*—These qualities are necessary to give refinement. In some cases, but not often, a well-developed fringe or frill is admissible.

4. *Colour.*—This must be bright or pure and decided in self-flowers (that is flowers of one colour); and well-defined and well-contrasted in striped or laced flowers.

5. *Fixity of Colour* is a quality of some importance, and depends partly, but not wholly, on the texture or substance of the corolla.

6. *Proportion of Parts to the Whole* is an essential element of beauty, but must be defined individually in the different kinds of flowers.

7. *Size* is an advantage so that it is not disproportionate nor conducive to coarseness, but it is very apt to degenerate into coarseness.

8. *Distinctness* is absolutely necessary for the sake of variety.

9. *Novelty* is a quality always welcome, as it enlarges the field of floriculture; but it is not a mere variation but a decided difference of form or feature which is comprehended under this head. The merit of novelty, however, must always be estimated subject to the higher qualities of form, substance, smoothness, proportion, &c.

These qualities may bear the numerical ratio indicated below:—

	Points.
1. Form	15
2. Substance	15
3. Smoothness	15
4. Colour	10
5. Fixity of colour	10
6. Proportion	10
7. Size	10
8. Distinctness	10
9. Novelty	5

The most glaring faults in this class of subjects are to be found in the following features, which are in most cases altogether incompatible with a high position:—

Open eyes, as they are called, when double flowers show any part of the disk or centre.
Split petals or florets.
Run or confused or fading colours.
Roughness of outline or surface.

XXII. Notice of De Bary's Observations on the supposed connexion of *Puccinia graminis* and *Æcidium Berberidis**. By the Rev. M. J. Berkeley, M.A., F.L.S.

The prevalent notion of a connexion between the barberry-bush and wheat-mildew, has hitherto rested on no scientific foundation. It arose probably from observation that both the shrub and the cereal were subject to rust, without any exact notion as to the nature or structure of either. It was, however, very improbable that the rust of the barberry was productive of mildew, as the latter is often extremely prevalent where not a single barberry-bush is to be found; and since the districts, for example, the Fens, most subject to mildew are precisely those where the barberry is unknown in a wild state, and where it is not very frequently found in gardens. The question is precisely like that of the supposed origin of the pear-mildew (*Rœstelia cancellata*) from the gelatinous fungus of *Savine*, as the *Rœstelia* abounds frequently in parishes where *Savine* is carefully excluded on account of the dangerous use to which it is put by low herb-vendors.

Recent observations, however, put the matter in quite a new light, and we are therefore happy to give an abstract of De Bary's paper, the subject being one of great interest, whether we regard it from an agricultural or horticultural point of view. The experience of the potato-murrain, the vine-, hop-, peach-, and rose-mildew, as well as other matters less connected with cultivation, lead us to expect that parasitic fungi should present a variety of modes of reproduction, and should assume occasionally very different forms; and this is no less true of fungi which produce the

* Monatsbericht der Königlichen Preuss. Akademie der Wissenschaften zu Berlin, Jan. 1865, p. 15, tab. 1.

rusts and mildews of cereals and other plants which are known to botanists under the names of *Uredo*, *Puccinia*, *Æcidium*, and a host of allied genera; but we have now, in addition, reason to believe that the same species may, at different periods of growth, require a different matrix, after the fashion of many parasitic Invertebrata.

It is not possible to give the whole of De Bary's introductory observations. The following seem, however, necessary to the proper appreciation of his argument.

Some of the allied parasites which have been the subject of his experiments, as *Uromyces appendiculatus*, Lk., *U. phaseolorum*, Tul., and *Puccinia Tragopogonis*, Cd., possess five kinds of reproductive organs. Towards the end of the year shortly stipitate spores appear on their stroma, which do not fall off. These spores, which do not germinate till after a shorter or longer winter rest, may conveniently be called resting-spores, or, as De Bary calls them, *teleutospores*, being the last which are produced. These at length germinate, become articulated, and produce ovate or kidney-shaped spores, which in their turn germinate, penetrating the cuticle of the mother-plant, avoiding the stomates or apertures by which it breathes. After about two or three weeks the mycelium, which has ramified among the tissues, produces an *Æcidium* with its constant companion spermagonia,—distinct cysts, that is, from which a quantity of minute bodies ooze out, often in the form of a tendril, the function of which is imperfectly known at present, but which, from analogy, we regard as a form of fruit, though it is just possible that they may be rather of the nature of spermatozoids. The *Æcidia* contain within a cellular membranous sac a fructifying disk which produces necklaces of spores, which ultimately separate from each other in the form of a granular powder. The grains of which it is composed germinate in their turn, no longer avoiding the stomates as before, but penetrating through their aperture into the parenchym. The new resultant mycelium, reproduces the *Uredo* or fifth form of fructification, and the *Uredo*-spores fall off like those of the *Æcidium*, and in respect of germination and mode of penetration present precisely the same phenomena. The disk which has produced the *Uredo*-spores now gives rise to the resting-spores, and so the cycle is complete.

We are not, however, to expect in every case precisely the same cycle, though it seems not to be an uncommon one, and in the case before us, the whole evolution has not been carried out. In some cases certainly there is no intermediate *Æcidium*, and in

many, apparently, the *Æcidium* is produced on the same matrix as the perfect parasite.

Puccinia graminis, then, or true wheat-mildew, produces two different kinds of spores from the same disk. Of these the first, whose connexion with *Puccinia* was first pointed out by Professor Henslow, are orange-coloured, unicellular, and echinulate, and are capable of germination as soon as they are mature, but become effete after a few weeks. Their germinating-threads enter the stomates of the leaves and produce in a few days fresh disks, covered with spores of the same kind.

The other spores, produced at a later period, which are septate, do not vegetate till they have had a longer or shorter winter's rest. The germinating-threads of the secondary spores, which are produced on their promycelium, will not, however, penetrate the epidermis of the mother-plant which gave rise to the resting-spores. When sown on *Triticum repens*, *T. vulgare*, and *Avena sativa* they behaved themselves exactly as if they had been sown on glass. It became probable therefore that they required some other plant as a matrix for their growth, and that they produced on this an *Æcidium* after the analogy of some other species. This supposition was corroborated by the fact that *Æcidia* occur on many plants which resemble in every respect those which belong to the cycle of development of *Puccinia*, except that they are not accompanied by the two kinds of spores mentioned above, or that Puccinoid-spores do not occur on the same mother-plant with the *Æcidium*. These conditions concur in *Æcidium Berberidis*, Gmel., and the prevalent notions of its connexion with wheat-mildew suggested the necessity of experiments.

Our author determined therefore to sow the spores of *Puccinia graminis* on the leaves of the barberry. For this purpose he selected the septate resting-spores from *Poa pratensis* and *Triticum repens*. Having caused the spores to germinate in a moist atmosphere, he placed fragments of the leaves on which they had developed their secondary spores on young but full-grown barberry-leaves under the same atmospheric conditions. In from twenty-four to forty-eight hours a quantity of the germinating-threads had bored through the walls, and penetrated amongst the subjacent cells. This took place both on the upper and under surface of the leaves. Since in former experiments it appeared that the spores would penetrate only in those cases where the plant was adapted to develope the parasite, the connexion between *P. graminis* and *Æ. Berberidis* seemed more than ever probable.

In a first series of experiments, seven leaves were used on the 31st of May. On the 9th of June numerous yellow spots appeared on five of the leaves, which under the microscope were found to be filled with spermogonia exactly as in the common *Æcidium Berberidis*. Two days later they were studded with numerous spermogonia.

Four summer shoots from a tree which had a few scattered *Æcidium* pustules were attended with precisely the same results. For comparison, a number of healthy leaves quite free from *Æcidium* were taken and no *Puccinia*-spores applied, and not the slightest trace of spermagonia appeared.

After a time the cut leaves always began to decay, so that the fungus never got beyond the spermagonoid stage. Some three years old unbranched seedlings were therefore taken, and the germinating resting-spores applied as before. The plants were kept under a bell-glass from twenty-four to forty-eight hours, and then exposed to the air like other plants. From the sixth to the tenth day yellow spots appeared with single spermagonia; from the ninth to the twelfth, spermagonia appeared in numbers on either surface, and a few days later on the under surface of the leaves; the cylindrical sporangia of the *Æcidium* made their appearance exactly as in the normally developed parasite, except that they were longer from being protected from external agents. The younger the leaves, the more rapid was the development of the parasite, and sometimes in the younger leaves the luxuriance was far greater than in free nature. Similar plants, to the number of 200, were observed in the nursery, and though some of them had *Æcidium*-pustules not one fresh pustule was produced; while two placed under similar circumstances, but without the application of any resting-spores, remained all the summer free from *Æcidium*.

It seems, then, indubitable so far that *Æcidium Berberidis* does spring from the spores of *Puccinia graminis*.

It is, however, to be remarked that our author has not been equally successful in producing the *Puccinia* from the spores of the *Æcidium*. In many cases the spores do not germinate when placed on glass, and they do not preserve their power of germinating at all very long. He reverts, therefore, to the evidence of experiments instituted by agriculturists. Bönninghausen remarked, in 1818, that wheat, rye, and barley which were sown in the neighbourhood of a barberry bush covered with *Æcidium* contracted rust immediately after the maturation of the spores of the

Æcidia. The rust was most abundant where the wind carried the spores. The following year the same observations were repeated; the spores of the *Æcidium* were collected, and applied to some healthy plants of rye. After five or six days these plants were affected with rust, while the remainder of the crop was sound.

In 1863 some winter rye was sown round a barberry-bush which in the following year was infested with *Æcidium,* which was mature in the middle of May, when the rye was completely covered with rust. The first traces appeared on the 26th. Of the wild grasses near the bush, it was the twitch (*Triticum repens*) which was the most affected. The distant plants of rye were free from rust.

The spores of the *Æcidium* would not germinate on barberry-leaves; the barberry *Æcidium* could not therefore spring from some previous *Æcidium.* The *Uredo*-spores of *Puccinia graminis* on germinating penetrate into the parenchym of the grass on which they are sown; but on barberry-leaves, if the tips of the threads enter for a short distance into the stomates, their growth at once ceases and the leaves remain free from parasites.

The resting-spores of *Puccinia graminis,* when applied to leaves of *Rhamnus frangula* and *Rhamnus cathartica,* do not penetrate the parenchym nor produce any parasite, therefore its *Æcidium* cannot be a member of its cycle; but whether it is connected with the *Æcidia* of other plants, as that of the nettle, is at present matter of doubt.

Montagne has, however, described a *Puccinia Berberidis,* on leaves of *Berberis glauca* from Chili, which grows in company with *Æcidium Berberidis.* This at first sight seems to contradict the above conclusions; but the *Æcidium* which from the same disk produces the Puccinoid resting-spores, appears to be different from the European species, inasmuch as the cells of the wall of the sporangium are twice as large and the spores decidedly of greater diameter*. The resting-spores, moreover, differ not only from those of *Puccinia graminis,* but from those of all other European species.

It does not seem necessary to go into that part of the memoir which relates to the history of the supposed connexion between the two parasites. De Bary, however, seems not to be acquainted with the remarkable memoir of Professor Henslow, in which he

* It is very doubtful whether these characters are of any real importance. The size may vary in plants growing on different individuals.—Ed.

pointed out the identity of rust and mildew, at a time, be it observed, when the accurate study of these parasites was in its infancy, and when people were inclined, with Unger, Fries, and others, to regard them as mere growths from the cellular tissue, and not as distinct specific organisms.

A very important point in De Bary's memoir is the distinction which he draws between *Puccinia graminis* and *Puccinia straminis*, because the latter is more especially addicted to wheat than the former; and should it be found on further experiment that its winter spores do not produce the *Æcidium* on barberry-leaves, many of the anomalous cases will at once receive a good explanation. The *Uredo*, or rust of *P. graminis*, is much later in its appearance than that of *P. straminis*, the latter frequently occurring in spring, while the former does not appear till the end of May or June, and sometimes later. The *Uredo*-spores of *P. graminis* are oblong, with four pores for the exit of the germinating-threads; those of *P. straminis* nearly globose, with six pores. Moreover, the resting-spores of the latter are not contained in the same sorus with the rust-spores, but in especial sori covered with the cuticle. They are in general clavate, the lower division longer than the upper; they are close pressed to each other, and in consequence have many sharp angles. Their peduncle is always shorter, and often much shorter than one of the divisions. The margin of the sorus bears a number of light brown prismatic paraphyses, and a few are scattered over the disk. In *Puccinia graminis* the divisions of the spores are nearly equal, and the upper division blunt, while the whole is free from angles.

These distinctions require a very careful reexamination, and it is much to be wished that our author should complete his very useful experiments, by trying whether the winter spores of *P. straminis*, like those of *P. graminis*, are capable of developing the *Æcidium* on the barberry.

There are many other points of interest in the memoir, but rather of a botanical than horticultural interest, though something like just views as to the real nature of these parasites is absolutely necessary to the cultivator.

XXIII. On the Nutritive Constituents of Water. By Professor SCHULZ-SCHULTZENSTEIN *.

[THE memoir, of which the present translation forms a second part, is entitled "On the Nutritive Properties of Water and Artificial Irrigation in Horticulture and Agriculture." A short abstract was given in the 'Gardener's Chronicle,' January 1854, but the views it entertains are so important, that a translation of the whole can scarcely be unacceptable to the Society.]

In the first division of this treatise (Tr. Pruss. Hort. Soc., vol. xx. part 2. p. 354), I have spoken historically of irrigation as practised in the culture of plants, and have shown, from the historical facts of cultivation, in contradiction to the theory of their nourishment by means of carbonic acid derived from the air (as first stated by Ingenhousz, in his treatise "On the Nourishment of Plants and Fertility of the Soil," and afterwards by Senebier in his 'Physiologie Végétale,' by Th. de Saussure in his 'Recherches Chimiques sur la Végétation,' and recently reproduced by our countryman Liebig, in opposition to the notion of the nourishment of plants being derived from the soil), that the nutritive constituents are for the most part dissolved in water, that water is the only vehicle of nutriment, and that the theory of nourishment by means of air is in the most decided opposition to all practical experience in horticulture and agriculture, and more especially to the effects of manure on growth. I now purpose to show that the nutritious constituents of plants are separated from the soil by means of water, and that the water contained in the soil, and that of springs and wells, is loaded not merely with saline, but more especially with the humous elements of the ground, and that the humous organic constituents dissolved in water furnish the true nutriment. Liebig promulgated the notion that the waters of springs and wells contain no organic constituents, or, at least, none worth mentioning, and adduced the Selter-water as a proof, which, like many waters springing from deeper primitive formations, seldom contains humous or bituminous matter in solution; but the consequent conclusion that all other spring- and pump-

* Translated from the German in vol. xxi. part 34 of the Transactions of the Horticultural Society of the Prussian States.

This translation was prepared in part some years since by the editor, at the request of Dr. Lindley, for the former series of the Journal of the Horticultural Society of London, but was not published in consequence of its discontinuance. It is to be expressly understood that the translator is not responsible for any of the opinions expressed, much less for the occasionally somewhat severe criticisms.

waters are void of organic constituents is quite erroneous. This appears from a comparison of the different chemical analyses which we possess of the waters of numerous medical springs and baths, in which, besides the saline constituents, there are also organic constituents of a more or less decided humous character, which, for the most part, are reckoned under the name of extractive matter.

The waters of Wiesbaden, for instance, contain, according to Richter, 1·75 gr. of organic extract in the pound; those of Hermansbad, near Moscow, according to Hermbstaedt, 1·5 gr.; those of Seidschütz, according to Steinmann, 0·35–0·42 gr. of humous extract; those of Wildbad, in Baireuth, 0·6 gr. of extractive matter, according to Martius; those of Kreuth and Tegernnsee, in Bavaria, $\frac{1}{4}$ gr. of *humus* in the quart, according to Vogel; those of Beringerbad, in the lower Hartz, 0·5 gr. of extractive matter in the pound, according to Bley; those of Bocklet, near Würzburg, $\frac{2}{3}$ gr. of humous extract per pound, according to Goldwitz. In many bath-waters there is contained a nitrogenous extractive matter (an animali-vegetable substance, crenic acid of Berzelius). For instance, the waters of Schmekwitz, in Bautzen, contain 6·5 gr. of nitrogenous extractive matter, 10·8 gr. of saponaceous matter, 1·3 gr. extractive matter in 30 lbs., according to Ficinus; those of Châteauneuf, in Puy de Dome, and Enghien, near Montmorency, contain, according to Fremy, 0·3 gr. per pound of animali-vegetable matter. The glairine (Zoogen, Gimb.) a gelatinous matter in the sulphur-springs of Barèges, in the Pyrenees, is, according to Anglade, of a similar character, and is so abundant in the sulphur-springs at Aachen and Burtscheid, according to Mohnheim, that the daily produce amounts to about 1000 lbs. A similar organic substance is left after the evaporation of the spray of the Karlsbad water on the margin of the spring, and affords a matrix for the development of the vast masses of *Oscillatoriæ* which are found there. The mother-lye of the water of the Baltic, contains, according to Pfaff, two kinds of extractive matter; and in many other waters, as in those at Northeim, near Göttingen, according to Wurzer, and at Warmbrunn, in Silesia, according to Tschörtner, there is resinous and gummy extractive matter. The Berlin spring-waters contain from $\frac{3}{4}$ to $1\frac{1}{2}$ gr. of humous extract per quart. All these waters, therefore, when kept are subject to more or less rapid decomposition, and give rise to Infusorial and Conferval organisms.

Now, since all river-water is derived from springs, it is clear that

it must be rich in humous and extractive matter. As regards the quantity of *humus* in river-water, we have at present only very confined observations; but little attention was given to the subject so long as the important agency of the quantity of *humus* contained in water upon vegetation was unknown. It is, however, sometimes so great, that it communicates a yellow, or in great depths a coffee-coloured, or even dark-brown tint. The black streams first attracted attention in America, where the Rio Negro, or Black River, derived its name from the dark colour of the water, as also many tributaries of the Orinoko. The Atapabo, Guiainia, and Tuamini are of a dark coffee-brown. Lyell states, in his 'Travels in North America,' that in the vast swamps in the narrow atlantic plain of North America, especially in the Great Dismal between Norfolk and Welden (between Virginia and North Carolina), there is a lake seven miles long and five wide whose waters are of a dark brown from the dissolved *humus*.

The "blackwaters" (Karassu) which are often found on the mountains of the East, derive their name equally from the brown or black colour of their waters in consequence of the dissolved *humus*.

Very recently, Junghuhn, in his travels in Sumatra, directed his attention to the "blackwaters." He says, "The mountain-streams of the Batta land of Sumatra, especially on the tableland of the provinces of Sieperok and Tobah, have a coffee-brown tint. In the beds of the river shaded by forests, their water appears very dark, but of a golden-yellow in a transparent glass. This tint is universal in the interior of Sumatra; but it is most striking in the high tableland, where the slight inclination of the surface in the dark primeval forests gives rise to frequent inundations, and where, besides the vegetable substances which rot upon the moory ground, a quantity of root-threads are irrigated with water, which, impregnated with the extractive matter which enters into their composition, forms a kind of cold infusion. The water may nevertheless be drunk without injury, and is void either of taste or smell." ('Travels in the Batta Land of Sumatra,' i. p. 256.)

It is rather surprising that the dark waters of Europe should hitherto have been almost entirely overlooked, notwithstanding their appearance in almost every river which runs down from the Hartz, especially the Brocken. The water of Ilse, near Ilsenburg, is at some deeper parts of the river almost coffee-brown. If we follow the river towards the heights of the Brocken, we remark that almost

all its sources are derived from dark peat-moors, from which the water streams coloured brown from their dissolved humous constituents. The same is the case with the other rivers of the Upper Hartz, especially on the north side of the Brocken. Almost all the fresh-water lakes of the marsh districts of Northern Germany are black from humous matter.

I have endeavoured by means of evaporation to ascertain the quantity of *humus* in different German river-waters. Four pounds and a half of that of the Spree yielded, on evaporation, 4 grs. of solid residuum, of which three consisted of salts, the other of a humous extract. The Spree water is, for the most part, not entirely colourless, but has a yellowish tint; on evaporation it acquires a brown tint as it becomes more concentrated. Every pound of it contains $\frac{2}{9}$ gr. of humous extract; a cubic foot, therefore, or 66 lbs., contains $14\frac{2}{3}$ grs. According to observations made at the Berlin Mills, 576 cubic feet pass every second at low flood, 2016 at high flood, the mean of which is 1296.

At low flood, then, there are 2,072,600 cubic feet per hour, or 49,766,400 cubic feet per day, or in weight 29,859,840 cwt. This, then, contains $49{,}766{,}400 \times 14\frac{2}{3} = 729{,}907{,}200$ grs. or 422 cwt. 100 lbs. of humous extract, which quantity passes through Berlin on its way to the sea.

The turbid water of the Elbe, collected at Magdeburg in August 1851, became clear when allowed to settle, with a very slight yellow tint. Four pounds of this evaporated to a coffee-brown fluid; and this, when freed from the sediment of salts of lime and silicates, yielded $6\frac{1}{2}$ grs. of humous extract, free from water. The Elbe water is therefore far richer in *humus* than that of the Spree—the richest, indeed, of all which I have examined, although it is by no means so deeply coloured as the Hartz water. It contains more than $1\frac{1}{2}$ gr. of humous extract per pound, which in the cubic foot amounts to $107\frac{1}{2}$ grs. If we assume that 4000 cubic feet per second pass by Magdeburg to the sea, which is double that of the high flood of the Spree, we have for the twenty-four hours 14,400,000 cubic feet, and this will supply daily, if 100 grs. of *humus* only be reckoned to the cubic foot, about 1798 cwt. of extractive matter which can be appropriated to the nourishment of plants. We see then how rich the waters are in nutriment.

The water of the Ilse, at Ilsenburg, collected in August 1851, gave, after the evaporation of 4 lbs., 2 grs. of humous extract, which is $\frac{1}{2}$ gr. per pound.

The water of the neighbouring Ecker, which is browner than that of the Ilse, in 4 lbs. yielded $2\frac{1}{2}$ grs. of very dark humous extract.

Two quarts of water of the black Elster, collected at Herzberg, gave, after evaporation, a treacle-brown fluid, which, reduced to perfect dryness, gave $\frac{3}{4}$ gr. of saltpetre and $2\frac{1}{8}$ grs. of humous extract.

The Rhine, at Basle, passes 13,000 cubic feet of water per second (which, reckoning $\frac{1}{2}$ gr. of *humus* to the pound, contain 56 lbs.), 3360 lbs. per minute, 1832 cwt. per hour, and 43,968 cwt. per day.

The Ganges, above its bifurcation at the Delta, near Sicligully, passes in April, according to Prinsep, 21,500 cubic feet per second; at Benares 20,000. If there is only $\frac{1}{2}$ gr. of humous extract per pound, or 33 grs. per cubic foot, we shall have

$$33 \times 20{,}000 = 660{,}000 \text{ grs.} = 85 \text{ lbs. of } \textit{humus},—$$

5100 lbs. per minute, 306,000 lbs. per hour, and 66,764 cwt. per day.

The Indus, according to Prinsep, sends out at its bifurcation at Tatta 80,000 cubic feet per second—that is, four times as much as the Ganges, which yields 267,056 cwt. of *humus* per day, if the water has only the sixth part of the nutritious matter contained in the water of the Elbe.

The Mississippi, in the rainy season, passes 550,000 cubic feet per second—that is, nearly eight times as much as the Indus; and supposing the same proportion of *humus*, it sends daily to the sea 2,136,000 cwt. of *humus*.

Since *humus* contains every constituent necessary for the sustenance of plants—carbon, hydrogen, oxygen, nitrogen—the possibility of their nutriment by means of the *humus* held in solution by the water contained in the soil and streams is proved. We must, however, first examine the other views which have been held respecting the agency of water in the nutriment of plants.

Liebig and the more modern chemical physiologists regard vegetable matters as hydrated carbons in which water is condensed and combined with the carbon of the carbonic acid which has been received as nutriment. In this case the hydrogen and oxygen must exist in all vegetable constituent parts in precisely the same proportions in which they are found in water. This is allowed by Liebig and many other chemists, since they find in sugar and lignine nearly the proportions of hydrogen and oxygen

which exist in water (eight times the weight of oxygen), so that they may be regarded as hydrated carbons. These assumptions, however, by no means accord with the very perfect modern analyses of starch, sugar, flax, and cotton, by Prout, Herrmann, Henry, and Ure, since all these substances show a greater or less excess of oxygen above hydrogen. Wheat-starch, according to Prout, contains 44 C, 49·42 O, and 6·18 H, being an excess of 0·2 of oxygen*. Potato-starch, according to Hermann, contains 37·6 C, 55·76 O, 6·64 H, or 2·64 excess of oxygen over the constituents of water. Cotton-wool contains, according to Ure, 42·11 C, 52·83 O, and 5·06 H, or an excess of 12·35 O, which cannot be taken into the plant by the condensation of water.

In all other component parts of vegetables the elementary matters differ most decidedly from the proportions of oxygen and hydrogen in water, so that their origin from the condensation of water or the formation of hydrates seems quite impossible.

These vegetable matters may conveniently be divided into three sections.

1. Matters which contain a great excess of oxygen as vegetable acids. Citric acid contains, according to Berzelius, 41·36 C, 54·83 O, 3·8 H, an excess of 24·43 of oxygen. Malic acid, according to Liebig, contains 42·11 C, 56·14 O, 1·75 H, an excess of 42·14 O. Tartaric acid, according to Berzelius, 35·98 C, 60·21 O, 3·80 H, an excess of 29·75 of oxygen.

2. Matters which contain an excess of hydrogen, as resin, fat, and ethereal oils. Olive-oil, according to Gay-Lussac and Thenard, contains 77·21 C, 9·42 O, 13·36 H, an excess of 12·18 H. Camphor (a solid ethereal oil) contains, according to Liebig, 81·76 C, 8·53 O, 9·70 H, an excess of 8·63 H. Bees'-wax contains, according to Gay-Lussac, 81·78 C, 4·63 O, 14·07 H, an excess of 11·9 H.

Coal is one of the substances which has a decided excess of hydrogen. According to Ure it contains 75–76 per cent. C, 5–8–10 per cent. O, 5–6 per cent. H, 1–2 per cent. N. Since eight parts of oxygen in weight go to one of hydrogen in the formation of water, coal must contain 5–6 per cent. H, with 40–48 per cent. O, if it is a hydrated carbon; there is, therefore, an excess of 4–5 per cent. H.

3. There are, moreover, vegetable matters which contain hydrogen without oxygen, and are therefore anything rather than

* There is evidently something wrong about the figures here, as there is a defect of oxygen to the amount ·02.—Tr.

hydrates, as oil of lemons, oil of turpentine, india-rubber. Oil of lemons, according to Th. de Saussure, contains 86·89 C, 12·32 H, proportions which are absolutely contrary to the hydrate theory.

In DeCandolle's 'Physiology of Plants,' as translated by Röper (vol. i. p. 364), we find a table of the elementary composition of many vegetable substances, from which an addition may easily be made to the instances which have been brought forward.

It is abundantly clear, then, that, in the nourishment of plants, water cannot be used for the formation of hydrated carbons with the carbon derived from the carbonic acid of the air—that it must be useless in practical gardening and agriculture to attempt to nourish plants with pure water and carbonic acid without any humous constituents, as, in fact, all attempts to nourish plants with carbonic acid and water have miscarried.

Another view of the agency of water in the nutriment of plants is that of Berthollet, that a decomposition of water takes place in such a manner that the hydrogen is assimilated, but the oxygen set free. Saussure contradicted this completely, by showing that the water always runs unaltered through the plant, whose substance never increases by the assimilation of water. Notwithstanding which, Liebig, altogether unacquainted with Saussure's experiments, has sought a new explanation of Berthollet's theory, without troubling himself previously about the truth of the grounds on which it depends, and without making a single experiment on the subject. Liebig supposes that we must explain the decomposition of water after the analogy of the contact of zinc, water, and carbonic acid, where the zinc rusts in the water and the oxide of zinc unites with the carbonic acid to form carbonate of zinc. The living plant, according to this view, acts as zinc in galvanic decomposition. This is an addition to Liebig's numerous explanations of circumstances of organic life, which are not present in nature, but are mere fancies, since decomposition and assimilation of water do not take place in plants, as appears from every experiment; but suppose there were such processes, the view which would make plants galvanic batteries is just as though a man should explain living growth out of decomposition, as indeed is sometimes the case, or compare a living plant with a stinking dunghill. The gardener and cultivator can only be puzzled by such lifeless explanations. His first principle should be that in the cultivation of plants he has to do with living beings, which he must keep alive, and not sacrifice by galvanic experiments.

If, then, water does not act by means of its chemical constituents as nutritive matter for plants, it can serve only as the means of conveying those nutritive substances which are dissolved in the water. We have spoken of the humous extract dissolved in the water as the peculiar nutritive substance of plants, and especially the different, in fact, nitrogenous humates which are found in it, and which, according to the experiments contained in the treatise on the discovery of the true nutriment of plants, are the only source of the oxygen which is exhaled under the influence of light. The ground is therefore the only magazine of nutriment for plants, the water the bearer of the nutritive matter dissolved out of the ground. All necessary ingredients for the organic formation of the tissues of plants must be contained in the humous matters, to which the mineral salts are only added as stimulants and promoters of assimilation. Carbon, hydrogen, nitrogen, and oxygen, and even sulphur and phosphorus are contained in *humus* as matters of nutriment; plants need no nutritive matter from the air; they can imbibe only water from it in order to maintain their full flow of life (Entd. der wahren Pflanzennahrung, pp. 140–141).

Liebig contends that *humus* cannot be the nutritive matter, inasmuch as he considers it impossible that the necessary quantity of humic acid or humate of lime could be dissolved in the water. An acre of land produces 10 cwt. of carbon in the corn or fruit, whereas the quantity of rain which falls upon an acre in four months is only 700,000 lbs., wherein only 3 cwts. of humic acid can be dissolved, and applied to the purposes of vegetation. The data are, however, all incorrect in this calculation. An acre of sand without any coating of *humus*, yields frequently a produce of scarcely 5 cwt., in which are only 2½ cwt. of carbon, and frequently yields no harvest all; the quantity of rain-water does not determine in the least the fertility of the soil, since a poor soil is soon dried up after a quantity of rain, and a rich bottom during a long drought may keep itself moist by hygroscopic action; besides which, in every soil a quantity of moisture rises from beneath, which keeps it damp; the solubility, moreover, of humate of lime in water is by no means a measure of the quantity of carbon contained in it, as the greater part of the *humus* enters the plant as humous extract and perhumate of ammonia, which is very soluble in water.

Many persons have allowed themselves to be led astray by the question as to the origin of carbon, inasmuch as they imagine that

originally at the creation there was no carbon in the soil, but merely carbonic acid in the air, and the *humus* arose at a later period from the decomposition of carbonic acid by means of plants. These suppositions, however, are quite erroneous. We find even in the primitive mountains carbon in the form of bituminous mixtures, as in bituminous talc, basalt, and lava, which contain 3 per cent. of inflammable constituents; and although coal was in the first instance a result of vegetation, there are in its neighbourhood, in all mountain formations, rocks containing carbon, whose bituminous constituents, being soluble in water, can serve for the nutriment of plants. Coal, moreover, as stated above, could not be formed of carbon and water, since it contains totally different proportions of oxygen and hydrogen from those which exist in water, and, moreover, much nitrogenous admixture whose presence is quite inexplicable on the carbonic-acid theory. On the other hand, water, after long contact, dissolves even out of the hardest bituminous rocks carbonic constituents, which in this form may be absorbed by plants. The more barren soil may be rendered fruitful by means of such water laden with nutritious particles, when it springs up from below. In this way it is also possible that, without any carbonic acid from the air, a sterile sand may acquire a coating of *humus* from a vegetable growth, induced by the surface-water, as the plants which have thus generated decay in the lapse of generations and increase the formation of mould. This can arise only from the fact that water is the medium of nutriment. The carbon of plants comes, then, from the ground, and not from the air. So it is in our modern world; and there is nothing to prevent its having been so in the ancient world. This truth must give a more natural direction to the theory and practice of cultivation.

Nitrogen plays an important part in the nourishment of flowering-plants, with which the influence of animal manure on the cultivation of flowers and fruits is intimately connected. Saussure, who made the discovery that rain-water contains a small quantity of carbonate of ammonia, expressed an opinion that the nitrogen of plants might be derived from the air in the form of carbonate of ammonia, that this substance might be developed from animal matters by putrescence and so dispersed in the air, and that manure decomposed entirely into carbonate of ammonia and carbonic acid. The quantity of carbonate of ammonia which is brought down by the rain from the air is, however, so small, that a hogshead of rain-water contains barely $\frac{1}{2}$ gr.; while, on the other

hand, rotting dung, as Davy has shown, evolves, besides carbonic acid, gaseous acetate and carbonate of ammonia, and is by no means entirely decomposed into carbonic acid and ammoniacal gas, but leaves behind a solid ammoniacal *humus* or mould—which is contrary to the views of Ingenhousz, who supposed the whole of the dung passed into a gaseous form by fermentation and putrescence, so that all the constituents which were nutritive to plants were communicated to the air; whereas, on the contrary, the nutritive properties reside, for the most part, in the mould which arises from the dung by means of decomposition.

The ammoniacal matter in the atmosphere is therefore extremely small, whereas that of the soil, and of many particular soils, is very large. Clay is the richest of all in ammonia. According to Baumhauer, the clay of the Zuidersee of Holland, contains in a thousand parts ·075–·078 of ammonia, which is about 0·13 or $\frac{1}{8}$ per cent. The virgin forest-soil of Texas contains $\frac{1}{4}$ per cent. of ammonia; 100 lbs. of it contain 6 ozs. of sal ammoniac, or 2 ozs. of ammonia. According to Krocker's experiments, loam contains $\frac{1}{8}$ per cent., sand and marl $\frac{1}{20}$–$\frac{1}{10}$ per cent. of ammonia. In four acres of land having 1 foot depth of soil, containing $\frac{1}{8}$ per cent. of ammonia, there are above 16,000 lbs., or 4000 lbs. per acre. This quantity is greater than what is given to land by manure. If an acre of land contains 120 cwt. of manure, supposing it to contain $\frac{1}{200}$th of ammonia, there are only 66 lbs. of ammonia, whereas in the soil just mentioned there are 4000 lbs. The dung is by no means effectual merely by addition of ammonia, but besides by the accumulation of *humus* as a ferment for other constituents.

The mode in which ammonia is formed in the soil is elucidated by the experiments of Kuhlmann on the formation of saltpetre, and has been further followed out by Mulder in his 'Physiological Chemistry.' Ammonia is formed in rotting, porous matters, which evolve hydrogen, while the nitrogen of the air combines with the nascent hydrogen, as in the rusting of metals by decomposition of water—as, for instance, in damp iron-filings, in consequence of which iron-rust also contains ammonia. So porous fermenting soil without dung forms ammonia by the elimination of hydrogen, which at a later period is oxidized into saltpetre. Thus humate of ammonia is first formed in the ground, and then nitrogenous geic acid and crenic acid, which are absorbed as vegetable nutriments. Decidedly, therefore, the ammonia is not contained in the soil as carbonate of ammonia. The nitrogen, on the contrary, is com-

bined with carbon, hydrogen, and oxygen, in the form of geic acid, crenic acid, humate of ammonia, which exist in vegetable nutriment thus formed. This nutriment is therefore a single substance, whose different constituents are by no means gathered together from so many quarters as Liebig supposes. Carbonate of ammonia is never assimilated by plants.

Another form in which nitrogen enters into plants is nitric acid, which is widely diffused in the soil, and generally combined with clay, magnesia, lime, potash or soda—in many places so abundantly that in Egypt, Tibet, the East Indies, Italy, France, Spain, Hungary, and America the saltpetre effloresces and is easily collected. Nitric acid is formed by the oxidation of the ammonia, which is produced by the combination of the hydrogen eliminated from the soil with the nitrogen of the air. In consequence nitric acid, nitrate of lime, and saltpetre always exist in humous clay and limestone soils. The nitric acid is assimilated by the plants in the same way as other acids and humic acids, since the oxygen is exhaled in light, the nitrogen retained (Entd. der Pflanzennahrung, p. 120).

Saussure's view, reproduced by Liebig, that the nitrogen of plants originates from the carbonate of ammonia in the air, and that all manures operate only by the formation of carbonate of ammonia, is therefore altogether erroneous, and can only lead to great errors in practical farming. Liebig's theory of manures runs throughout on the evolution of carbonate of ammonia from the dung, and the addition of gypsum in order to its fixation. It is supposed that the effect of gypsum depends only on the fixation of ammonia. It is plain, from practical experiments on the effect of gypsum in Horticulture and Agriculture, that this view is altogether wrong. Gypsum promotes the growth of the leaves and stems only of leguminous plants, as clover and peas, but never the blossoming and ripening of the fruit. On the contrary, gypsum, in consequence of the continued luxuriant growth, hinders the formation and ripening of the fruit, and therefore is very injurious in the cultivation of peas in fields, since these plants, when strewed with gypsum, continue green for a long time and produce with difficulty only a little seed. We have also shown that no neutral salts, and therefore neither gypsum nor sulphate of ammonia, can be decomposed and assimilated by plants.

Ammoniacal, especially nitrogenous matters, have precisely the contrary effect on vegetation: they promote, that is, the blossoming and formation of fruit, and impede the growth of leaves and

stem. We may therefore by manuring push the production of fruit and flowers, in fruit-trees, to such an extent that they will at last perish, especially in dry soils. I have myself seen young pear- and plum-trees, in certain years, perish from over-manuring. Gypsum never produces this effect, whereas if gypsum operated by the fixation of carbonate of ammonia it must have the same effect as animal manures.

In my treatise 'On the Discovery of the Real Mode of Nutrition in Plants,' I have thoroughly explained the operation of gypsum, and illustrated it by experiments. It rests simply on the supply of sulphuric acid and the assimilation of sulphur, whereby the oxygen is carried off by respiration. The sulphate of lime in the gypsum is not immediately appropriated by plants; but the abundant oxalic acid in leguminous plants sets the sulphuric acid free, since the oxalic acid, in consequence of its greater affinity for lime, combines with it to form oxalate of lime. In the older parts of the plant, therefore, as a residuum of this process, large quantities of crystallized oxalate of lime are found, which often fill the whole tissue.

Thaer was aware that pure attenuated sulphuric acid sprinkled on plants has the same effect as gypsum, which is easily explained by the fact that gypsum itself operates by means of the elimination of sulphuric acid by means of oxalic acid. Gypsum, therefore, has no effect on plants like grasses, which contain little or no oxalic acid. This old experience is explicable only in this manner. Exactly in the same way as gypsum, phosphate of lime is decomposed by oxalic acid, and the phosphoric acid assimilated, and exactly in the same way all other salts of lime, and amongst them the humate.

Were Liebig's theory true, that gypsum acts only by the fixation of ammonia, the effect on all plants must be the same, and similar to that of animal manure; in this case gypsum must be as profitable a manure to meadows, rye and wheat crops, as to clover and peas, which is, however, notoriously contrary to truth.

The Liebigian theory of patent manures, which rests on erroneous views of the nutriment of plants by means of carbonate of ammonia, and according to which a mixture of salts of potash and soda with lime and magnesia is prepared with carbonate of ammonia, has not been confirmed by its practical use, and the sanguine hopes which were entertained by many in its favour have been sadly deceived. Prince Dimitrii Dalgoroucki has in consequence lost a whole crop of mangel wurzel in the South of

Russia. Curiously enough the majority have not given up the theory of the nourishment of plants by carbonic acid and carbonate of ammonia, and especially that of their nutriment by means of the air, though Liebig's manure has proved a failure.

The theoretic grounds which have been brought forward since the time of Van Helmont, De Geer, and Bonnet against nutriment from the soil, and in favour of the sustenance of plants from the air, have been constantly repeated, to the prejudice of science and practical cultivation, without any thorough refutation. They deserve therefore to be recapitulated and illustrated. Van Helmont, in 1654, instituted an experiment of planting a willow, of 5 lbs. weight, in a pot filled with 200 lbs. of dried earth, and watered this in a covered pot with river-water only. At the expiration of five years, the willow weighed 169 lbs. 3 ozs., and the soil after being dried 198 lbs.; so that the earth had lost 2 lbs., while the tree, without reckoning the fallen leaves, had gained 164 lbs. On this it was concluded that nutrition takes place by the decomposition of water and from the air, without a knowledge of the large quantity of *humus* contained in the river-water, which was more than enough to supply the whole of the increase. Similar experiments were made by Eller (1752) and Duhamel (1748), and admit of the same explanation, the error involved in them being inevitable so long as the quantity of *humus* in spring- and river-water was imperfectly known. Bonnet sowed in a wet sponge and moss oats and barley, and obtained a few miserable plants, a circumstance which admits of explanation if it is considered that all dead organic substances are changed into *humus* by contact with the roots of plants. De Geer endeavoured to raise plants on strips of paper, cotton-wool, and sawdust; he produced only a few shoots, but regarded these as the product of nutrition from the air, although it does not appear why, in this case, as gigantic plants should not be developed as in good soil. He left out of sight the partial decomposition of the organic matrix; the experiments moreover were imperfect, inasmuch as it was not observed that in new sawdust plants not only would not grow, but soon perished.

Very recently the theory of the aërial nourishment of plants has received some support from the communications of the English traveller Darwin, which, it may be assumed, were brought forward without a proper knowledge of the circumstances by Liebig, Schleiden, &c. Darwin had before him especially the cultivation of tropical countries—the culture of rice, sugar-cane,

bananas, coffee, yams and mandiocca, which is conducted by mere irrigation without any animal manure. Darwin has himself visited but few tropical countries where such a cultivation takes place without manure, and has observed even this very imperfectly. He instances the cultivation of maize in Peru and Chili, which is conducted in barren river-sand, without remembering that it is irrigated by rich humous water from the mountains, and in consequence receives the richest possible nutriment. Further he concludes from the cultivation of the oil-palm in Guinea, in the moist sand of the coast, that nourishment takes place from the air. Schleiden, Liebig, &c. have spoken with amazement of the fact that 33,000,000 lbs. of palm-oil are exported every year from Guinea, which contains some 24,000,000 lbs. of carbon, without any animal-dung from which it might arise, and conclude therefore that dung and soil supply no carbon. Had they known that a single moderate-sized German river, the Elbe, for instance, at Magdeburg, yields daily 1798 cwt., or yearly 64,728,000 lbs. of humous extract, which contains above 40,000,000 lbs. of carbon, their amazement at an exportation of 24,000,000 lbs. from the whole of Guinea would be much diminished, especially since the waters of tropical lands are far richer in diffused *humus* than those of colder districts. Darwin and Tschichatschew ('Travels through the Pampas,' 1844) estimate that a proportionate quantity of carbon is afforded, without any manure, by the luxuriant growth of the herbage in the Pampas of Buenos Ayres, from which countless herds of wild oxen and horses are supported—simply from the skins of these animals, which answer to a weight of 6,000,000 lbs., which therefore must arise from the carbonic acid of the air, and the decomposition of water. When, however, we consider how rich the water of the soil is in *humus*, we shall see that the alleged amount of organic matter is nothing in comparision with the carbon which flows yearly into the sea with the *humus* of the Amazon and Orinoco, into which rivers pour whose waters are almost black, and which is constantly renewed from the soil. According to Darwin's theory, the culture of palms in our stoves could certainly not be accomplished.

To arrive at a correct judgment of the cultivation of plants without manure in warm climates, great distinctions must be made of different lands and localities. We may reckon as countries in which, with few exceptions, cultivation is carried on by mere irrigation without the use of manure,—in Asia, Arabia, Persia, Turkistan, Chiwa, Bochara, the East Indies, Siam, Cochin China,

China, Japan, Malacca, Birma, Ceylon, Java, New Holland, Tasmania, and the South-Sea Islands; in Africa, the Cape, Guinea, Madagascar, Senegal, Marocco, Egypt, Abyssinia, Madeira; in America, the Brazils, Mexico, Chili, Southern North America, and a part of Canada. In these different countries, however, in spite of the irrigation, the soil is not equally favourable to cultivation, but the nature of the ground is as important an element of fruitfulness as with us. It is a very great error, therefore, when Schleiden, Liebig, &c., decide from the very imperfect and one-sided observations of Darwin on the perfect indifference of tropical soils as regards the success of cultivation.

As regards the nature of the soil in Hindustan, especially Malabar and Coromandel, we have the excellent observations of Franc. Hamilton (Buchanan), 'Journey,' ii. pp. 504–857, as also of Christie (Jameson's 'New Edinb. Journ.' 1829, April–Oct.). Good and bad classes of soil are generally distinguished there, as in Germany, with reference to their constitution, colour, aridity and moisture. The richest black soil is the "cotton-ground," which covers the whole basin of the tableland of Darwar, in the Deccan, in beds which are often from 20–30 feet thick, and are frequently deeply cut by the tributaries of the Kistna. This soil becomes extraordinarily hot in dry weather, and affects the plants by its temperature. It has arisen from the decomposition of the trap rock, which extends far and wide through the Deccan, and derives its dark colour from root-fibres and animal and vegetable *débris*. This soil produces from year to year without manure, which is not surprising, from its great depth, inasmuch as its thinnest stratum is at least 3 feet.

Cotton, however, can be cultivated on this soil only every third year. It is sown at the end of the rainy season in August and September; it vegetates in a week, and grows in the dry season, with indigo, spring-wheat, and tobacco. The harvest is from January to March.

A second sowing takes place at the end of May, or the beginning of June, at the commencement of the rainy season, as soon as the ground is soft, of barley, eleusine and sesamum, which are capable of enduring considerable moisture.

The third summer's sowing takes place at the end of June or the beginning of July, during the height of the monsoon rain, especially of leguminous plants, as beans, lentils, *Dolichos Lablab*, *D. Catiang*, *D. tranquebaricus* and *Cytisus Cajan*, besides sorghum and rice. The mountain-rice, according to Christie, is manured.

Even the sandy bottoms on the coast, where the coco-palms are cultivated, may be divided into good and bad. In good moist soil the coco grows so fast that it bears fruit in eight years, and in twelve has attained its full diameter, lasting to eighty. The poorer the soil, the later the palm is in coming to perfection, and the shorter the duration. In good soil each tree produces monthly twenty, or yearly 100 nuts, while in bad soil it yields only from two to six. It bears blossoms every month in good soil only, and yields palm-juice the whole year; in poorer bottoms the produce of wine is small and at the most continues for six months only.

All this is quite incompatible with the theory of air-nutrition. We have information with respect to the soil of the island of Java, from Raffles in his 'History of Java,' and from Junghuhn. According to the fertility, they distinguish:—1. Rich black mould in the course of rivers (Tána ládu), such as occurs between Batavia and Weltewreden, with a rich vegetation of banana, mango, tamarind, custard-apple and coffee. The richer in *humus*, the lighter and looser the soil, the more it is adapted for coffee-plantation. 2. Tána línchad is a pure light clay with sand, which in plains fitted for irrigation yields a single rice-harvest. 3. Tána pasir is the alluvial soil in the maritime district—the delta-land.

The nature of the soil in the North of China has been described by Fortune ('Wanderings in the Northern Provinces of China,' London, 1847). The cotton-ground is here a rich but never boggy loam, though it is manured with canal-mud. Tea succeeds only on very fruitful rich sandy loam. Since the agriculture here does not depend on breeding cattle, the use of green manure is general. In the rice-fields a *Trifolium* and *Coronilla* are cultivated for manure, which is of use in the case of rice, which is poor in nitrogenous matter, but does not answer for wheat.

The sugar-cane attains a height of from 10–16 feet in Guiana, in the flooded levels of the Essequibo; while in the hungry limestone it is but from 6–10 feet high. We see, then, what enormous errors require rectification, as regards the accounts of the fertility even of the most barren soil within the tropics.

One of the most important observations is that even the richest soil, when it is tilled year after year without any manure, is at last completely exhausted, which would be quite impossible if nourishment were derived from the air. The richest sugar-plantations in Guiana, on the Essequibo, endure only forty years. The

EXTRACTS FROM PROCEEDINGS

OF THE

ROYAL HORTICULTURAL SOCIETY

AND

MISCELLANEOUS MATTER.

January 20, 1866.—A fine bunch of English-grown Dates was sent by Mr. G. Fairbairn from the gardens at Syon House, in which they had been raised and ripened. A prize of 20*s.* was awarded.

January 23.—A fine display of plants and flowers was made, the most important collections being furnished by Mr. Bull of Chelsea, and Mr. Veitch of Chelsea,—the former contributing a very large collection of miscellaneous new or rare plants; and the latter a very handsome group of Orchids, consisting chiefly of varieties of *Lycaste Skinneri.*

Mr. Bull's collection consisted of sixty-eight plants, including several large specimens—as, for example, an Orange-tree, two Tree Ferns, together with Palms, Yuccas, and Dracænas. Among the interesting though less bulky objects, the following may be particularly mentioned:—*Pandanus ornatus*, a species, of elegant drooping habit, with narrowish dark-green glossy leaves margined with short white spines; it was considered to be a very pretty subject for room-decoration, especially in the small state. *Herrania palmata*, an erect-growing, single-stemmed, Aralia-like plant, with pale-green, three- or four-parted, palmately divided leaves, the leaflets of attenuated lance-shaped form and coriaceous texture; an elegant-habited plant belonging to the order Byttneriaceæ. *Sedum aizoideum variegatum*, a neat variegated greenhouse succulent. *Selaginella Martensii albo variegata*, a variety of this pretty stove Lycopod freely variegated with white. *Tacca pinnatifida*, with tripartite leaves, the branches divided into pinnatifid decurrent leaflets. *Peperomia arifolia*, one of the variegated plants introduced for the Society by Mr. Weir. *Dielytra spectabilis alba*, with pure-white

flowers. The spiny-stemmed *Calamus dealbata*, the silver palm of Madagascar. *Thrinax elegans*, one of the most elegant of the elegant race of miniature palms, with palmated leaves on smooth slender stalks. *Rhodea japonica aureo striata*, with the leaves distinctly striped with yellow. *Trichomanes radicans*, a remarkably fine specimen. *Xanthosoma appendiculatum*, a green-leaved Arad, curious on account of the midrib abruptly terminating at about two-thirds the length of the leaf-blade, at which point a small leaf-like lobe was developed upside down on the under surface, so that there appeared to be two leaves of unequal size set back to back. *Agave americana longifolia*, a long-leaved variety, considered inferior to the older variegated variety. The collection also contained some large handsome bushes of the common Aucuba, well furnished with berries, and smaller plants of the newer varieties. To this collection the Lindley Medal was given, the second awarded by the Society; the first having been granted to the fine group of *Lycastæ* shown by Mr. Veitch at the December Meeting.

Mr. Veitch's contribution was less extensive, but even more attractive. It consisted of a large number of beautiful forms of *Lycaste Skinneri*, varied by the intermixture of *Epidendrum Skinneri*, *Odontoglossum cordatum*, a fine mass of *Angræcum eburneum*, the exquisitely tinted *Cattleya Warscewiczii delicata*, which is said to be the same as *C. pallida*; *Cattleya bogotensis*, a variety of similar character, but of deeper and richer lilac tint; and *Franciscea calycina major*, the most beautiful of all the Francisceas, with violet-coloured flowers, measuring $3\frac{1}{4}$ inches in diameter.

Messrs. A. Henderson and Co., Pine-Apple Nursery, Edgware Road, sent a handsomely striped Fern, in the shape of a finely variegated form of *Lastrea Sieboldii variegata*, the leaves of which were streaked all over transversely with creamy white. From the gardens of J. Bateman, Esq., were contributed some cut specimens, namely:—from Mr. Sherratt, gardener at Knypersley Hall, a spike of *Phalænopsis amabilis*, another of the long-tailed *Angræcum sesquipedale*, with *Dendrobium nobile* and *moniliforme*; and from Mr. Stanton, gardener at Biddulph Grange, two species of *Thibaudia*, namely *macrantha* and *bracteosa*, the latter with elliptic acuminate five-nerved leaves, and deep-red flowers tipped with green. Mr. Willcock, gardener to Dr. Patteson, St. John's Wood, sent a nice young blooming plant of the curious long-tailed *Angræcum sesquipedale*, and a plant of *Barkeria Skinneri*. Mr. Williams, of Holloway, contributed a new variety of *Calanthe vestita*, with the

usual white flowers, only closer and more compact in form and purer in colour, and with a small red eye, but much less prominent than in the usual red-eyed sort: it was regarded as a desirable acquisition, and was called *Turneri*. Mr. Williams also sent two fine plants of *Angræcum eburneum*—the one being the variety called *superbum*, with a very broad pure white lip, and the other *virens*, in which the lip is smaller and of a greenish white.

Mr. Earley, gardener to Felix Pryor, Esq., Digswell, sent a hybrid *Begonia*, which he called Earley's hybrid. It had short stout erect rough stems, acutely lobed serrated leaves, and deep-rosy-pink flowers. Mr. Earley stated that the male parent was *B. ricinifolia*, and added, "the leaves shine very beautifully by artificial light, and in small pots are well adapted, with the addition of their bold spikes of flowers, for table or indoor decoration, the spikes rising well above the foliage, and requiring no artificial support." Mr. Reynolds, gardener to Dr. Sankey, Sandywell Park, near Cheltenham, sent *Selaginella denticulata variegata*, a plant with yellowish-green tips, which it was thought was not in condition.

From the Society's Gardens, at South Kensington, came a beautiful little plant of *Sophronitis grandiflora* with nine expanded flowers, a plant of *Odontoglossum hystrix* introduced by Mr. Weir, and one of Mr. Weir's Cattleyas from Bogota, which proved to be the same as *C. Warscewiczii delicata*.

From Chiswick Garden was contributed *Palicourea discolor*, one of Mr. Weir's introductions, with opposite elliptic-acuminate leaves of a dark velvety bottle-green, with a distinct white midrib, which in age becomes somewhat pinkish; *Dracæna fragrans*, a good old plant, which opens its blossoms in the evening, and then deliciously scents the house in which it stands; *Clivia nobilis*, another good old plant; *Saxifraga tricolor*, with handsomely variegated leaves; *Pycnostachys urticæfolia*, a labiate with bright-blue flowers; also a collection of sixteen varieties of Yellow-leaved *Pelargoniums*.

Mr. Berkeley first drew attention to the supposed new species of *Calanthe*. It was clearly a form of *C. vestita*, differing only in the rosy streak on the lip, which is yellow in the older form. This is the species which, with *Limatodes rosea*, was the parent which gave rise to the beautiful hybrid *Calanthe Veitchii*, which attracted so much notice at a former Meeting.

One of the *Odontoglossa* exhibited by Mr. Low at the last December Meeting was *O. hystrix*, a species, in common with *O.*

Alexandræ and its varieties, distinguished by its ciliated column. The other species seemed very near to *O. Halliæ*.

Xanthosoma appendiculatum, an Arad which formed part of Mr. Bull's splendid collection, was remarkable for an appendage on the underside of the leaf, as if a portion had been turned inside out. An exactly similar formation occurs in an Indian species of *Ficus*, of which Dr. Carter brought home specimens.

Dracæna fragrans was exhibited from the Society's Gardens, a night-blooming species and exceedingly fragrant. It was figured in the 'Botanical Magazine' as long ago as 1808, and is well worthy of cultivation.

From the Gardens also were sent *Ficus Cooperi* in fruit, and *Pycnostachys urticæfolia*, of which seeds were sent home by Dr. Livingstone. All the species are of African origin, or from adjacent islands; but the present far exceeds the others in beauty.

Herrania palmata was exhibited, but only in an early stage of growth. Its relation to *Theobroma* was pointed out, to which genus the plant belongs which produces chocolate.

Young plants of *Palicourea discolor* were sent from Chiswick, an extremely pretty member of Rubiaceæ. Its lovely leaves promise to make it a favourite when generally known. It is one of Mr. Weir's discoveries in Brazil.

Attention was drawn to some specimens of *Aucubæ*, from their interest in a commercial point of view. A fruited plant which in its barren state was worth half-a-crown, was now valued at from fifteen to twenty pounds. A small male plant was pointed out, the selling-price of which was two guineas. Such plants were actually let out to nurserymen for the purpose of impregnation.

A seedling pear was received from Mr. R. H. Betteridge, Milton Hill, near Steventon, Berks, which in shape resembles the *Beurré d'Aremberg*; and is also not unlike a medium-sized specimen of *Huyshe's Victoria*. The flesh is very melting and juicy, and has a flavour similar to that of Autumn Bergamot. It possesses the desirable property, that, when it begins to decay, it does so from the surface, and not from the core. This was awarded a First-Class Certificate.

Handsome specimens of *Uvedale's St. Germain*, were exhibited by George F. Wilson, Esq., and which were grown on trees, in pots, in his orchard house at Geshurst Cottage, Weybridge Heath. They were produced *four* in one cluster, and the whole number were perfected in the condition in which they were exhibited.

The crop was set in the orchard-house; and when sufficiently developed and all risks of spring frost were gone, the trees were plunged in the open ground, and the fruit ripened out of doors. The colour was a fine deep yellow, and a bright crimson blush on one side.

Mr. Tillery, gardener to his grace the Duke of Portland, at Welbeck, sent bunches of black *Tripoli*, *Trebbiano*, West's *St. Peter's*, and *Muscat of Alexandria* grapes. The first of these, the black *Tripoli*, has been proved to be identical with the *Frankenthal*, a grape which, from its similarity to the Black Hamburgh, is very generally grown under that name and those of Victoria Hamburgh and Pope Hamburgh. The fact of the Duke of Portland having received this grape from Tripoli, may be an indication of its origin. *Trebbiano*, if not identical with, is so closely allied to *Syrian*, that there is difficulty in distinguishing them. Recent observations seem to show that they are the same, and it is anticipated that future experience will prove that such is the case.

Mr. Culverwell, gardener to Mark Milbanke, Esq., of Thorpe Perrow, near Bedale, sent a bunch of grapes, which proved to be the *Ferral* of Portugal, a very large and long olive-shaped black grape, which is met with very frequently in the vineyards of the South of Europe. In Bulgaria it received the name of *Sabalskanskoi*, in honour of the Russian General Diebitch Sabalskanskoi, and in the collection at the Luxembourg it is called *Raisin de Balkans*.

Fruit of *Pyrus nepalensis*, was sent by Mr. W. B. Page, of Southampton. It is of the size and shape of a small pear, and with the flavour of the quince. It appears to be intermediate between the pear and the quince, having two seeds in each cell (which characterizes the former), and having mucilaginous seeds (which characterizes the latter).

February 20.—A very interesting collection consisted of a group of twenty-four plants of the new large-flowered Russian *Violet* raised by F. J. Graham, Esq., of Cranford, and named the *Czar*. The blooms of this new Violet, as well as the foliage, are very large, and the whole plant has a most robust-looking aspect. It had already gained a First-Class Certificate, and now fully maintained the high character thus given to it. With it was a seedling, called *Princess Dagmar*, with smaller flowers of a duller, paler purple, altogether inferior.

From the garden of W. Wilson Saunders, Esq., was brought up by his gardener Mr. Green, a little group of what are sometimes

called "miseries of Orchids,"—minute flowering species, interesting only to botanists. Among them were a supposed species of *Leochilus*, of little beauty, but having a scent like that of Heliotrope, especially when the sun shines on the flowers; *Epidendrum Hormidium*, the blossoms of which smelt like fresh-gathered Primroses; *Pelexia triloba*, remarkable for the beauty of its structure; *Bletia teretifolia*, *Maxillaria pulchella*, a *Pleurothallis*, an *Eria* from Assam, and some others. Most of these were fastened to thin slabs of wood or cork, on which they were found to succeed best. They require a continuous supply of moisture, not only in the atmosphere, but also about their roots; and this is obtained by wetting both sides of the wood on which they grow with a syringe. These were accompanied by the curious-looking *Tillandsia bulbosa picta*, which Mr. Saunders finds to succeed better attached to a block than when grown in soil in pots. In the same group was a little creeping *Peperomia* (*nummulariæfolia*), which had inadvertently turned up among some of Mr. Weir's Brazilian Orchids, and which, owing to its pendulous habit, though a mere stove-weed, may doubtless be used with advantage in the ornamentation of hanging baskets, its thread-like branching stems being furnished with pale-green, roundish-oval leaves.

From Mr. Bull, of Chelsea, came three new Camellias:—*Venanzio*, a small imbricated sort, of a flesh-colour faintly striped; *Contessa Novello*, blush-white, faintly striped, in the style of, but, as shown, not equal to, Countess of Orkney; and *Archiduc Carlo di Toscana*, a small flattish-cupped crimson, with white blotches, in the style of Bacciochi, which, however, is superior to it. Messrs. Waterer and Godfrey, of Knaphill, sent three plants of the recently-introduced green-leaved *Aucuba japonica*, in fruit, and chiefly remarkable for the size of the clusters of berries.

Several plants were contributed from the Society's garden establishments:—among them, a well-flowered specimen of *Libonia floribunda*, gay with a profusion of tubular crimson and yellow flowers; and a very handsome New Granada *Cattleya* of Mr. Weir's importation, coming very near the original form of *C. Trianæi*: the sepals were blush; the petals deeper blush and crispy at the edge; the lip finely undulated at the margin, very deep blush in the rolled-in portion, with a yellow blotch at the base of the disk, and richly tipped with magenta purple. These Cattleyas, which flower in spring, bloom as soon as their growth is made, as occurs in *C. labiata*, and not after resting awhile as is the case with *C. Mossiæ*.

Mr. Berkeley brought a branch of *Wellingtonia*, with male catkins, from the Marquis of Huntly's at Orton Longueville. Many of the trees there, of which there are some hundreds, had borne female fruit; but this was the only one with catkins. He made a few observations on the disease which is so common and destructive to Pear-trees, directing the attention of the Meeting to the curious observations of Oersted on its connexion with the gelatinous parasite of *Juniperus Sabina*, an account of which is given by Mr. Currey in the present number of the 'Journal.'

AWARDS OF THE FLORAL COMMITTEE,

FROM 1859 TO 1865.

The following list gives the names of the whole of the newly introduced plants, and new garden flowers, which have received awards from the Floral Committee from the time of its establishment in 1859 up to the end of 1865. Such a list, now printed for the purpose of ready reference, being, in fact, a record of nearly all the more deserving novelties imported or raised in this country since that very useful body has been at work, will be found serviceable to those who take interest in new introductions; whilst those who are themselves but novices in the matter of plant-selection, may take it as a very trustworthy guide. The existence of such a tribunal has acted as a wholesome check upon the crowd of worthless novelties which are ever being thrust forward to catch the unwary purchaser.

It may be explained that the value of the several awards is indicated by the following initial letters:—S. K., Silver Knightian Medal; S. B., Silver Banksian Medal; B., Bronze Medal (these being awards made to certain subjects at the great summer shows); F. C., First-class Certificate; S. C., Second-class Certificate; C., Commendation. It should be observed that the S. C. was not made use of before 1862; so that prior to that date the C. is really equivalent to a second-class instead of a third-class award, as it afterwards became. For the sake of completing the record of the awards made directly to new plants by the Society since its resuscitation, a few subjects (marked *) which were shown on the day of the opening, June 5, 1861, are included, as well as a few other subjects (marked †), to which awards were made by the Society at the show in St. James's Hall,

May 12, 1859, a month or two before the meetings of the Floral Committee were instituted.

Abies canadensis brevifolia. Fisher and Co. June 17, 1863.—B. & C.
Abies excelsa aurea. Lee. September 23, 1862.—F. C.
Abies firma. Veitch. May 27, 1863.—S. K. & F. C.
*Acer polymorphum atropurpureum. A. Henderson and Veitch. June 5, 1861. —S. B.
Acer polymorphum fol. dissectis apic. brunneis. Veitch. May 17, 1864.—F. C.
Acer polymorphum fol. dissectis roseo marginatis. Standish. July 2, 1862.—S. B.
Acer polymorphum fol. dissectis roseo marginatis. Bull. June 10, 1865.—F. C.
Acer polymorphum fol. dissectis viridibus. Veitch. July 2, 1862.—B.
Acer polymorphum rubro variegatum. Standish. July 2, 1862.—S. K.
Acer Pseudo-Platanus Leopoldii. Bull. June 10, 1865.—F. C.
Acer sp. (broad, white, variegated-leaved). Standish. May 27, 1863.—B. & C.
Acer sp. (broad purple- and red-leaved). Standish. July 2, 1862.—S. B.
Achimenes Aurora. Parsons. September 13, 1864.—F. C.
Achimenes Mauve Queen. Parsons. August 26, 1862.—F. C.
Achimenes Moorii. Parsons. July 21, 1863.—S. C.
Achimenes Rose Queen. Parsons. September 13, 1864.—F. C.
Achimenes Stella. Parsons. September 27, 1864.—S. C.
Acorus japonicus argenteo striatus. Bull. June 10, 1865.—F. C.
Acrophorus affinis. Veitch. July 1, 1863.—S. B. & S. C.
Adelaster albivenis. Veitch. April 23, 1861.—C.
Adiantum cardiochlæna. Bull. September 9, 1863.—F. C.
Adiantum chilense. Veitch. May 6, 1862.—F. C.
Adiantum colpodes. Veitch. June 10, 1865.—F. C.
Adiantum farleyense. Green. July 29, 1865.—F. C.
Adiantum Féei. Linden. June 5, 1861.—1st Pr.; Bull. Sept. 10, 1862.—F. C.
Adiantum Ghiesbreghtii. Backhouse. July 1, 1863.—B. & C.
Adiantum patens. Veitch. February 9, 1860.—F. C.
Adiantum scabrum. Veitch. May 6, 1862.—F. C.
Adiantum sulphureum. Veitch. May 6, 1862.—F. C.
Adiantum tinctum. Veitch. July 2, 1862.—B.
Aërides hybridum. Veitch. June 11, 1862.—F. C.
Aërides Lindleyanum. Stone. June 27, 1865.—F. C.
Aërides nobile. Veitch. September 10, 1862.—F. C.
Agathæa cœlestis fol. variegatis. Bull. March 12, 1861.—F. C.
Agave americana elegantissima. Bull. November 12, 1861.—F. C.
Agave schedigera. Williams. May 17, 1864.—F. C.
Allamanda Hendersoni. Henderson. September 6, 1864.—F. C.
Alocasia Lowii. Low. September 23, 1862.—F. C.
Alocasia macrorhiza variegata. Veitch. October 8, 1861.—F. C.
Alocasia metallica. Low. September 22, 1859.—F. C.
Alocasia Veitchii. Veitch. September 8, 1859.—F. C.
Alocasia zebrina. Veitch. June 11, 1862.—S. K.
Alocasia zebrina. Veitch. April 15, 1863.—F. C.
Alsophila glauca (contaminans). Veitch. November 12, 1861.—F. C.
Alsophila Tænitis denticulata. Veitch. June 17, 1863.—S. B. & S. C.
Amaranthus melancholicus ruber. Veitch. July 23, 1861.—C.
Amaryllis Brilliant. E. G. Henderson. March 31, 1863.—S. C.
Amaryllis Fire King. Bull. March 31, 1863.—C.
Amaryllis ignescens. Veitch. May 30, 1865.—F. C.
Amaryllis perfecta marginata. Williams. June 17, 1863.—F. C.
Amaryllis refulgens. Williams. April 18, 1865.—S. C.
Amaryllis Unique. Williams. March 19, 1862.—F. C.
Andromeda fastigiata. Backhouse. May 16, 1865.—F. C.
Andromeda hypnoides. Backhouse. May 2, 1865.—F. C.
Andromeda sp. Veitch. June 17, 1863.—B. & C.
Androsace Chamæjasme. Backhouse. May 16, 1865.—F. C.
Anemone fulgens. Backhouse. April 18, 1865.—F. C.

Anemone japonica Honorine Jobert. F. and A. Smith. Sept. 9, 1863.—C.
Anemone japonica Honorine Jobert. E. G. Henderson and Son. Oct. 6, 1863.—S. C.
Angræcum sesquipedale. Veitch. December 10, 1861.—F. C.
Angræcum sp. Veitch. March 7, 1865.—C.
Anœctochilus argyreus. Bull. February 25, 1863.—S. C.
Anœctochilus Bullenii. Low. August 27, 1861.—F. C.
Anœctochilus Dominii. Veitch. May 16, 1865.—F. C.
Anœctochilus Petola. See Macodes Petola.
Anœctochilus Petola superba. See Macodes Petola superba.
Anœctochilus Schælleri. Bull. October 8, 1862.—S. C.
Anœctochilus speciosus. Bull. March 30, 1864.—S. C.
Anœctochilus sp. Osborn and Son. October 8, 1861.—F. C.
Anœctochilus Turneri. Williams. July 11, 1865.—F. C.
Anthurium leuconeurum. Bull. August 26, 1862.—S. C.
Anthurium magnificum (cordifolium). R. H. S. { July 6, 1864.—S. C. / August 16, 1864.—F. C. / June 10, 1865.—F. C.
Anthurium Scherzerianum. Wendland. July 2, 1862.—B.
Anthurium Scherzerianum. Veitch. March 31, 1863.—F. C.
Anthurium sp. Bull. April 15, 1863.—C.
Antirrhinum (majus) Giuseppe Garibaldi. Bull. September 13, 1864.—C.
Aquilegia cærulea. Thompson. May 16, 1865.—F. C.
Aquilegia (vulgaris) caryophylloides. Carter. June 14, 1860.—C.
Aralia leptophylla. Veitch. April 9, 1862.—F. C.
Aralia Sieboldii variegata. Veitch. May 28, 1861.—C.
Araucaria Cunninghamii glauca. Bull. October 8, 1862.—F. C.
Araucaria Rulei. Bull. July 1, 1863.—S. B. & S. C.
Araucaria sp. Port Molle. Bull. September 10, 1862.—S. C.
Areca dealbata. Bull. May 27, 1863.—S. B. & S. C.
Arisæma ringens purpurata. Bull. March 21, 1865.—S. C.
Arthrobotrya articulata. See Polybotrya Lowii.
Asplenium Adiantum-nigrum flabellatum. Stansfield. July 29, 1865.—F. C.
Asplenium alatum. Williams. May 2, 1865.—F. C.
Asplenium consimile. Veitch. July 1, 1863.—B. & C.
Asplenium elegantulum. Standish. July 1, 1863.—S. K. & F. C.
Asplenium erectum proliferum. Barker. August 22, 1865.—F. C.
Asplenium ferulaceum. Bull. March 30, 1864.—F. C.
*Asplenium flabellifolium. Linden. June 5, 1861.—1st Pr.
Asplenium flabellulatum. See Asplenium myriophyllum var.
Asplenium Hemionitis cristatum. Gray. December 7, 1864.—F. C.
Asplenium inæquale var. Backhouse. May 30, 1865.—F. C.
Asplenium myriophyllum. Linden. May 10, 1860.—F. C.
Asplenium myriophyllum. Linden. June 5, 1861.—1st Pr.
Asplenium myriophyllum var. Bull; Veitch. April 1, 1862.—F. C.
Asplenium rachirhinæ. See Asplenium rachirhizon.
Asplenium rachirhizon. Bull; Veitch. April 1, 1862.—F. C.
Asplenium resectum. Barker. September 27, 1864.—F. C.
Asplenium Trichomanes Harovii. Holland. July 19, 1864.—S. C.
Asplenium Trichomanes Harovii. Holland. June 27, 1865.—F. C.
Asplenium Trichomanes incisum triangulare. Stansfield. July 29, 1865.—F. C.
Astelia bivittata. Watson. July 6, 1864.—C.
Astrocaryum mexicanum. Bull. October 8, 1862.—C.
Athyrium Filix-fœmina Applebyanum. Ivery. May 27, 1863.—B. & C.
Athyrium F.-f. Applebyanum. Ivery. November 21, 1865.—F. C.
Athyrium F.-f. curtum. Stansfield. July 29, 1865.—F. C.
Athyrium F.-f. diffisso-multifidum. Ivery. June 1, 1864.—F. C.
Athyrium F.-f. diffissum. Bull. May 27, 1863.—B. & C.
Athyrium F.-f. Fieldiæ lancifolium. Ivery. June 1, 1864.—S. C.
Athyrium F.-f. fissidens irregulare. Girdlestone. June 27, 1865.—F. C.
Athyrium F.-f. Frizelliæ. Bull. August 13, 1861.—F. C.
Athyrium F.-f. glomeratum. Ivery. June 17, 1863.—B. & C.
Athyrium F.-f. Iveryanum. Ivery. September 10, 1862.—F. C.

Athyrium F.-f. mucronatum. Ivery. September 10, 1862.—F. C.
Athyrium F.-f. multiceps. Veitch. August 11, 1859.—F. C.
Athyrium F.-f. Parsonsiæ. Parsons. June 26, 1862.—S. C.
Athyrium F.-f. Parsonsiæ. Parsons. September 10, 1862.—F. C.
Athyrium F.-f. plumosum. Stansfield. June 28, 1860.—F. C.
Athyrium F.-f. sagittatum. Bull. May 5, 1863.—F. C.
Athyrium F.-f. Vernoniæ. Ivery. November 8, 1864.—F. C.
Athyrium F.-f. Vernoniæ. Bull. June 10, 1865.—F. C.
Athyrium F -f. Victoriæ. Ivery. November 8, 1864.—F. C.
Aubrietia purpurea variegata. Bull. May 2, 1865, and June 10, 1865.—F. C.
*Aucuba japonica (vera fœmina). Standish. June 5, 1861.—B.
Aucuba jap. fœmina latifolia. Bull. March 7, 1865, and June 10, 1865.—F. C.
Aucuba jap. fœm. longifolia. Bull. June 10, 1865.—F. C.
Aucuba jap. fœm. longifolia variegata. Bull. June 10, 1865.—F. C.
Aucuba jap. fœm. viridis. Bull. June 10, 1865.—F. C.
Aucuba jap. foliis marginatis. Bull. May 17, 1864.—F. C.
Aucuba jap. lancifolia variegata. Bull. June 10, 1865.—F. C.
Aucuba jap. longifolia. Veitch. June 1, 1864.—F. C.
Aucuba jap. macrophylla. Bull. March 7, 1865, and June 10, 1865.—F. C.
Aucuba jap. mascula angustata. Bull. June 10, 1865.—F. C.
Aucuba jap. mas. bicolor. Bull. June 10, 1865.—F. C.
Aucuba jap. mas. elegans. Bull. March 7, 1865, and June 10, 1865.—F. C.
Aucuba jap. mas. elegantissima. Bull. March 7, 1865.—F. C.
Aucuba jap. mas. maculata. Bull. June 10, 1865.—F. C.
Aucuba jap. mas. varia. Bull. June 10, 1865.—F. C.
Aucuba jap. mas. viridis. Bull. June 10, 1865.—F. C.
Aucuba jap. picta. Bull. October 11, 1864, and June 10, 1865.—F. C.
Aucuba jap. picturata. Standish. May 21, 1862.—B.
Auricula Buckstone. Turner. May 4, 1864.—F. C.
Auricula Ensign. Turner. April 15, 1863.—S. C.
Auricula Godfrey. Turner. April 18, 1865.—F. C.
Auricula Harry. Turner. April 18, 1865.—S. C.
Auricula Mrs. Eyles. Holland. April 9, 1862.—C.
Auricula Rev. G. Jeans. Turner. April 9, 1861.—C.
Auricula Richmond's North Star. Turner. May 10, 1860.—F. C.
Auricula Volunteer. Turner. April 26, 1860.—F. C.
Auricula (alpine) John Leech. Turner. May 2, 1865.—F. C.
Auricula (alpine) Meridian. Turner. May 2, 1865.—F. C.
Auricula (alpine) Shakspere. Turner. April 20, 1864.—S. C.
Auricula (alpine) Supreme. Turner. April 15, 1863.—C.
Auricula (alpine) Titian. Turner. May 2, 1865.—S. C.
Azalea amœna hybrida. Standish. June 14, 1860.—C.
Azalea (indica) Beauty of Dorking. Ivery. April 15, 1863.—S. C.
Azalea (ind.) Bellona. F. and A. Smith. April 20, 1864.—S. C.
Azalea (ind.) Bride of Abydos. Barnes. May 6, 1862.—C.
Azalea (ind.) Duc d'Aremberg. F. and A. Smith. April 9, 1862.—F. C.
Azalea (ind.) elegantissima. Williams. May 21, 1862.—C.
Azalea (ind.) Flag of Truce. Todman. March 26, 1861.—F. C.
Azalea (ind.) Kinghornii. Kinghorn. April 9, 1861.—F. C.
Azalea (ind.) Lord Derby. Todman. March 9, 1864.—C.
Azalea (ind.) Louise von Baden. Turner. April 15, 1863.—F. C.
Azalea (ind.) Mad. A. Verschaffelt. Veitch. April 15, 1863.—S. C.
Azalea (ind.) Magnet. Barnes. June 28, 1860.—C.
Azalea (ind.) Mars. Kinghorn. May 24, 1860.—C.
Azalea (ind.) Meteor. Kinghorn. April 20, 1864.—S. C.
Azalea (ind.) President. Kinghorn. May 10, 1860.—F. C.
Azalea (ind.) President Claeys. Veitch. February 25, 1863.—F. C.
Azalea (ind.) Roi des doubles. Bull. April 20, 1864.—F. C.
Azalea (ind.) Souvenir du Prince Albert.—J. Vershaffelt, May 6, 1862.—S. C.
Azalea (ind.) Stella. Veitch. April 20, 1864.—F. C.
Azalea (ind.) Vesuvius. Veitch. June 1, 1864.—F. C.
Azalea (sinensis) altaclerensis. Lee. May 6, 1862.—F. C.

*Bambusa variegata. Standish. June 5, 1861.—B.
Barkeria Skinneri superba. Veitch. February 25, 1863.—F. C.
Beaucarnea sp. Williams. July 6, 1864.—F. C.
†Begonia amabilis. Veitch. May 12, 1859.—S. C.
Begonia blanda. Parker and Williams. September 22, 1859.—F. C.
Begonia digswelliensis. Earley. March 30, 1864.—C.
Begonia Gem. Low. September 22, 1859.—C.
Begonia imperialis. Veitch. May 6, 1862.—S. C.
Begonia Lowii. Low. September 22, 1859.—F. C.
Begonia mutabilis. Harland. May 21, 1862.—S. C.
Begonia ornata. Clarke. November 8, 1864.—S. C.
†Begonia Queen Victoria. Veitch. May 12, 1859.—3rd C.
Begonia smaragdina. Veitch. May 6, 1862.—S. C.
Begonia sp. Veitch. June 10, 1865.—F. C.
Begonia sp. Santa Martha. Salter. November 12, 1861.—C.
Begonia Zebra. Low. September 22, 1859.—C.
Berberis stenophylla (handsworthiensis). Fisher and Co. May 4, 1864.—F. C.
Bertolonia guttata. Veitch. May 16, 1865, and June 10, 1865.—F. C.
Bertolonia margaritacea. R. H. S. August 26, 1862.—F. C.
Bertolonia pubescens. Veitch. May 16, 1865, and June 10, 1865.—F. C.
Bignonia argyrea violascens. Bull. July 25, 1865.—F. C.
Biota sp. (pendulous). Veitch. May 21, 1862.—B.
Blechnum nitidum contractum. Veitch. June 17, 1863.—B. & C.
Blechnum Spicant serratum rigidum. Stansfield. July 29, 1865.—S. C.
Blechnum Spicant undulatum. Stansfield. July 29, 1865.—F. C.
Bletia hyacinthina. Osborn. April 18, 1865.—F. C.
Bolbophyllum psittacoglossum. Stone. July 11, 1865.—S. C.
Bomarea multiflora. Veitch. July 1, 1863.—S. K. & F. C.
Boronia Drummondii alba. Smyth. May 16, 1865.—F. C.
Bougainvillea (lateritia). Turner. April 18, 1865.—F. C.
Bougainvillea glabra. Daniels. October 8, 1861.—F. C.
Brahea dulcis. Bull. March 21, 1865.—F. C.
Brasavola nodosa grandiflora. R. H. S. July 11, 1865.—F. C.
Bromelia Sceptrum. Veitch. June 17, 1863.—S. B. & S. C.
Browallia Jamesoni multiflora. Veitch. May 5, 1863.—S. C.
†Caladium Chantinii. Veitch. May 12, 1859.—S. C.
Caladium Lowii. See Alocasia Lowii.
Caladium Veitchii. See Alocasia Veitchii.
Caladium Wightii. Osborn. July 12, 1860.—F. C.
Calamus australis. Veitch. October 8, 1861.—F. C.
Calandrinia sp. Chili. Veitch. July 9, 1861.—C.
Calanthe Dominii. Veitch. September 10, 1862.—S. C.
Calanthe Veitchii. Veitch. December 8, 1859.—F. C.
Calanthe Veitchii superba. Veitch. December 8, 1863.—F. C.
Calceolaria (bedding) Beauty of Herts. Watson. July 6, 1864.—S. C.
Calceolaria (bedding) Bijou. Watson. June 17, 1863.—S. C.
Calceolaria (bedding) Bijou. Watson. July 21, 1863.—F. C.
Calceolaria (bedding) canariensis. G. Smith. June 28, 1860.—C.
Calceolaria (bedding) canariensis. G. Smith. May 28, 1861.—F. C.
Calceolaria (bedding) Cloth of Gold. Downie. June 26, 1862.—S. C.
Calceolaria (bedding) General Tom Thumb. Watson. July 6, 1864.—S. C.
*Calceolaria bellidifolia. Veitch. June 5, 1861.—B.
Calceolaria ericoides. Veitch. September 10, 1862.—S. C.
Calceolaria plantaginea. Veitch. May 21, 1862.—B.
Calceolaria suavis. Veitch. July 2, 1862.—B.
Calendula officinalis fl. pl. Whiting. August 23, 1860.—C.
Callirhoë involucrata. W. Thompson. September 27, 1864.—C.
Calonyction sanguineum. Bull. May 16, 1865.—F. C.
Calonyction sanguineum. Bull. June 10, 1865.—S. C.
Camellia (japonica) Contessa Lavinia Maggi. Veitch. March 19, 1862.—F. C.
Camellia (jap.) Filippo Parlatore. Veitch. March 31, 1863.—F. C.
Camellia (jap.) Napoleon III. Lee. March 18, 1863.—C.

Camellia (jap.) Reine des Beautés. Standish. March 7, 1865.—F. C.
Camellia reticulata flore pleno. Standish. March 7, 1865.—F. C.
Campsidium chilense. Veitch. March 4, 1862.—F. C.
*Campylobotrys pyrophylla. Linden. June 5, 1861.—F. C.
Campylobotrys refulgens. Bull. April 9, 1861.—F. C.
Campylobotrys regalis. Linden. May 10, 1860.—F. C.
Campylobotrys smaragdina. Linden. May 10, 1860.—F. C.
Canna nigricans. Bull. June 29, 1864.—F. C.
Carnation Sir H. Havelock. Turner. July 7, 1859.—F. C.
Carnation Rose of Castile. Turner. August 2, 1860.—F. C.
Carnation Shakespere. Bragg. August 9, 1860.—F. C.
Cassiope fastigiata. Veitch. May 5, 1863.—F. C.
Cattleya Aclandi-Loddigesii. Veitch. July 1, 1863.—S. K. & F. C.
Cattleya amethystina var. Pilcher. May 2, 1865.—F. C.
Cattleya amethystoglossa. R. Warner. March 4, 1862.—F. C.
Cattleya devoniensis. Veitch. October 11, 1864.—F. C.
Cattleya Dominiana. Veitch. November 10, 1859.—F. C.
Cattleya Dominiana alba. Veitch. September 10, 1862.—S. C.
Cattleya Dominiana alba. Veitch. October 11, 1864.—F. C.
Cattleya exoniensis. Veitch. September 9, 1863.—S. C.
Cattleya exoniensis. Veitch. September 27, 1864.—F. C.
Cattleya guatemalensis. Veitch. March 26, 1861.—F. C.
Cattleya hybrida. Veitch. August 11, 1859.—C.
Cattleya hybrida picta. Veitch. August 22, 1865.—F. C.
Cattleya quinquecolor. Veitch. June 27, 1865.—F. C.
Cattleya Schilleriana var. See Lælia Schilleriana.
Cattleya sp. Veitch. August 8, 1865.—F. C.
Centaurea argentea. Bull. June 17, 1863.—B. & C.
Centaurea argentea. E. G. Henderson and Son. September 9, 1863.—F. C.
Centaurea ragusina compacta. Henderson. June 10, 1865.—F. C.
Cerasus sp. (semi-double blush). Standish. April 15, 1863.—C.
Chamærops stauracantha. Bull. March 30, 1864.—F. C.
Chameranthemum Beyrichii. R. H. S. April 22, 1862.—F. C.
Cheilanthes Borsigiana. Veitch. April 15, 1863.—F. C.
Cheiranthus Marshallii variegatus. E. G. Henderson & Son. Sept. 22, 1863.—C.
Cheiranthus Marshallii variegatus. E.G.Henderson&Son. June 10, 1865.—F. C.
Chrysanthemum Abbé Passaglia. Salter. November 11, 1862.—S. C.
Chrysanthemum Canary Bird. Salter. December 13, 1860.—C.
Chrysanthemum Caractacus. Salter. December 13, 1860.—C.
Chrysanthemum carissimum. Salter. November 6, 1861.—C.
Chrysanthemum carissimum. Salter. November 12, 1861.—S. C.
Chrysanthemum Duchess of Buckingham. Salter. November 11, 1862.—S. C.
Chrysanthemum Duchess of Wellington. Salter. November 12, 1861.—F. C.
Chrysanthemum General Slade. Salter. November 6, 1861. F. C.
Chrysanthemum Gloria Mundi. Salter. November 7, 1865.—F. C.
Chrysanthemum Golden Ball. Salter. November 7, 1865.—F. C.
Chrysanthemum Golden Beverley. Salter. November 7, 1865.—S. C.
Chrysanthemum Golden Hermine. Salter. December 13, 1860.—C.
Chrysanthemum grandiflorum. Standish. December 9, 1862.—S. C.
Chrysanthemum Hereward. Salter. November 7, 1865.—S. C.
Chrysanthemum laciniatum. Standish. November 11, 1862.—S. C.
Chrysanthemum laciniatum. Standish. December 9, 1862.—F. C.
Chrysanthemum Lady Hardinge. Salter. November 8, 1860.—F. C.
Chrysanthemum Lady H. St. Clair. Downie. November 6, 1861.—F. C.
Chrysanthemum Late Yellow Dragon. R. H. S. November 10, 1863.—C.
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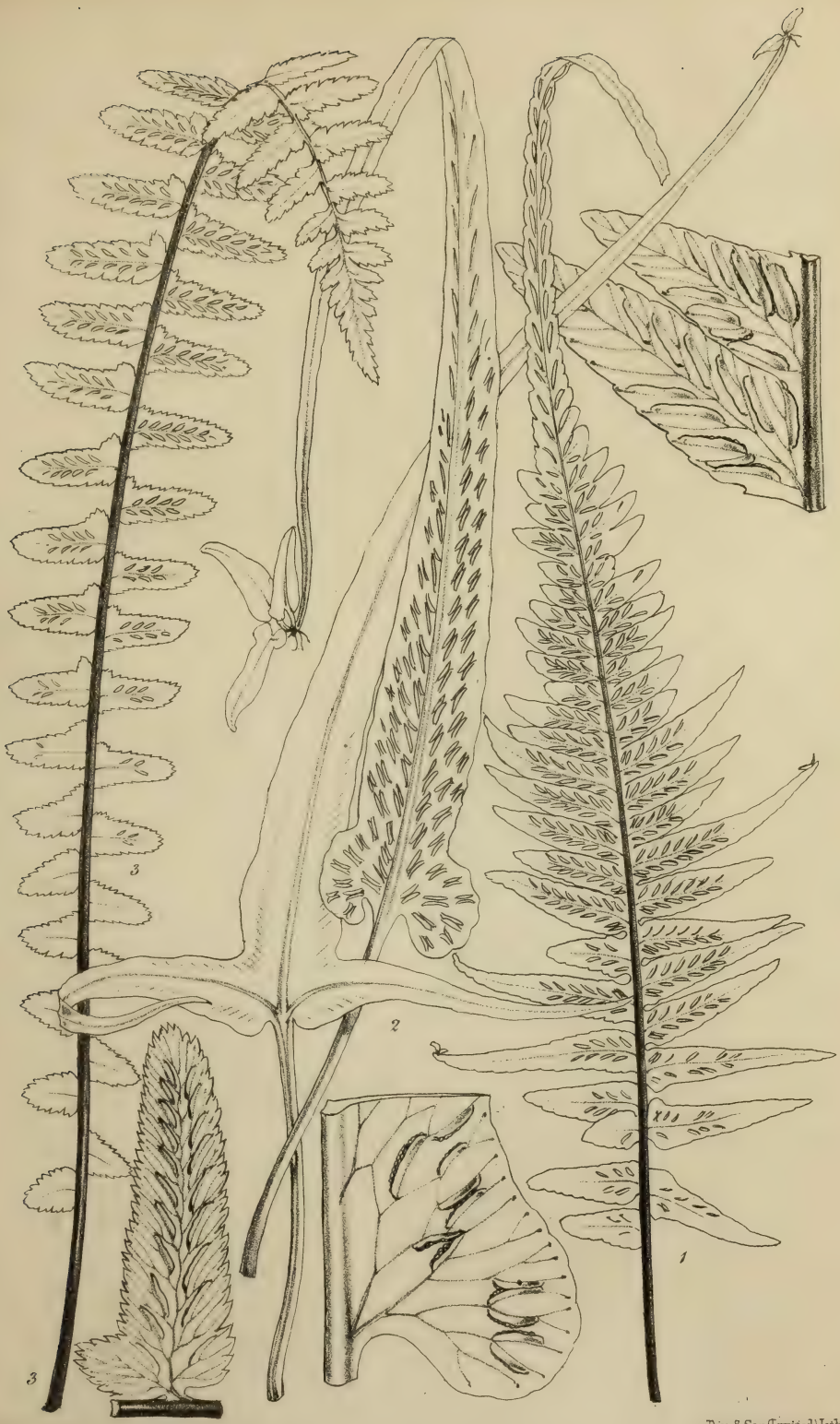

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Vol. I.] [Part 3.

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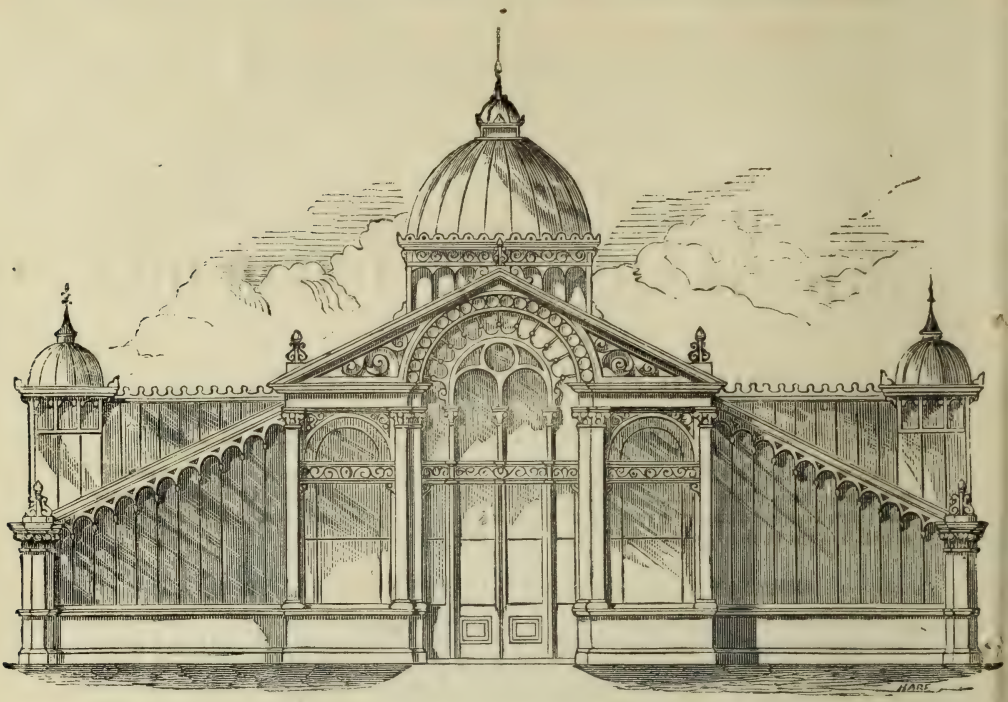

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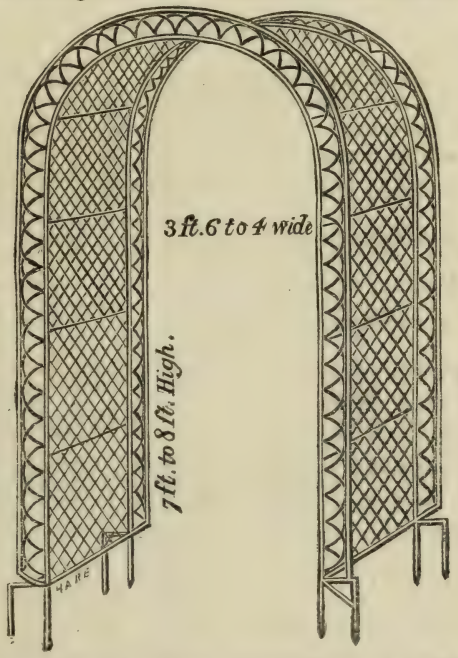

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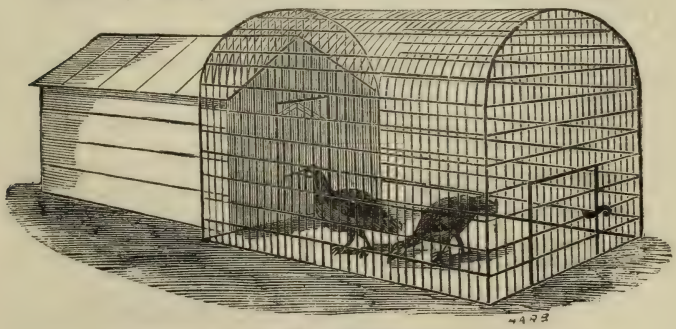

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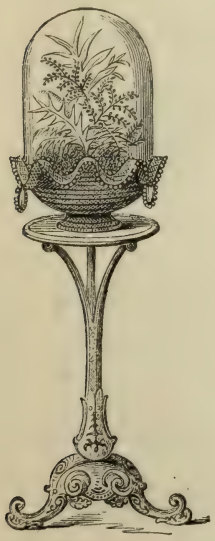

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unmanured coffee-plantations of Java last about the same time. According to Junghuhn, those on the terraces of Tjisondari, planted in 1804, had grown quite wild in 1846*, and yielded very little fruit, whereas recent plantations, made since 1836, were so luxuriant that not a sunbeam could reach the earth. The richest soil of Texas is exhausted in twenty years; the poorer in from eight to ten. This exhaustion depends not upon the exhaustion of ammonia, as asserted by Liebig and Boussingault, since, according to the observations of Baumhauer and Krocker, the contents of the soil in ammonia without any manure are far larger than could be the case were it exhausted by the growing plants; besides, ammonia, according to the observations of Kuhlmann, is naturally reproduced in the soil itself. The exhaustion of the soil depends rather on the exhaustion of the *humus*; and from this arises the possibility of restoring its fertility by means of mouldering humific dung. But where no manure is used, fertility is restored after many years by the growth and decomposition of hardy weeds which are supported by the moist innutritious soil. We find, according to Junghuhn, in Sumatra and Java abandoned plantations turning into Allang-fields (tracts overrun with species of *Saccharum*), while the inhabitants avail themselves of new plots of forest-ground. The effect of fallowing is nothing more than that of dressing ground with green weeds, which live on the water of the soil (which is poor in nutritious matter), and then form *humus* by their decomposition. The process which favours the nourishment of plants is the process of decomposition.

The assumption of Liebig, in favour of the carbonic-acid theory, that every acre of land, whether it be meadow or field, produces on an average 20 cwt. of dry vegetable matter, either as hay, wood, clover, corn, or tubers, rests upon entire ignorance of the experience of horticulture and agriculture, and is as wrong as the imperfect observations of Darwin, according to which tropical plants grow from pure sand by means of the air. Such notions can only lead to error in practice, and act injuriously on cultivation if it is conducted in accordance with such theories. All experiments on the fertility or sterility of soils, on the restoration of fertility by means of different kinds of manure, on the different produce of woods, meadows, fields, and gardens, are useless in the face of such assumptions; we may as well give up speaking of fruitful and barren land. The reckonings of pounds and hundred-

* Literally had been converted into Allangfields, a term explained below.

weights of carbon, nitrogen, and hydrogen in plants, which proceed on such fundamentally erroneous prejudices, are altogether worthless, and lead only to perplexity in things of everyday experience. The carbonic-acid theory has long retarded and confused the physiology of plants, and separated science from practice, as its theories are practically useless. Such errors and such ignorance must be expressly and clearly exposed, in order first to get rid of them and then to make progress possible to something better.

The fertility of the soil depends upon its capability of furnishing nutritive dissolvable substances, with which the surface-water may be impregnated. The *humus* must be capable of being dissolved. The insoluble condition of ulmin in peat does not allow water to extract from it nutritive matter; therefore peat-moss, though moist, is sterile without contact with the air through desiccation. The soluble humous constituents of the soil must be difficult of solution, in order to their entering into the water in a very weak proportion, since plants can receive nourishment in very weak solutions only. This is a very important point, that plants can endure no concentrated food. The richer the soil, the greater must be the quantity of moisture to attenuate properly the nutritive liquid. This is the reason why strong manure is so injurious in a dry soil. Inquiries into the injury of plants from concentrated manure, suggested the idea to Ingenhousz that dung does not enter principally into plants in the form of a solution, but must be converted into a gaseous form by decomposition, and that carbonic acid and nitrogen are the peculiar nutritive elements of plants,—a theory which cannot be made to agree with the practice of manuring.

A consequence of the reception of very attenuated nutriment is the great need of water, and the great quantity which plants consume. The strong evaporation of plants, on which we have the old statistical experiments of Hales, Duhamel, and Bonnet, as well as the more recent ones of Schübler, corresponds with this large quantity of water. A surface of water covered with *Pistia Stratiotes*, according to Isert, gives off six times as much as that which is free. The negroes in Guinea, as Forster relates, place this plant in pots of water at the doors of their houses to cool the air. Schübler found that a square foot of meadow-ground, covered with grass, gave off twice as much evaporation as 40–45 cubic inches of water. The evaporation of a moderately large potato-

plant may be reckoned at from $1\frac{1}{2}$–2 lbs. daily; so that when full-grown it consumes mostly about 60 lbs. of water. It appears that no physical drying takes place, from the fact that, as the plant in autumn withers and decays, the evaporation diminishes in an extraordinary degree.

The very attenuated condition of the humous nutritive matter in surface-water, makes an easy transmission of it possible. There exist in surface-water, besides the humous extract, perhumate of lime and ammonia, humates containing nitrogen, crenic acid and its modifications, geic acid, humic acid, ulmic acid. Instead of these acids there appear in the raw sap, after imbibition, gallic acid, acetic acid, tartaric acid, malic acid,—also, instead of humous extract, on the thickening of the raw sap, as for example in birch, a gum which assumes the colour of a humic brown. These new acids are slight modifications of the proportionate ingredients of humic acid; and it may be regarded as a proof that they arise from these, that the colourless sap containing these acids is very easily reduced through boiling to *humus*, of which it assumes the brown tint. Carbonic acid and carbonate of ammonia are never found in in raw sap. The further alterations are these:—the change of mucilage (dextrine) in the sap into grape- and cane-sugar, as also the separation, by respiration, of oxygen from the above-mentioned vegetable acids, which are the only sources of the oxygen eliminated from plants, whereby the plant assimilates not only carbon, as in the carbonic-acid theory, but at the same time the hydrogen and nitrogen of the base of the acids to form gum, sugar, wax, fatty matter, starch, and wood. The easy transformation of *humus* and of the bituminous constituents of the soil into gum and sugar, appears from the extraordinary tendency of both, especially in black soil, to form sugar in the cultivation of beet-sugar and wine. The dark bituminous lime in the Crimea produces a rich development of bunches and large berries; the black clay, early ripening and great sweetness. A large production of sugar, from which wine acquires its peculiar strength, is found only in dark clay and calcareous soil; the vineyards on the light-coloured Jura lime and white chalk yield a rich gathering, but a much weaker wine. The darker the ground is with *humus*, the greater is the quantity of sugar in the beet. Manuring with turf mouldering in the air has afforded the richest harvest of sugar-beet; the formation of sugar in beet is almost entirely prevented by ammonia and fresh animal manure.

The process of nutrition through the gradual transformation of

the humic particles dissolved in the water, the humic extracts, and humates, may be traced through every step, which is quite impossible according to the carbonic-acid theory.

The leading fact is, that the materials of the sap are imbibed from the soil with the water, but that carbonic acid and carbonate of ammonia are not found in the water, and that these substances are not found in the raw sap. Nothing is more natural than that we must find in the imbibed raw sap those materials which, after the Ingenhousz-Saussure theory, are the chief nutriment of plants. Let them come whence they will, whether from the air or from the ground; they must be present in the raw sap, if they are really the nutritive matter of plants. But since they are not found there at all, they cannot belong to this category. It is, moreover, quite impossible to explain the origin of the matters which really exist in raw (sap as gum, sugar, tartaric acid, gallic acid, malic acid) from carbonic acid and carbonate of ammonia, which, however, must be the case if that theory is true. On the contrary, the origin of all the component parts of the sap from the constituents of the water which we have enumerated, is easily and fully explicable, since the altered constituents of *humus* really exist in the sap of plants.

The near relation of humous extract to grape-sugar was pointed out by Saussure, though possibly without knowing that this was a constituent of sap, and in ignorance of the presence of dextrine and its relation to humous extract. These relations, in the perplexity of the views which have arisen from the carbonic-acid theory, are never mentioned. Sprengel, who was the first, after Saussure, to examine *humus* completely and to exhibit its different salts, set out from the notion that humic acid alone, in the form of humate of lime, was the prime nutriment. Liebig contended against this view; and it is easy to prove that neutral humate of lime is not the only or the chief nutriment of plants, since, independently of their difficulty of solution, neutral salts cannot be directly assimilated, as I have proved.

Sprengel, as well as his opponents, had overlooked the importance of humous extract and perhumates. Liebig was exasperated against the notion of the reception of humous extract by plants, since this is brown, while the juice of plants is mostly colourless. It was overlooked, however, that very weak solutions of humous extract, as those in river-water or surface-water, are often quite colourless, though when concentrated by inspissation they become brown. The clearest waters of mountain-streams

contain humous extract, since by evaporation they give a dark-brown residuum.

On the other side, Liebig was not aware that the colourless sap of such trees as birch and maple yields a brown humous residuum when evaporated, as I have proved by experiment. The brown tint, therefore, of humous extract is no argument against its imbibition from water.

The humous extract imbibed, together with humic acid and perhumates, forms the foundation for the formation of dextrine and sugar in raw sap, whence the gum is transformed into sugar. The dextrine is therefore, at first, of a humous brown, as also grape-sugar. The formation of all the constituents of sap out of the humous particles dissolved in surface-water and river-water, which may be regarded as belonging to the same category as the bituminous particles in the older alpine formations, and in consequence the process of nutrition, may therefore be regarded as incontestable. The further development of these constituents into vital sap, has been followed out by us in our treatise 'On the Discovery of the Mode of Nutrition in Plants,' through observations on the respiration of plants, according to which the oxygen given out does not arise from the decomposition of carbonic acid, but simply from the decomposition of the hydrated vegetable acids, or the mineral acids containing sulphur and phosphorus. All this was inexplicable according to the earlier notions on the nutritive power of *humus*, while the facts which have been detailed were unknown. This was the cause of the value ascribed to the carbonic-acid theory, and of the practice of manuring in gardens and in the fields being so perplexed; so that it was a matter of absolute necessity in behalf of agriculture and horticulture to get rid of the errors of this theory; while it is a subject of regret that, in botanical teaching, theories the most contrary to nature and in contradiction to all practical experience, and leading only to botanical perplexity, should be preferred. It was necessary to show previously that it is not the air, but the water alone, which conveys nourishment—that the nutritive matter is dissolved in water, by means of which it preserves its nutritive powers—and how it works.

The observations of the long-sustained vegetation in many succulent plants, as *Sedum*, *Epidendrum*, *Tradescantia*, are very deceptive as regards the carbonic-acid theory and the nourishment of plants from air. Such plants when hanging in the air, while the pots are unwatered, flourish only after having first

formed fleshy stems, shoots, leaves or other organs, and then, like a germinating potato, live at the expense of the fleshy organism, which is at length completely exhausted—which frequently happens for many generations, as the older portions die off and the young shoots are developed. This happens especially when the plants are in rich ground up to the time of flowering, when the young shoots, as also the blossoms, live from the nutritive matter laid up in the older stems. These phenomena are easily explicable from the laws of anaphytosis, though not comprehensible from those of metamorphosis. It is never possible to raise a plant from germination into a perfect individual in pure sand, in distilled water, or in pure air, without any nutriment from soil. All attempts, since the days of Bonnet and De Geer, have failed. Plants raised from seeds germinating without soil die off as soon as the nutriment which was laid up in the albumen or cotyledons is exhausted. No one has ever been able to raise plants from germinating seed, irrigated with water containing carbonic acid, or in air charged with carbonic acid; carbonic acid acts as a poison on germinating plants, as it does on animals; and it has been a mere superstition of many *savans*, causing them to dream of the possibility of such aerial nutriment, while they do not see with open eyes the real course of nutriment; and it can only be a matter of surprise that so many cleave more to the old botanical superstition than to reality.

The knowledge of the fact that so-called pure water, pure spring-water, pump-water, river-water, contains an inexhaustible supply of nutriment—the knowledge that water is the real staple of nourishment to plants, as also of the gradual development of the constituents of raw and elaborated sap from the ingredients in water, is calculated to throw light on many puzzling phenomena in vegetable physiology and culture; and it is to be hoped that it may contribute to the understanding of many circumstances of vegetable nutrition which were formerly explained artificially and unnaturally, from ignorance of circumstances which might have suggested a better explanation. The art of making water nutritious will be the true aim of horticulture and agriculture.

XXIV. Hints on Hybridizing Fruits.

By John Standish, Royal Nursery, Ascot, Berks.

Having been occupied for many years in hybridizing plants, and being very fond of it, I at length turned my attention to fruits: I commenced with grapes.

My object was to make the Muscat easier to cultivate, and increase the size of the Frontignan; also to make the large coarse kinds of a better flavour, and to improve the early ones.

I began, in the first instance, with the Muscat of Alexandria (one of the most difficult grapes to cultivate) and the Trouvéren Muscat (a remarkably free grower, but a long time in coming to maturity). It is a most delicious grape, though not so highly musked as the former. I expected to obtain grapes less difficult to cultivate, and was partly right; but I was rather astonished at the final results. It should be premised that the Trouvéren is a round grape; the Muscat of Alexandria an oval one. The latter I made the female parent; and out of thirty seedlings no two were alike. The first three that fruited were black, one being a large early grape, in shape an *oval*, with a fruit-stalk like a piece of wire; it was of a very fine flavour, with the slighest possible taste of Muscat, and hung well. This was a great success and well worth all my trouble. The other two were late ones, with large *round* berries, but nothing else remarkable about them. In the following year I fruited ten or twelve more from the same lot. One of these was of a beautiful white or golden colour, and ripened quite as soon as the Hambro'; its fine vinous flavour was exquisite, mingled as it was with a Muscat taste about half as strong as that of its parents. This also had very stiff fruit-stalks, and kept a very long time. Another, and this astonished me more than anything else, was a perfect miniature of the Muscat of Alexandria, perfectly oval, and with the strongest Muscat flavour that I ever tasted, but it was no larger than a red currant! I have not as yet discovered anything very remarkable among the others. The next experiment I tried was with General Marmora (no doubt a white seedling variety of the Hambro') crossed by Burchart's Amber Cluster. My object was to obtain a very early grape; and in this I succeeded beyond my expectations, as I got a very fine white transparent grape like the Amber Cluster, but as large as the Hambro', and fully five weeks earlier than that kind. This of course is a great gain, and what has been much wanted, as the sweetwater grapes are very bad setters, and the Muscadine is too

small for table use. The next crosses were between Blanc de Saumur and Chasselas Musqué, and Chasselas Musqué and the Citronelle. From these two crosses I have obtained the most delicious kinds that ever came under my notice, more so even than the old Frontignan and Chasselas Musqué. Two of them are sweet-scented, smelling, when the sun shines on them, like orange-blossom. Nothing I have ever seen can compare with them in flavour and productiveness; their size, too, is very large, some of them being as large again as the Frontignan.

Two other most remarkable crosses are Chasselas Musqué fertilized by the Long Noir Durant, a large oval black grape, on a very large bunch, but of an inferior flavour. This cross produced grapes of various colours, black, pink, and grizzly, but all quite round. The next time I made Long Noir Durant the female parent; and, curiously enough, the result was almost identical with the former, there not being an oval berry obtained. A very slight Muscat taste is observable in a few; but in the greater number it is not observable at all.

These are the results from about 500 seedlings that I have raised and 400 sorts that I have fruited; I have some more yet to fruit, such as the Cannon Hall crossed by the Japanese one.

As the result of my experience, I am convinced that no one can tell, in raising a lot of seedling grapes, what they will be likely to get, they vary so much.

I next directed my attention to peaches.

My object was to obtain peaches with nectarine flavour, and I am glad to say I have succeeded. The Nectarines I made the female plants were the Violet Hâtive, Pitmaston Orange, and the Stanwick, crossed with the Noblesse and Barrington peaches. Although the Violet Hâtive nectarine had a small flower, still, when crossed with the large-flowering peaches, eight out of twelve were large-flowered; and out of fifteen kinds fruited this summer, only one was a nectarine, the others were all peaches, most of them with the nectarine-flavour. Two of them were especially delicious, having a beautiful nectarine-flavour, melting like a peach, but full-coloured like the former fruit. The stones that produced the seedlings were sown in the beginning of February 1863; the greater part of them flowered in February 1864; but the fruit fell off. I now have one planted out in my peach-house that will have next June ten or twelve dozen peaches on it. It is 10 feet high, about the same width, and covered with fine-blooming wood.

XXV. On a supposed Hybrid Fern from Philadelphia. By the Rev. M. J. Berkeley, M.A., F.L.S.

I received a short time since a letter from Mr. R. Robinson Scott, of Port Kennedy, Philadelphia, enclosing a specimen accompanied by a nature-printed impression of an extremely interesting fern, which is the subject of the present communication. The letter commences as follows:—

"I take the liberty of enclosing a frond of an *Asplenium* found by me three years ago in this vicinity, eight miles from Philadelphia on the banks of the Schuylkill, growing on limestone rocks in a very rocky place. It was surrounded by *Camptosorus rhizophyllus* and *Asplenium ebeneum*. It has the characteristics of both these ferns in part. It is, as you will see, distinct from any of the species in Gray's 'Manual of the Northern United States.' Dr. Gray, after three years, admits it to be a new species; and as I had called it *ebenoides*, he agrees to adopt that name. It may not appear new to you." A single plant only was found, which is still alive; and I believe no other has since occurred.

I immediately transmitted the specimen to Sir W. J. Hooker for verification, who pronounced it entirely new to him, and the most probable instance he had yet met with of a real hybrid amongst ferns.

The species seems to combine exactly the characters of the two with which it was found in company. *Camptosorus* is distinguished from *Asplenium* by the simple frond, reticulated veins, and the sori being often approximate in pairs by their free margins, or at their apices, so as to form curved lines, whence the name is derived. Now in *Asplenium ebenoides* the veins do not anastomose at all, but are just like those of *Asplenium*; but occasionally the sori are approximate, and the free edge of the indusium is in different directions, as in *Camptosorus*. They are occasionally scolopendroid, though more frequently diplazioid*. If we examine the frond we find that, while the pinnæ are obscurely crenate instead of being finely serrate, they are frequently much more elongated and far less auricled at the base than in *A. ebeneum*, and, in fact, have some of the character which appears occasionally in the auricles of *Camptosorus*; besides which, the apex of the frond is inclined to be caudate, and, above all, both this and the more elongated pinnæ are viviparous, a character which it has in common

* A similar diversity in the direction of the sori takes place in *Lomaria punctulata* (*Scolopendrium Krebsii*, Kze.).

with *Camptosorus*. The stem, meanwhile, is black as in *A. ebeneum*; and what perhaps is of greater importance, there is some difference in the sculpture and transverse section.

If we take into consideration the fact that the genus *Camptosorus* cannot finally be separated from *Asplenium*, that the pinnæ partake quite as much of the character of the auricles of the *Camptosorus* as they do of the pinnæ of *A. ebeneum*, both as regards the ill-developed auricle and the obscure crenulations, that the tip of the frond becomes caudate as in the *Camptosorus*, while both are proliferous—that though the veins are simple and not reticulate, there is a close resemblance between the fruit—and, above all, when we reflect that only a single plant was found, and that in the company of the two ferns in question, it is very difficult to escape the conclusion that we have here a genuine hybrid.

I should have been glad to have made a comparison of the spores; but those in the single imperfect frond communicated were more or less abortive—a circumstance in favour of the hybrid theory.

It is clear that impregnation can take place only when the proembryo is very young, and the antheridia and archegonia are quite fresh, and then only when the spermatozoids have moisture in which they can move about in freedom. Crosses certainly take place between different varieties of *Gymnogramma*; or, if the forms with different-coloured meal are regarded as species, we shall have true hybrids. Once, at least, a similar circumstance has taken place amongst the party-coloured species of *Pteris*. It is, however, strange, if there are really cases of hybridizing, that intermediate forms between distinct species do not occur more frequently in cultivation, where the proembryos are often in a very favourable condition for the access of the spermatozoids of strange species. The subject is one of considerable interest, and by no means unimportant, in a practical point of view, to the cultivator.

It is, however, impossible to make any successful experiments in the hybridizing of ferns, without some definite notions as to the nature of the male and female organs. Without this any result must be the mere effect of chance. It may not, therefore, be useless, as this 'Journal' is addressed to horticulturists rather than botanists, to make a few observations on the subject, though they are entirely without novelty.

Every cultivator knows that the effect of germination in ferns is to produce a little filmy kidney-shaped body, which sends out a frond from the little notch in its margin. Few, however, in

comparison, are aware that this frond is the result of impregnation. One of the first persons to observe the production of little tubercles filled with active molecules on the underside of the filmy disks (or proembryos, as they are sometimes called) was Mr. J. Henderson, for many years gardener to Earl Fitzwilliam, and one of the most talented persons I have ever had the good fortune to reckon in the number of my friends. Other observers perceived that there were two kinds of tubercles, that one of these, the antheridia, or male organs, contained a number of minute ciliated bodies (spermatozoids), which moved about like *Infusoria* when in water, and were destined to impregnate the little embryo-cell situated at the base of the female tubercles, called pistillidia or archegonia. As these spermatozoids can move about only where there is sufficient moisture, it is obvious that a proper supply of water is an absolute necessity in the act of impregnation. Where the spores of different species of fern chance to germinate on the same limited spot, it is very possible that the spermatozoids of one species may obtain access to the embryo-cell of another, and thus a true hybrid may arise. As, however, the proembryos are for the most part closely pressed to the surface of the soil, and often bound down by little rootlets, they are not situated in very favourable circumstances for impregnation.

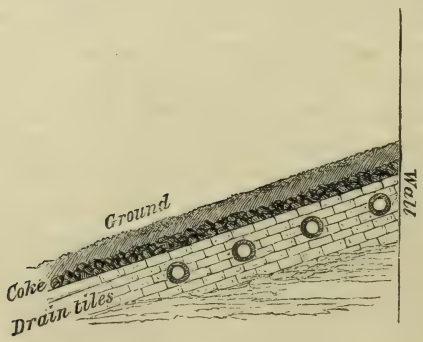
What steps, therefore, should the cultivator take to give him any chance of success in experimenting for the production of hybrid ferns? It is first absolutely necessary that he should work with species whose proembryos come to maturity at the same moment. A good pocket-lens, and ordinary accuracy of observation will easily enable him to ascertain this, and if he finds that one species comes to maturity more rapidly than another, it will be necessary for him to sow the spores a few weeks later, as the individual case may make it requisite. Having the proembryos on which he wishes to experiment in a proper condition, he must have recourse to a little delicate manipulation. That of the male parent will give him little difficulty. He will merely have to lift it up from the soil, and with a camel's-hair pencil and a small drop of water, wash off a quantity of the spermatozoids, taking care to apply his brush where there is no soil attached to the membranous body. He will then very carefully lift up the edge of the proembryo which is to supply the female parent, and touch the minute archegonia with his brush, and in all probability some of the spermatozoids of the strange plant will obtain entrance. It is true that in many cases its own spermatozoids will gain admission;

and, if so, should the same law obtain as in phænogams, that native pollen is generally more active than strange pollen, he will so far fail in his experiments; but there is still a great probability that in some cases he will be successful; and if so, he will not only have the satisfaction of solving a very interesting difficulty, but if he is a nurseryman, he is sure to be amply rewarded for his pains. A single chance variety of fern has realized to its producer more than a thousand pounds; and the probability of gain is so great, that I shall be greatly disappointed if some of our more intelligent cultivators do not set about the task in earnest.

Our Plate (Tab. II.) contains figures, of the natural size, of *Asplenium ebeneum*, Ait., *Camptosorus rhizophyllus*, Link, and *Asplenium ebenoides*, Scott, together with magnified representations of the pinnæ of the two *Asplenia*, and of a portion of the auricle of *Camptosorus*.

XXVI. Note on Border-heating. By the Rev. W. Kingsley.

The border which I have the means of heating is about 120 feet long and 10 feet wide, and is at the foot of a south wall 12 feet high, with a cross wall at each end. Four pipes run the entire length, and are in the midst of a mass of drain tiles, which are at right angles to these hot-water pipes, and lie in lines sloping upwards towards the wall, with rise enough to secure the flow of the



water, and the circulation of the hot air; upon the drain-tiles there is a layer of coke. The result gives me a temperature about that of a very gentle hotbed. I do not think I should construct

the bed in the same way again; but I had been doing a good deal of draining, and the defective tiles were good enough for this purpose. My fruit-trees are in pots, some as large as 2 feet across, but most of them 15 inches. The pots stand upon the coke or very little above it. In winter they are covered with earth and dry litter, so as to keep the frost off completely; but in the mild weather they are little more than half buried, and in the heat of summer are raised to the surface to let the sun give them as much heat as possible, and at the same time to allow the roots during the summer months to pass out of the bottoms of the pots into the ground.

The way in which I have applied the heat is, as far as I can, to encourage the growth of roots in winter, and to give a temperature to them, when the fruit is setting, above what we get from the sun in this climate, and then again, when the heat begins to fail in early autumn, to give warmth to ripen the wood and get the trees put to rest early, by their having heat and no water. Perhaps it will be best to state how the trees are heated throughout one year. During the sharp frosts of winter the hot water is kept going night and day, and I have heat enough to thaw any snow that falls, but I do not raise the temperature of the ground so high as this, but only enough to prevent the roots being so much checked in their growth as to destroy the young spongioles. Whenever the weather is mild the fire is not lighted; and by the end of February there is rarely any occasion for artificial heat. As soon, however, as the trees are in full blossom, the fire is again lighted and the heat steadily increased, and kept up till the sun warms the ground thoroughly; at this period the fire is lighted early in the morning and allowed to go out at night, and so gradually till artificial heat ceases about the middle of June, or later if the season be cold; and if a few cold days come, I give heat again during the day. During the blossoming-season the trees have a wide piece of netting over them. The trees now will have got a very great advance upon those in the open ground so far as the ripening of the fruit is concerned, but they do not open their blossoms more than a very few days before them.

Then again about the end of August I give heat during the day, and, according to the nature of the fruit, give water or withhold it, as I would encourage growth or ripen the wood. In the latter case it is necessary to cover the pots with slates or wood, to keep the rain off. My rule is to withhold water and give heat as soon as ever the fruit is ripe. When the terminal buds are fully

developed, the pots are lifted and the protruding roots cut off; the soil taken out halfway down, and the roots so far cut within a few inches of the stem; fresh soil is put in, a little water given to the tree, which is placed on the hot border again for about a couple of weeks, and then kept dry till the leaves fall and for some time after. The root-pruning is going on from the end of September to the end of October (I believe it should always be performed before the leaves fall); and by giving water and heat the trees do not flag for more than a day, and heal their wounds at once. No doubt much has to be learned here, and it will require many seasons to find out the best treatment. My object is to get the trees to cast their leaves very soon after the wood is mature, and to stop the long herbaceous growth that our damp autumns produce. I need hardly mention that close summer pinching is practised, so that very little winter pruning is needed. The dry heat soon sends the leaves off, and a long rest is given to the trees during the autumn. Some are placed under glass to ripen their fruit; and all would be, if I had sufficient extent of it; for as the trees are merely resting, a small space accommodates a great number, as they may be packed close together, and, the pots being dry, no mildew need be feared, as they have at this time plenty of air. Finally, as soon as the rains of autumn are over and the cold weather sets in, the hardy trees are again put into the hot border.

As may be expected, the flavour of the fruit is first-rate, and the additional length given to our summers allows many kinds to come to perfection that otherwise we cannot ripen. A month or six weeks is certainly thus added. We have plenty of light from our long days in summer; but, excepting for July and part of August, we have no heat in the ground, and during our long cold and wet autumns the rootlets of our trees rot and die, and they have to grow again before the trees have strength to swell their fruit. I tried three trees of Beurré Superfine last year, all grafted at the same time and equal in vigour—one in the open ground, one in the orchard-house, and one with root heat and no glass. The pears from the open border were about the size of walnuts, those from the orchard-house fair-sized and good, but those from the hot border were larger and finer than I have ever seen in the south of England: and it must be remembered that the season was one especially favourable for the open border, the trees in which had not been disturbed for three years, and were kept well mulched during the hot weather.

I first began the system of bottom heat by plunging stawberry-plants in an open hotbed and planting them out after giving them a rest in the autumn; and the result induced me to try the plan on a larger scale with very various kinds of fruit. One very useful application of the hot border is for grafting young trees: the stocks potted early in the autumn and treated like the other trees during the autumn and winter and early spring are quite vigorous enough then for grafting, and they push strongly and get no checks, and so there is no trouble in keeping back the scions till the stocks are ready.

Last year I put a row of potatoes just over one of the hot-water pipes, at the same time that the ordinary crop was planted. Some time afterwards my man (who is not learned in gardening though thoroughly trustworthy and interested in his work) came to me and said, "The taties on the hot pipes are not thriving like those in the grund." I asked him what made him think so; and then it came out that he was judging by the tops. However, in a few days more the ground over those in heat swelled and broke up like mole-hills, and we had in the beginning of June the best potatoes I have had at any time since I came here six years ago.

I am now making preparations for giving bottom heat with glass over head, and I shall be very glad to work out any systematic experiments on the use of heat without glass, glass without heat, and heat and glass united; but I am sure that unless our experiments are based upon some principle to begin with, they will never be of value for making correct inductions: and so I shall be glad to give some time to experiments of a scientific kind in order to obtain results that, as an individual, I should never live long enough to see, but which by the united efforts of many may be arrived at in a very few seasons. So please do not think that in the account I am giving you, I suppose my system to be anything more than an experiment, or that I should consider it otherwise than a hasty induction to declare from it that the principles which for the sake of clearness I have stated, are in anywise *proved* to be correct.

South Kilvington,
Thirsk.

XXVII. Note on the cultivation of *Amherstia nobilis*. By Mr. Taplin, gardener to His Grace the Duke of Devonshire, at Chatsworth.

The age of the plant is probably about twenty-five years; the height 5 feet, the circumference 45 feet. It is planted out in a house specially built for it, in a bed of soil about 6 feet square and 3 feet deep, raised above the level of the surrounding path. The soil is warmed to a temperature of about 85° by pipes underneath.

The soil is good open loam and sand, to allow free passage for water, of which it requires a large quantity during the growing-season, both on the surface and also poured down a perpendicular opening to the heating pipes below, so as to give moisture with bottom heat. There is sufficient piping to keep the top heat at 70° even in severe weather. The following is the mode of treatment.

When the plant has flowered, a portion of the old soil is removed from the surface without disturbing the roots, and some nice fresh soil added; it will soon commence growing, when it must be kept shaded from the bright sun; for the young growth especially is very impatient of the sun's rays. I keep the plant sprinkled twice each day, and evaporating-pans constantly full of water. The plant generally makes two growths in the summer. The growing-temperature is 75° at night, and from 85° to 100° by day.

In the autumn, when the wood begins to ripen, I give less shade, and reduce the supply of water, for about three months, but do not allow it to be very dry, and keep some of the evaporating-troughs full of water during the winter.

Winter temperature 70° to 75°. In January I give more water, and the plant will begin to show flower by the end of the month, the flowers pushing out very rapidly and continuing to open for five or six weeks.

There have been this year fifty-five racemes of bloom open, and there are three more to open, in all fifty-eight, with from ten to sixteen flowers on each raceme. The greatest number of racemes with flowers open at one time was about twenty.

XXVIII. Report on Peach- and Nectarine-Trees at Chatsworth. By Mr. Robert Thompson, Royal Horticultural Society's Gardens, Chiswick. With a Note by the Editor.

An application was made by the Duke of Devonshire to the Horticultural Society to send down some one without delay to inspect some Peach- and Nectarine-trees which were in a very unsatisfactory condition at Chatsworth. Mr. Thompson was accordingly sent down; and the following report is the result of his inspection. The case was afterwards submitted to the editor, who has therefore appended a note, founded not on personal observation of the trees themselves, but on specimens forwarded at the desire of the Duke, who has kindly sanctioned the publication of the Report.

The trees which form the subject of this Report are planted in a peach-house, and are old; and one of them in particular is remarkable for its size. It is considered the largest peach-tree in England; and as regards the extent and thickness of its branches is perhaps unequalled in the world. It appears to be upwards of fifty years old. Its limbs seem to be the original ones from the stem; they are very thick, and may be termed massive. The peach is not naturally a long-lived tree compared with the apple, pear, vine, &c.; nevertheless this one has borne well till lately, as the others have likewise done in the same house.

The present state of these trees is not satisfactory. The shoots are weak, and seem not likely to be able to push buds for fruit, or young shoots and leaves sufficient to carry on the vegetation of the trees. Although weakly, they are endeavouring to push even now some blossom-buds; but instead of these buds becoming of a plump, roundish-ovate form, they are slender and elongated; and at the same time the parts of fructification are further advanced than they ought to be. The stamens exhibit the yellow colour which we expect to see in buds that are plump and ready to burst into flower. This indicates weakness; for the last efforts of a sickly plant are more especially directed towards the parts of fructification, if the rudiments of such have been formed, as they have been partially in this case. The shoots are too weak to nourish the blossom-buds, or even the wood-buds; the former in consequence must prove abortive, and the latter unable to push any but still weaker shoots. In the usual mode of managing the peach-tree, weakly shoots are frequently to be met with amongst others vigorous enough; but in the trees in question a

general and nearly uniform degree of weakness prevails, to an extent that renders it doubtful whether they will survive. At all events they cannot bear a good crop of fruit.

This unsatisfactory condition of the trees is much to be regretted, and the cause has been made the subject of careful examination and inquiry. The first question that naturally arises is, can it be ascribed to mismanagement at any time?

Without knowing the particulars of the mode of management adopted in former years, it is certain it could not have been bad, but rather the contrary; otherwise the trees could not have lived so long or borne so well.

There appears to have been nothing wrong in their recent management, nor anything in it that could reduce the trees to their present weakly condition. The borders have been top-dressed with fresh soil. The pruning has been properly enough performed under the circumstances; for, owing to the weakness of the shoots, no one could prune them satisfactorily. The gardener, it could be seen, had been in difficulties between shortening the shoots to the lowest wood-bud at the base with the view of making it push a stronger shoot for future bearing, in which case it would have been said that he had cut away all the bearing wood, or, anxious to save this, in case some of the shoots might perchance produce some fruit, leaving them longer than he otherwise would have done if there had been a sufficiency of vigorous shoots. Then it may be supposed that the production of these weak shoots is the result of bad pruning in the previous season; but this does not appear, from the sections yet to be seen, to have been the case; besides, bad pruning in the year before last in healthy trees might have produced irregularities of growth, some shoots too weak, others too strong, but not shoots so uniformly weak as those now under consideration are.

There being nothing wrong in the management of the trees to which their present condition can be attributed, there is room for conjecture that the evil has arisen from some other cause. It may be supposed to have been occasioned by injuries inflicted intentionally; and although it is improbable that any one would be inclined to do so in this instance, yet as it is known that trees may be killed easily and secretly, a few remarks may be offered on the subject.

It can be proved that the present condition of the trees could not be secretly brought on, nor, indeed, by any means which human skill could employ or malice invent. It is well known that there are

many substances by which trees can be readily killed—for instance, common salt applied to the roots. This substance would soon kill the whole tree, but so quickly that it would be seen that some such substance had been applied. Any ignorant person could kill plants outright by certain applications; but great skill and abundant opportunities would be requisite to mitigate the doses so as not to kill instantly, but cause a lingering, weakly growth, by small doses frequently applied; and this could not be done without stirring the soil of the border in a way that would lead to certain discovery.

It can be seen that the branches have been done over with a composition; but it is only such as is usually applied against insects, with impunity. The ingredients were soft soap, tobacco-water, sulphur, and water, with a little glue and loam to make the mixture adhere. The proportions were by no means too strong; besides, it was applied after the foliage had dropped, whereas the weakly shoots must have been produced in the course of the summer, whilst the leaves were in action to elaborate sap; for through the leaves, the shoots, and all the solid parts of the tree, even an oak, the sap must pass in a fluid state.

Nothing could have affected these trees in such a peculiarly injurious way except some kind of MILDEW. Of this I have no doubt. The species of mildew are very numerous, and of late have proved very destructive,—for example, that causing the vine-disease, or vine-mildew (*Oïdium Tuckeri*), and another the potato-disease (*Botrytis infestans*). These, and particularly the latter, have produced disastrous effects; and that which attacks the roots of trees is allied to these; it is probably the *Byssus*, or *Racodium Rhizophila* of the French, which they say occurs more frequently than is generally supposed, and attacks the roots of peaches, apples, and roses, and many other plants, and kills them. They describe it as one of the most perfidious enemies which we know; nothing announces its presence but death. I cannot however pretend to determine the name of the species of mildew which unfortunately attacked the trees at Chatsworth.

NOTE.

At the request of Mr. Thompson, specimens of the young wood and roots of the several trees, and soil in which they were growing, were submitted to Mr. Berkeley, together with a sample of the compost which is used on the borders in the peach-house. The condition of the first has been sufficiently described by Mr.

Thompson. That of the roots was extremely bad; many were quite decayed and infested with the mycelium of some fungus, which in some cases penetrated the tissues; but whether the original cause of mischief, or merely consequent on decay, it was impossible to say. Some of the roots in two of the trees were studded with irregular knots covered with a thick bark and producing on their surface a quantity of lenticels, and in one or two instances two or three abortive adventitious buds. When these were examined in the fresh state, no cavities were discovered in the wood such as will be mentioned hereafter; but on reexamination after becoming perfectly dry, the wood appears to be full of the little cavities just mentioned; and the soil, equally dry, is now full of fungous threads.

The compost consisted mainly of half-charred turf from a loamy field, which contained much undecomposed vegetable matter, and parts of it traversed with extremely delicate fungous threads sparingly mixed with spores, and certainly a highly dangerous matter to apply to the roots of trees. There was no indication either as regarded colour or smell that any injurious chemical matter had been used; and the conclusion was that the trees had suffered from mycelium, which is one of the most deadly enemies of the gardener.

On speaking of the case to Dr. Hogg, who is well acquainted with Chatsworth, he remarked that some years ago the trees were in very much the same condition in consequence of the harsh and sodden nature of the soil, and that careful root-pruning and an entire renewal with good compost completely reestablished them. This, however, is not inconsistent with the view which has been taken on actual personal inspection, and examination of the specimens transmitted; but it gives some hope that the mischief may be remedied, and is certainly highly suggestive to cultivators.

Some weeks since, a few twigs were sent, by a correspondent, to the office of the 'Gardener's Chronicle,' from some peach-trees in a house, in which the terminal bud died and communicated a taint to the subjacent tissues, so as to cause ultimately the death of the shoot. Immediately beneath the bud were a number of minute cavities in the wood, as appeared in specimens which were taken to one of the Tuesday Meetings at South Kensington.

This character was particularly striking, because it formed one of the most marked peculiarities in a formidable disease which was lately submitted to Messrs. Rivers, but of which they were wholly ignorant. The trees were on a south wall, in the Isle of Wight, and were either wholly or partially affected. In the latter case

the roots, which corresponded with the part which ultimately died, were like those in the trees at Chatsworth, studded with knots covered with thick bark, but instead of producing lenticels were rough with abortive adventitious buds, which soon decayed and communicated the seeds of decomposition to the subjacent tissues. The wood beneath the bark was full of little cavities, precisely of the same nature as those beneath the buds in the case just mentioned, as was demonstrable in the specimens exhibited at South Kensington. It was stated, then, that there were no cavities in the knots of the Chatsworth roots; but though this was true at first, a fresh examination of them a few days after when dry, showed exactly similar cells. An examination with the microscope did not show the presence in either case of fungous threads in the knots; but every microscopist knows how difficult it is in many cases to determine accurately whether spawn is present or no.

After the case was brought forward on the 1st of May, it was remarked, by a gentleman present at the Meeting, that no cause had been assigned for the malady—a reproach which may be made in animal as well as vegetable pathology. In how very few cases comparatively is it possible to assign a cause for the origination of disease, even in those cases where their treatment is perfectly understood. Diseases, of various kinds, are transmissible by contagion, and when once established do not readily die out, but sometimes remain unaltered for centuries. But in most instances who can assign the original cause? So is it with the maladies of plants. Where they spring evidently from parasitic fungi, the cause is often clear enough, and the remedy occasionally distinct, though more frequently hopeless; but there are doubtless many diseases to which vegetables are subject whose origin will ever remain unknown. The chlorotic disease in cucumbers, for example, which has been so prevalent for some years, has baffled every inquiry into its cause or origin.

In conclusion it may be well to call attention to a case of canker in apple-trees, which is closely analogous to that in the Isle-of-Wight peach-trees, though it is the trunk which is attacked and not the roots. Certain disks appear on the bark, which swells and cracks, and at length give rise to a multitude of adventitious roots. The tender spongelets of these soon decay, and the mischief spreads in every direction till the tree falls a sacrifice. This is only one of various forms of canker, and certainly not the most common one; but it is clearly deserving of especial notice here, from its peculiar characters.

XXIX. Note on a Disease in Celery.
By the Rev. M. J. Berkeley, M.A., F.L.S.

Some celery-leaves were brought up to South Kensington on the 7th of last September by Mr. Wheeler, with the information that not only was his own crop almost a failure, but plants which he had sent to a friend in Cambridgeshire were similarly affected, while other plants in the same garden, which came from a different source, were healthy. It was at once clear that some fungus had affected the plants; and it is well known that vegetables are often attacked by parasitic fungi in a very early stage of growth, and that in the case of perennial plants, as, for example, the Violet and *Achillæa Ptarmica*, when once they are affected, the disease may recur for an indefinite period.

On the 4th of October a whole plant was brought up, which was thoroughly infested with fungus, and was in consequence spongy and flaccid, and utterly unfit for food. The bases of the leaves, however, were not distorted. The root, moreover, was hard and woody.

It is the first time that I have ever seen celery attacked in this way; and the fungus which is the cause of the evil appears to be uncommon. It is figured in the sixth posthumous volume of of Corda's 'Icones,' with the characters—

> *Sori* large, confluent, rufous brown, pulverulent, seated on annular yellowish spots; *spores* oblong, uniseptate, constricted in the middle with an even thick epispore; *nucleus* hollow, somewhat plicate; *pedicel* short, attenuated, white.

It is said to occur, but very rarely, in gardens at Prague. Specimens are published by Rabenhorst (no. 693) under the name of *Puccinia Apii*, Fresenius (gathered at Frankfort-on-Maine by Fresenius), and by Fuckel in 'Fungi Rhenani exsiccati' (no. 362). The parasite is in turn attacked by a minute parasite *Darluca filum*, which has minute fusiform uniseptate spores ·0006 of an inch long, furnished at either end with a short hyaline point.

There is another parasite on celery-leaves which it may be well to record, though it has not hitherto occurred in this country. Specimens are published by Fuckel (no. 117) under the name of *Cercospora penicillata*, Fresenius. The fungus grows, but rarely, on dry discoloured spots on the leaves, and has very long multiseptate spores, by which character he says it is distinguished from *Passalora* of Cesati.

Fungi were not, however, the only enemies of celery-plants last year; the celery-fly was very active about the leaves, doing a

great deal of mischief; and some insect, whose perfect state I was unable to secure, attacked in great numbers the heart of the plants, reducing it rapidly into a loathsome pulp, no indications of the disease appearing till the crop was raised for sale.

XXX. On certain species and varieties of the Genera *Cratægus* and *Pyrus* as Ornamental Plants. By Mr. Thomas Kier Shortt.

It has long been to me a matter of wonder that these remarkably beautiful genera are so much neglected in ornamental planting; the only reason I can suggest is the general ignorance of gardeners as to their merits, as not one in fifty can correctly name ten species or varieties if laid before them.

It matters not whether we take them for their flowers, fruit, or foliage; for selections can be made from the three classes, where the particular object can be attained, or two or more combined.

Among those remarkable for the beauty of their flowers *Cratægus Oxyacantha punicea* with its single scarlet flowers, *C. O. punicea flore pleno* or double deep-rose-coloured thorn, *C. O. multiplex* or double white, *C. O. præcox* or the Glastonbury-thorn (which frequently flowers at Christmas) may be mentioned. Nor is the common Hawthorn planted singly in anything like the frequency it deserves. Any one who has seen the numerous large specimens in the Phœnix Park, Dublin, when in full bloom, will own they never saw a more beautiful sight in nature; and several of the American species may be scattered about with great advantage. *C. lobata* (=*Mespilus grandiflora*, Sm.) should not be omitted.

Among the *Pyrus* tribe, some of the varieties of the common crab as seen in the copses and hedges, or standing singly in our parks, are well worthy of notice, and are only exceeded by the lovely *Pyrus Malus spectabilis* and *P. M. coronaria* in the size, fragrance, and colour of their blossoms. Nor must we omit the *Pyrus japonica*, which, when well grown, is decidedly one of our most ornamental shrubs.

In the class conspicuous for their fruit we have a much wider scope for selection. *Cratægus coccinea corallina*, or large coral-red, *C. glandulosa*, large deep red, *C. punctata brevispina*, dark crimson, *C. nigra*, small bright black, *C. Aronia*, large light yellow; *C. Oxya-*

cantha baccata aurea, small yellow, *C. Pyracantha* and *C. P. crenulata*, with their dense clusters of small crimson and orange fruit, are excellent examples.

Pyrus contributes more especially *Pyrus Malus prunifolia*, with fruit of a light scarlet, covered with a delicate bloom, *P. Malus hyemalis*, with large red fruit which hangs on the tree all the winter, *P. nigra*, with large deep purplish-bronze or almost black fruit, *P. Malus tatarica*, with large fruit, beautifully striped with yellow and scarlet, *P. aucuparia* (the mountain-ash), with its dense clusters of scarlet berries, and the yellow variety, *P. spuria pendula*, with fruit of a deep purple, and *P. arbutifolia melanocarpa*, whose fruit is small and of a bright black.

The foliage of the two genera differs in a remarkable degree, and is often as conspicuous for beauty as their flowers and fruit.

In *Cratægus*, the large cordate-lobed acutely serrated leaves of *C. coccinea maxima*, and the deeply lobed leaves of *C. Layii*, are a fine contrast; these grouped with *C. Lambertiana*, with its large oval, lanceolate, notched leaves, and *C. Aronia*, with wedge-shaped, three-cleft, and pubescent leaves, are worthy a place in every collection.

Pyrus, again, contains some beautiful varieties of foliage, *P. sinensis* taking the front rank, with its large thick shining deep-green leaves, and massive robust habit of growth. *Pyrus arbutifolia serotina* with its *Arbutus*-shaped leaves, assuming in autumn a deep crimson, but only surpassed by the gorgeous colours seen in the foliage of trees on the banks of the Potomac and Delaware, *P. communis variegata*, and *P. c. amygdaliformis*, with its beautiful narrow silvery foliage, are all worthy of cultivation; nor need we exclude our own native *Pyrus Aria*, which is always a beautiful object, especially when waving under a breeze.

The following list may be useful, as giving at one view some of the species most worthy of notice, whether as regards flowers, fruit, or foliage.

1. Conspicuous for Flowers.

(Where space is limited, those marked with an asterisk are most eligible.)

**Cratægus Oxyacantha multiplex* (double white).
*—— —— *punicea* (single scarlet).
*—— —— —— *flore pleno* (double pink).
—— —— *præcox* (single white, very early).
—— *glandulosa* (flowers white, very large).
*—— *lobata* (flowers white, very large).

**Pyrus sinensis* (large, sweet-scented).
—— *Malus* (the wild crab, deep pink).
—— —— *prunifolia* (deep pink).
—— *japonica* (scarlet or white).

2. Conspicuous for Fruit.

Cratægus coccinea corallina (deep coral-red).
*—— —— *maxima* (large, deep red).
*—— *glandulosa* (large, fine, deep red).
*—— *punctata rubra* (very large, bright red).
—— —— *brevispina* (large, long, deep crimson).
—— *nigra* (bright black, small).
—— *purpurea altaica* (small, transparent scarlet).
—— *flava lobata* (large, yellow, depressed).
*—— *Aronia* (very large, light yellow).
—— *Pyracantha* (evergreen, fruit orange-red).
Pyrus sinensis (large, russety green).
*—— *Malus prunifolia* (light scarlet).
*—— —— *rosea* (bright scarlet).
—— —— *hyemalis* (red, hangs all winter).
—— —— *nigra* (large, dark bronze or black).
*—— —— *tatarica* (large, yellow striped with scarlet).
*—— *Aucuparia fructu luteo* (deep yellow).
—— *spuria pendula* (small, deep purple).
*—— *arbutifolia melanocarpa* (bright black).

3. Conspicuous for Foliage.

Cratægus coccinea maxima (large, cordate).
*—— *glandulosa* (large, lobed, acutely serrated).
*—— *Layii* (large, deeply lobed; lobes pointed).
—— *Aronia* (wedge-shaped, 3-cleft, pubescent).
Pyrus communis fol. var. (variegated).
*—— —— *amygdaliformis* (narrow, bright silvery).
*—— *sinensis* (very large, thick, bright green).
*—— *arbutifolia serotina* (deep crimson in autumn).

4. Foliage and Fruit combined.

Cratægus coccinea corallina.
—— *punctata rubra.*
—— —— *brevispina.*

Cratægus purpurea altaica.
—— *Aronia.*
—— *tanacetifolia.*
—— *Pyracantha.*
—— —— *crenulata.*
Pyrus communis fol. var.
—— *Malus.*
—— ——*fol. var.*
—— *sinensis.*
—— *Aucuparia pendula.*
—— ——*fructu luteo.*
—— *spuria pendula.*
—— *arbutifolia serotina.*
—— *Chamæmespilus.*

XXXI. On two species of *Rudgea*.
By the Rev. M. J. Berkeley, M.A., F.L.S.

The genus *Rudgea*, which at the time it was proposed by Salisbury consisted of two species only, is now of some magnitude, having received a number of outcasts from other genera, especially *Coffea* and *Psychotria*. The points of distinction are so well indicated in a paper by Mr. Bentham, in the twenty-third volume of the 'Linnæa,' a journal which is not accessible to every one, that it can scarcely be unacceptable to give a translation of the passage at length.

"In *Coffea arabica* and the few species really congeneric, the æstivation of the corolla is contortoplicate, and the ovules fixed laterally to the dissepiment; in *Rudgea* the æstivation of the corolla is valvate, and the ovules erect from the base of the cells, as in *Psychotria* and *Palicourea*. The genus *Rudgea* is not easily capable of strict distinction from these in words, and is connected with either by a few intermediate species. Most, however, are easily distinguished by the habit, stipules, calyx, corolla, and fruit. The stipules, at least the upper ones, are adorned with frequent cartilaginous cilia or lacerations, either marginal or dorsal, which at length frequently vanish. The teeth of the calyx are distinct in all the species with which I am acquainted, with the exception of *Rudgea longiflora* alone, where they are connected at the base into a short cup-shaped body. The corolla is infundibuliform, some-

times with a very long nearly equal tube, sometimes shorter and wider above, divided into four or five laciniæ, the number very frequently varying in the same specimen, with a valvate æstivation, and commonly more or less thickened and cucullate at the apex, and furnished at the back beneath the tip with a tubercle or horn; more rarely obtuse, with the margin merely slightly inflected. The stamens are generally exserted, the anthers supported on more or less distinct filaments. The ovary is perfectly bilocular, the ovules distinct from the dissepiment, obovate, erect from the base of the cells. The berry obovate or globose, crowned with the teeth of the calyx, or umbilicate when these are obliterated, even, or more rarely angular with a few acute ribs; frequently but not always furrowed, with interlongitudinal crustaceous nuclei as in *Psychotria*. The seeds are erect from the base of the cells, with a flat side; I have however seen perfect seeds in a few species only. The inflorescence, in all which have been observed, is terminal, the branches often opposite, simple or di-trichotomous, the ultimate one sometimes three-flowered, sometimes capitate 5–∞-flowered."

Of the two species described below, one was exhibited by Mr. Bull, on the 17th of April, which has since been ascertained to be *Psychotria leucocephala*, Brongn., *Rudgea macrophylla*, Benth.; the other attracted much attention at the late International Horticultural Exhibition, whither it was sent by Mr. Linden under the name of *Psychotria nivosa*, but is assuredly a *Rudgea*, and apparently an undescribed species. It belongs evidently to Mr. Bentham's division *Eriantheæ*, and is near to *Rudgea longiflora*, Benth., and *R. magnoliæflora*, Benth. (*Coffea magnoliæflora*, Cham.), but especially the latter, with which it agrees in the elongated and extremely villous corolla; but which seems from the description, made from a single specimen, with the flowers not yet expanded, which I have had no opportunity of seeing, to differ in its smooth stem, and probably in the stipules, inflorescence, and other points. The leaves also seem to be on a much larger scale. It should however be remarked that there is no great difference of geographical position; Linden's plant is from Paranas, and that gathered by Sellow in intertropical Brazil. It also agrees in some points with *Rudgea eriantha*, Benth. (*Coffea eriantha*, Gard. in 'Lond. Journ. of Bot.,' vol. i. p. 534), especially in the foliage; but the villosity of the inflorescence is very different.

1. RUDGEA MACROPHYLLA, Benth., in Linn. 1850, vol. xxiii. p. 456. *Psychotria leucocephala*, Brongn. in Hort. Par. 1843; Lemaire, Jardin-Fleuriste, 1853, vol. iii. tab. 292, 293. *Psychotria leucantha*, Hort. Belg.

Discovered by Messrs. Guillemin and Houllet, on the mountains about Rio Janeiro, who introduced living plants into Paris. Specimens were also gathered in, or very near to, the same locality by Gardner, Raddi, and others. It is correctly said by Brongniart to differ from *Rudgea* as formerly characterized in the exserted stamens; but there are other true *Rudgeæ* in which this character occurs.

Stem erect, internodes about 3½ inches long, tetragonous; leaves 9 inches long, thick, coriaceous, shining, oblongo-lanceolate or obovate, narrowed below and cordate, slightly undulated; midrib strong, with many pinnate nerves; petiole short; stipules intrapetiolar, persistent, connate, sheathing, closely pressed to the stem except where the inflorescence is given off, the back furnished with two rows of rigid linear sometimes flattened processes, the margin prolonged beyond the processes; inflorescence terminal, on a short stalk, subcapitate, composed of several fascicles of extremely crowded sessile flowers, which are closely united to each other by small bractes, the lowest of which somewhat resemble the stipules, the upper bifid or simply linear; calyx 5-cleft, with one or two intermediate processes of variable size and length, broader at the base, their edge scarious and shortly ciliated, white where it adheres to the ovary; tube of corolla long, gradually enlarged above; limb 5-cleft, divisions acute, thick, white, uncinate at the apex; stamens 5, exserted; annular disk conical; style ¾ inch long; bifid at the apex. Ovarium adnate, bilocular; ovules solitary in each cell, erect, springing from the base. Berry obovate, truncate above, 6–7 lines long.

This species belongs to the division *Grandes* of Bentham, and is a very desirable object of cultivation, from the beauty of the leaves and the large white masses of flowers.

2. RUDGEA NIVOSA (Linden, sub *Psychotria*).

Received by Monsieur Linden, from Paranas.

Stem erect, cylindrical; internodes at first densely tomentose; leaves shining above, whitish and minutely tomentose below, oblongo-elliptic, coriaceous, slightly cordate at the base, resembling those of *Prunus Laurocerasus*; petioles short, clothed with short brownish down; stipules intrapetiolar, connate below, distinct above, adorned at the back with two rows of acute bristle-like processes; inflorescence terminal; peduncle snow-white, woolly, as is the whole of the calyx and corolla, divided above into 4 or 5 branches which bear a few

imperfectly cymose flowers, so as to form a lax head; calyx quadrifid, with distinct laciniæ; tube of the corolla an inch or more long, dilated above; limb quadrifid, laciniæ with a long horn-like process below the apex, smooth within, externally clothed everywhere with long jointed pointed hairs, the walls of which are marked with close spiral lines, and granulated towards the apex; stamens four, included, their filaments connate below with the tube of the corolla, but free for a short space above; pollen white, globose; ovary extremely short, but with two cells and ovules; annular disk minute; style long, thread-shaped, bifid at the apex.

The ovary is so short that I was at first inclined to think that, as occasionally in some allies, it was imperfect. I have to thank Monsieur Linden for allowing me to take a description, and to the attendant on his collection for enabling me to make a minute examination.

XXXII. A short Note on the state of Horticulture in Hungary. By Miles Berkeley, Esq.

Some observations from an eye-witness of the condition of horticulture in one of the most beautiful countries of the south-east of Europe can scarcely be unacceptable when it is considered how very little, comparatively, is known of a country which contains no less than 6155 geographical square miles. My residence for three years was at Szúd, in the neighbourhood of Schemnitz; but I have had frequent opportunities of visiting other parts of the country, to which my observations equally apply.

As the vegetables more commonly in use, including tomatoes, are supplied almost entirely by field cultivation, the kitchen-garden is by no means the prominent object which it is in England. The vineyards supply the finer kinds of fruit—as peaches, nectarines, apricots, medlars, and figs; while different kinds of gourds are planted along the boundaries, forming a loose kind of enclosure. Some of these are cultivated merely as food for cattle; others are used as vegetable marrows, amongst which is a very superior one known under the name of Spargel-Kürbiss (or Asparagus Pumpkin), while others are a favourite food when baked. *Cucurbita melanosperma* is amongst the kinds which are cultivated; but it does not appear that they have, at least north of the Danube, any variety of *Cucurbita moschata*, which almost supersedes the vegetable marrow where the heat is sufficient.

The commoner kinds of fruit, as cherries, mulberries, walnuts, strawberries, and raspberries, grow on the mountains, on the road-side, or by every ditch or waste piece of ground; so that even in bad years the proprietor has a constant supply without any pains, and in good years he merely gathers the best, and lets every one, after he is served, take what he pleases. In fact travellers, or indeed every passer-by, help themselves for the most part without any let or hinderance. The orchard is almost exclusively devoted to the cultivation of plums (which are grown in enormous quantities) for drying, a process which is performed on hurdles in a low-heated oven. The varieties, however, in cultivation are very inferior to those which yield the better kinds of French plums of commerce. A few pears and apples are grown, but of very inferior quality. Wall-fruit is unknown. It cannot be expected, therefore, that much attention should be devoted to the kitchen-garden, though a few hotbeds, as in England, are made for the rearing of brinjals and other plants which require to be brought forward artificially. The better kinds of melons and cucumbers are grown on the open ground in the garden, while the large coarser kinds and water-melons (which are of excellent quality) are consigned to the field. Cabbages, carrots, the different kinds of kidney beans, some of which are of very superior quality, and a few other vegetables have garden culture. A very small kind of pulse, known under the name of rice-beans, used frequently for soup, and belonging apparently to the genus *Dolichos*, with one or two other subtropical varieties, is an object of cultivation. Fruit-trees, with the exception of a few apricots and plums, are for the most part excluded; as regards those beyond the pale, scarcely anything is done in the way of pruning beyond chopping off the dead or useless branches, which takes place in April.

The flower-garden is of far more importance, and is in general large and laid out in beds of various shapes in the midst of a lawn, which is, however, not kept close-shaved as in England, but is mowed three times only in the year, as the proprietor depends on the grass-plots for the maintenance of his cows in summer, the meadows being devoted to the production of hay for the winter food of the sheep. It is mowed by the cowherds, who carry it away on a curiously shaped cart drawn by two donkeys: the cart is made without a piece of iron or a single nail. The paths are made of silt, which is brought from the larger rivers, and the beds separated from the grass by a very prettily worked edging of wickerwork, the bark of the osiers having first been carefully

removed. The flowers are of much the same sorts as those cultivated in England, though, from the severity of the winter, some perennials which succeed with us do not admit of out-door cultivation. Numerous white chairs and tables are scattered every where, which, with the wickerwork of the borders, give the ground a gay appearance.

What, however, strikes an English eye the most is the entire absence, in most Hungarian gardens, of anything like evergreens; for there are no yews, no cedars, no firs, no holly trees, nor anything that is green in winter; in consequence of which there is a comparative want of contrast in summer, and an appearance of utter desolation in winter. In summer the foliage is afforded chiefly by acacias, gleditschias, poplars, and occasionally oaks.

The garden is cultivated by peasant girls under the superintendence of the gardener, who are paid 2*d.* a day. They always go about without shoes or stockings, as the only time when the Hungarian peasants wear shoes, which are considered a luxury, is when they are at church, or when the snow is on the ground. As was formerly the case almost universally in Scotland, the boots or shoes are carried in the hand, and put on only when they arrive at the church-door.

The tools generally used in a Hungarian garden are very large heart-shaped hoes and wooden rakes. A spade is very seldom seen. The wheelbarrow holds no more than a bushel, and is made entirely without iron, the wheel consisting of a disk of board, and the spindle of a piece of juniper or other tough wood.

The most prominent feature on entering a Hungarian gentleman's garden is the hothouses, which, though not as magnificent as they are frequently in our own gardens, are on an extensive scale, adapted to the exigencies of the climate. They are of three different kinds: 1, the Szaporító Ház (the slip- or propagating-house); 2, the Hajto Ház (the forcing-house); 3, the Hideg Ház (or cool house, answering to our greenhouse or orangery).

The Szaporító Ház is a neat structure with four stone walls and a sloping roof of glass, the front wall being 4 feet high, and the back wall 7 feet. It is heated by means of a flue, which goes round the house from the furnace to the chimney. The flue is enclosed in a wall or bricks about 3½ feet high, in which there are four doors for the insertion of pans of water, which are placed on the top of the flue. Deal boards, which have numerous holes pierced in them, are nailed to the two walls over the flue, and on these the mould is placed—the holes in the boards being first filled

up with moss, so as to prevent the soil falling through, and at the same time to admit the steam which arises from the pans. Cuttings inserted in the mould, which are either uncovered or protected by bell glasses, grow, when treated in this manner, with astonishing rapidity and are soon ready for potting off.

The Hajto Ház is built in the same manner as the propagating-house, but has simply a flue. Into this the cuttings are removed as soon as they are potted, and arranged on stages. The furnace is heated with wood, of which only a small quantity is necessary. It is in this house that rose-grafting is conducted, the stocks being got forward in it by the beginning of February. The top is then sawn off horizontally, a slit made in the cut surface, and the graft inserted and secured by a cement made of resin, wax, and Venice turpentine. When treated in this way, scarcely a single graft fails, and the trees bloom well in the summer. This method is found to answer far better than budding, which is not suited to the climate.

The Hideg Ház, or orangery, is a very large room, heated by a flue in the soil, and glazed in front after the old English fashion. The chimney is composed of a number of large quadrate pieces made of clay, each succeeding piece fitting into that beneath, and decreasing from the base upwards. The whole, which is in the inside of the house, is painted green, and has not a bad effect. The plants are beautifully arranged, and the whole forms a sort of winter garden. The orange- and lemon-trees are dispersed in pleasing groups together with the shrubs, and the flowers in variously-shaped beds; but instead of having the wickerwork edging which is seen out-of-doors, they are surrounded by beautiful minerals from the mines, which often contain a good deal of gold and silver.

The expense of course varies according to the wealth of the Magyar; but, as a general rule, it may be reckoned that it amounts to about sixty pounds a year; and many of the nobles do not think it derogatory to their dignity, though extremely proud of their pure descent, to diminish the expense by the sale of the plants*.

* I have in my possession a catalogue of the plants in the garden of a Magyar of some property, with the prices attached, as in a nurseryman's list.—Editor.

Dendrobium Tattonianum. Veitch. August 8, 1865.—S. C.
Dendrobium tortile roseum. Wilson. May 2, 1865.—F. C.
Deutzia crenata flore pleno. Standish. June 17, 1863.—S. K. & F. C.
Dianthus hybridus Marie Paré. E. G. Henderson & Son. Sept. 22, 1863.—S. C.
Dianthus hybridus multiflorus. E. G. Henderson & Son. Sept. 22, 1863.—S. C.
Dianthus hybridus striatiflorus. E. G. Henderson & Son. Sept. 22, 1863.—S. C.
Dianthus sinensis Heddewigii. E. G. Henderson. July 7, 1859.—C.
*Dichorizandra albo-marginata. Linden. June 5, 1861.—2nd prize.
Dicksonia antarctica cinnamomea. Bull. July 11, 1865.—F. C.
Dicksonia Youngii. Veitch. March 21, 1865.—F. C.
Dictyogramma japonica. Veitch. July 1, 1863.—S. K. & F. C.
Dieffenbachia Baraquiniana. Bull; Williams. May 17, 1864.—S. C.
Dieffenbachia grandis. Bull; Williams. May 17, 1864.—S. C.
Dieffenbachia Verschaffeltii. A. Verschaffelt. May 27, 1863.—B. & C.
Diplazium glaberrimum. Bull. September 10, 1862.—S. C.
Disa grandiflora superba. Leach. July 22, 1862.—F. C.
Doryopteris nobilis. See Litobrochia nobilis.
Dracæna Cooperi. Veitch. April 20, 1864.—F. C.
Dracæna Cooperi. Veitch. June 1, 1864.—F. C.
Dracæna Ehrenbergii. Bull. June 1, 1864.—C.
Dracæna ferrea variegata. R. H. S. June 25, 1861.—F. C.
Dracæna Ghiesbreghtii. Bull. April 22, 1862.—S. C.
Dracæna indivisa. Standish. June 28, 1860.—F. C.
Dracæna limbata. Williams. March 21, 1865.—F. C.
Dracæna nigra. Veitch. June 10, 1865.—S. C.
Dracæna robusta. Veitch. June 1, 1864.—C.
Dracæna sp. Veitch. July 2, 1862.—S. B.
Dracophyllum sp. Veitch. May 5, 1863.—F. C.
Drosera sp. (linear oblong l.). Veitch. June 1, 1864.—S. C.
Drynaria diversifolia (Hillii). Veitch. October 8, 1862.—F. C.
Echeveria (metallica). Saunders. September 24, 1861.—F. C.
*Echites argyræa. Linden. June 5, 1861.—1st prize.
Elæagnus japonica aureo-marginata. Bull. March 21, 1865.—S. C.
Epacris Vesta. Veitch. April 9, 1861.—C.
Epidendrum cnemidophorum. Wills. August 8, 1865.—Special.
Epidendrum dichromum amabile. Lee. November 8, 1864.—F. C.
Epidendrum prismatocarpum. R. Warner. July 2, 1862.—B.
Epidendrum prismatocarpum. Lawrence. May 2, 1865.—F. C.
Epigynium leucobotrys. E. G. Henderson. August 23, 1860.—F. C
Epiphyllum truncatum tricolor. Lee. November 8, 1864.—F. C.
Eranthemum Cooperi. Veitch. September 22, 1863.—S. C.
Eranthemum rubronervium. See Gymnostachyum Verschaffeltii.
Eranthemum sanguinolentum. See Hypoëstes sanguinolenta.
Eranthemum tuberculatum. Veitch. September 22, 1863.—S. C.
Eranthemum verbenaceum. R. H. S. April 22, 1862.—S. C.
Erica aristata virens. Low & Co. March 29, 1860.—C.
Erica fragrans. Low. April 18, 1865.—F. C.
Erica Lindleyana. Williams. July 6, 1864.—F. C.
Eriopsis rhytidobulbon. Stone. July 11, 1865.—F. C.
Erodium guttatum. Saunders. April 23, 1861.—C.
Eugenia hybrida. Veitch. October 8, 1862.—S. C.
Eulophia sp. ex. Caffraria. Salmon. June 1, 1864.—C.
Euonymus ovata aureo-variegata. Bull. May 27, 1863.—B. & C.
Eurya angustifolia. Standish. May 6, 1862.—F. C.
Eurya latifolia. Standish. June 11, 1861.—F. C.
Eurycles coronata. See Pancratium amboinense.
Ficus Cooperi. Veitch. May 21, 1862.—S. B.
Ficus Porteana. Bull. May 16, 1865.—F. C.
Ficus Porteana. Bull. June 10, 1865.—S. C.
Forsythia Fortuni. Standish. March 30, 1864.—S. C.
Franciscea calycina major. Veitch. April 20, 1864.—F. C.
Fuchsia conspicua. G. Smith. August 12, 1862.—S. C.

Fuchsia Count Cavour. Banks. July 26, 1860.—C.
Fuchsia Enoch Arden. E. G. Henderson & Son. July 25, 1865.—F. C.
Fuchsia Father Ignatius. E. G. Henderson & Son. July 25, 1865.—F. C.
Fuchsia Garibaldi. See Fuchsia Count Cavour.
Fuchsia Gipsy Queen. Bull. August 22, 1865.—C.
Fuchsia Hugh Mollon. Veitch. August 13, 1861.—C.
Fuchsia Lord Elcho. Banks. July 26, 1860.—F. C.
Fuchsia Lucrezia Borgia. Henderson. July 6, 1864.—F. C.
Fuchsia Mammoth. G. Smith. June 25, 1861.—F. C.
Fuchsia Minnie Banks. Banks, July 26, 1860.—F. C.
Fuchsia Negro. G. Smith. July 26, 1860.—C.
Fuchsia Nonpareil. Bull. September 5, 1865.—F. C.
Fuchsia Pillar of Gold. F. & A. Smith. June 17, 1863.—C.
Fuchsia Prince Leopold. Banks. July 26, 1860.—F. C.
Fuchsia Solferino. G. Smith. July 28, 1859.—C.
Fuchsia Universal. G. Smith. September 24, 1861.—C.
Funkia sp. Standish. July 1, 1863.—S. B. & S. C.
Gardenia florida variegata. A. Henderson & Co. July 1, 1863.—B. & C.
Gardenia florida variegata. A. Henderson & Co. July 6, 1864.—F. C.
Gastronema sanguineum. See Cyrtanthus sanguineus.
Gazania splendens. E. G. Henderson. July 7, 1859.—C.
Genetyllis fimbriata. Veitch. May 17, 1864.—F. C.
Genista Everestiana. Everest. April 22, 1862.—F. C.
Genista prostrata. E. G. Henderson & Son. April 20, 1864.—S. C.
Geonoma Ghiesbreghtii. Bull. June 29, 1864.—F. C.
Gesnera chromatella. Bull. September 13, 1864.—S. C.
Gesnera refulgens. Bull. September 11, 1861.—C.
Gilia achilleæfolia alba. Carter. June 28, 1860.—C.
Gladiolus Charles Davis. Standish. September 9, 1863.—S. C.
Gladiolus Etna. Standish. September 9, 1863.—C.
Gladiolus Herr Rosenberg. Standish. September 27, 1860.—C.
Gladiolus Mrs. Blount. Standish. September 27, 1860.—C.
Gladiolus Mrs. Dix. Standish. September 9, 1863.—C.
Gladiolus Mrs. Mowbray Morris. Standish. September 27, 1864.—F. C.
Gladiolus Our Little Lucy. Standish. September 27, 1864.—F. C.
Gladiolus Randle Jackson. Standish. September 9, 1863.—C.
Gladiolus Rev. Joshua Dix. Standish. October 11, 1860.—F. C.
Gladiolus striata formosissima. Standish. August 13, 1861.—C.
Gleichenia cryptocarpa. Backhouse. May 30, 1865.—F. C.
Gleichenia furcata. Sim. July 12, 1860.—F. C.
Gleichenia (glauca). Veitch. October 8, 1862.—F. C.
Gleichenia hecistophylla. Bull. May 17, 1864.—F. C.
Gleichenia pubescens. Veitch. August 9, 1860.—F. C.
Gleichenia rupestris. Sim. July 12, 1860.—F. C.
Gleichenia semivestita. Sim. July 12, 1860.—F. C.
Gleichenia circinata glauca. Williams. July 11, 1865.—F. C.
Gloxinia Cygna. Lee. July 12, 1860.—C.
Gloxinia Lady Willoughby. Milne, July 12, 1860.—C.
Gonatanthus cupreus. See Alocasia metallica.
Goodyera Dominiana. Veitch. June 11, 1862.—F. C.
Goodyera Veitchii. Veitch. May 16, 1865.—F. C.
Goodyera Veitchii. Veitch. June 10, 1865.—F. C.
Graptophyllum versicolor. Veitch. November 12, 1861.—C.
Greenovia aurea. Bull. April 15, 1863.—F. C.
Grevillea Hillii. Veitch. April 9, 1862.—F. C.
Gymnogramma chrysophylla var. Fussell. July 1, 1863.—B. & C.
Gymnogramma flexuosa. Veitch. May 2, 1865; and June 10, 1865.—F. C.
Gymnogramma Parsonsii. Parsons. April 18, 1865.—F. C.
Gymnogramma Pearcii. Veitch. March 9, 1864; and June 1, 1864.—F. C.
Gymnogramma peruviana laciniata. Parsons. November 11, 1862.—S. C.
Gymnogramma Wetenhalliana. Kelly. September 13, 1860.—F. C.
Gymnostachyum Verschaffeltii. Veitch. May 27, 1863.—S. B. & S. C.

Gymnostachyum Verschaffeltii. Bull. April 20, 1864.—F. C.
Gymnostachyum Verschaffeltii. Bull; Williams. June 1, 1864.—F. C.
Gymnostachyum sp. Veitch. June 10, 1865.—F. C.
Gynerium argenteum albo-lineatum. Bull. May 17, 1864.—F. C.
Habranthus fulgens. Backhouse. April 4, 1865.—F. C.
Helichrysum (argenteum). Carson. June 1, 1864.—C.
Helipterum Sanfordii. Thompson. July 21, 1863.—F. C.
Hemerocallis disticha fl. pleno. Veitch. May 24, 1860.—F. C.
Hemerocallis sp. (Japan) (striped). Veitch. July 22, 1862.—F. C.
Hepatica angulosa. Backhouse. April 4, 1865.—F. C.
Hibiscus Cooperi. Veitch. February 25, 1863.—C.
Hollyhock Acme. W. Chater. August 25, 1863.—F. C.
Hollyhock Advancer. Johnston. October 11, 1860.—C.
Hollyhock Albion. Hawke. August 16, 1864.—S. C.
Hollyhock Alexander Shearer. Downie. July 21, 1863.—F. C.
Hollyhock Alfred. Chater. August 11, 1859.—C.
Hollyhock Brunette. A. Paul & Son. July 28, 1859.—F. C.
Hollyhock Cavalier. Hawke. August 16, 1864.—S. C.
Hollyhock Chairman. Chater. August 16, 1864.—F. C.
Hollyhock Charles Eyre. Downie. August 8, 1865.—F. C.
Hollyhock Cherub. W. Chater. August 4, 1863.—S. C.
Hollyhock Competitor. Chater. August 16, 1864.—S. C.
Hollyhock Countess Russell. Chater. August 27, 1861.—F. C.
Hollyhock Cygnet. Chater. August 16, 1864.—F. C.
Hollyhock Decision. Chater. August 16, 1864.—F. C.
Hollyhock Dowager Countess Jane Somers. Chater. July 28, 1859.—C.
Hollyhock Exhibitor. Chater. July 28, 1859.—C.
Hollyhock Fairest of the Fair. Chater. August 16, 1864.—S. C.
Hollyhock Fanny Chater. Chater. August 16, 1864.—F. C.
Hollyhock Firefly. Chater. August 8, 1865.—F. C.
Hollyhock Gem of Yellows. Chater. August 12, 1862.—F. C.
Hollyhock George Keith. Downie. August 13, 1861.—F. C.
Hollyhock Gladiator. Hawke. August 16, 1864.—F. C.
Hollyhock Glory of Walden. Chater. August 12, 1862.—F. C.
Hollyhock Harriet. Chater. July 28, 1859.—C.
Hollyhock Hebe. Chater. August 8, 1865.—S. C.
Hollyhock Hercules. Chater. August 16, 1864.—F. C.
Hollyhock Hesperus. Chater. August 12, 1862.—S. C.
Hollyhock Imperator. Chater. August 12, 1862.—F. C.
Hollyhock Invincible. Chater. August 27, 1861.—C.
Hollyhock Invincible. Chater. September 11, 1861.—F. C.
Hollyhock James Allen. Chater. August 16, 1864.—F. C.
Hollyhock John Laing. Bird Porter. August 8, 1865.—F. C.
Hollyhock Joshua Clark. Chater. July 28, 1859.—C.
Hollyhock Joshua Clark. Chater. August 13, 1861.—F. C.
Hollyhock Lady Dacres. Downie. August 27, 1861.—F. C.
Hollyhock Lady H. St. Clair. Downie. August 13, 1861.—C.
Hollyhock Lady King. Chater. August 27, 1861.—C.
Hollyhock Lady King. Chater. September 11, 1861.—F. C.
Hollyhock Leonora. Chater. July 28, 1859.—F. C.
Hollyhock Lord Clifden. Downie. September 22, 1863.—S. C.
Hollyhock Mr. G. Eyles. Bird Porter. July 29, 1865.—F. C.
Hollyhock Mrs. B. B. Todd. Downie. August 8, 1865.—S. C.
Hollyhock Mrs. M. Binning. Downie. August 4, 1863.—F. C.
Hollyhock Neatness. Downie. September 22, 1863.—F. C.
Hollyhock Ne plus ultra. Chater. August 27, 1861.—F. C.
Hollyhock Novelty. Chater. July 28, 1859.—C.
Hollyhock Othello. Chater. August 16, 1864.—S. C.
Hollyhock Perfection. A. Paul & Son. July 28, 1859.—C.
Hollyhock Prince Imperial. Bircham. September 11, 1861.—C.
Hollyhock R. B. Ullet. Downie. August 4, 1863.—F. C.
Hollyhock Rev. E. Hawke. Chater. August 16, 1864.—F. C.

Hollyhock Rev. Joshua Dix. Chater. August 16, 1864.—F. C.
Hollyhock Senior Wrangler. Hawke. August 8, 1865.—F. C.
Hollyhock Stanstead Rival. Downie. August 13, 1861.—F. C.
Hollyhock The Queen. Downie. August 25, 1863.—S. C.
Hollyhock Volunteer. Bird Porter. August 25, 1863.—S. C.
Hollyhock Volunteer Improved. Bird Porter. August 16, 1864.—S. C.
Hollyhock Warrior. Chater. July 28, 1859.—C.
Hollyhock Willingham Defiance. Rev. E. Hawke. August 25, 1863.—S. C.
Hollyhock Willingham Defiance. Rev. E. Hawke. August 16, 1864.—F. C.
Homoianthus viscosus. Veitch. June 17, 1863.—B. & C.
Hyacinth Cuvier. Cutbush. April 4, 1865.—F. C.
Hyacinth Henriette Elizabeth. Cutbush. March 9, 1864.—S. C.
Hyacinth King of the Blues. W. Paul. March 30, 1864.—F. C.
Hyacinth Josephine. Cutbush. March 9, 1864.—S. C.
Hyacinth La Française. Cutbush. April 4, 1865.—F. C.
Hyacinth Lord Palmerston.—W. Paul. March 9, 1864.—F. C.
Hyacinth Robert Fortune. Cutbush. March 9, 1864.—F. C.
Hyacinth Thorwaldsen. Cutbush. March 30, 1864.—F. C.
Hyacinthus amethystinus. Backhouse. May 30, 1865.—S. C.
Hydrangea japonica rosea. Henderson. June 10, 1865.—S. C.
Hymenophyllum valvatum. Backhouse. July 1, 1863.—S. K. & F. C.
Hymenostachys elegans. Bull. August 4, 1863.—F. C.
Hypoëstes sanguinolenta. Veitch. June 1, 1864.—S. C.
Hypolepis distans. Dean. July 9, 1861.—C.
Illicium sp. (variegated). Standish. June 11, 1861.—C.
Imantophyllum miniatum pictum. Bull. June 1, 1864.—F. C.
Ixora sp. (Moulmein). Baines. July 6, 1864.—C.
*Juniperus drupacea. Jackson. June 5, 1861.—B.
Kerria japonica variegata. Standish. April 15, 1863.—C.
Lælia albida var. R. Warner. December 8, 1859.—C.
*Lælia grandis. R. Warner. June 5, 1861.—S. K.
Lælia Lindleyana. Veitch.—March 7, 1865.—F. C.
Lælia Schilleriana var. (1). Backhouse. September 8, 1859.—F. C.
Lælia Schilleriana var. (2). Veitch. May 21, 1862.—S. B.
Lapageria rosea albiflora. Veitch. July 2, 1862.—S. K.
Lastrea deltoidea. Sim. July 12, 1860.—C.
Lastrea erythrosora. Veitch. June 17, 1863.—S. B. & S. C.
Lastrea Filix-mas Bollandiæ. Bull. June 26, 1862.—S. C.
Lastrea montana cristata. Williams. May 27, 1863.—B. & C.
Lastrea Standishii. Standish. May 21, 1863.—S. B.
Lastrea varia. Bull. March 30, 1864.—S. C.
Latania Verschaffeltii. Bull. September 10, 1862.—F. C.
Lathyrus odoratus, "Scarlet Invincible." Brown. July 11, 1865.—F. C.
Lepanthes Calodictyon. Osborn. October 8, 1861.—F. C.
*Libocedrus tetragona. Veitch. June 5, 1861.—S. K.
Ligustrum japonicum aureo variegatum. Veitch. June 11, 1862.—B.
Ligustrum ovalifolium variegatum. Bull. June 10, 1865.—F. C.
Ligustrum sp. fol. variegatis. Veitch. July 1, 1863.—B. & C.
Lilac Dr. Lindley. Lee. May 17, 1864.—F. C.
Lilium auratum. Veitch. July 2, 1862.—S. K.
Lilium nigrum. Backhouse. May 30, 1865.—S. C.
Lilium nilgherrense. Veitch. August 25, 1863.—S. C.
Lilium sp. Williams. June 27, 1865.—S. C.
Limatodes rosea alba. Low. February 25, 1863.—S. C.
Linaria bipartita splendens. Carter. July 26, 1860.—C.
Lindsæa crenata. Backhouse. July 1, 1863.—B. & C.
Lindsæa stricta. Backhouse. July 1, 1863.—S. B. & S. C.
Lindsæa ? trapeziformis. Bull. November 10, 1863.—F. C.
Linum Macræi. Veitch. July 6, 1864.—C.
Lithospermum fruticosum. Lee. April 22, 1862.—S. C.
Litobrochia nobilis. Veitch. June 11, 1862.—S. B.
Litobrochia nobilis. Bull. September 23, 1862.—F. C.

Litobrochia tripartita. Shortt. September 19, 1865.—C.
Lobelia Purple Standard. Kinghorn. August 23, 1860.—F. C.
Lobelia (Erinus) speciosa kermesina. Carter. August 26, 1862.—C.
Lobelia (ramosa) Snowflake. Cox, gr. to Earl Beauchamp. July 25, 1865.—F. C.
Lomaria Bellii. Shortt. September 19, 1865.—F. C.
Lomaria cycadifolia. Lee. April 23, 1861.—F. C.
Lomaria elongata. Standish. November 12, 1861.—F. C.
Lomaria fluviatilis. Lee. April 23, 1861.—F. C.
Lomaria Fraseri. Standish. May 28, 1861.—F. C.
Lomaria gibba. Veitch. July 2, 1862.—S. K.
Lomaria L'Herminieri. Veitch. March 21, 1865.—F. C.
Lomariopsis heteromorpha. Backhouse. May 30, 1865.—F. C.
Lomatia elegantissima. Bull. April 22, 1862.—S. C.
Lonicera brachypoda aureo-reticulata. Standish. July 2, 1862.—S. K.
Lonicera japonica hybrida. Ingram. August 9, 1860.—C.
Luzula sylvatica aureo-vittata. Salter. April 1, 1862.—C.
Lycaste Skinneri superba. Veitch. April 12, 1860.—F. C.
Lychnis Senno. Standish. June 17, 1863.—S. B. & S. C.
Lycioplesium pubiflorum. Veitch. March 9, 1864.—S. C.
Lycopodium Phlegmaria. Veitch. August 12, 1862.—F. C.
Lygodium polystachyum. Veitch. July 7, 1859.—F. C.
Macodes Petola. Low. September 22, 1859.—F. C.
Macodes Petola superba. Jackson. June 1, 1864.—F. C.
Magnolia Lenné. W. Paul. April 15, 1863.—F. C.
Manettia micans. Veitch. December 7, 1864.—F. C.
Maranta argyræa. Linden. May 10, 1860.—C.
Maranta striata. Veitch. June 1, 1864.—S. C.
Maranta tubispatha. Veitch. May 30, 1865.—F. C.
Maranta tubispatha. Veitch. June 10, 1865.—F. C.
Maranta Van den Heckei. Bull. June 10, 1865.—S. C.
Maranta Veitchii. Veitch. April 4 and June 10, 1865.—F. C.
Marattia Cooperi. Veitch. June 17, 1863.—S. K. & F. C.
Masdevallia sp. Backhouse. May 30, 1865.—S. C.
Miconia flammea. Green. April 4, 1865.—F. C.
Miconia pulverulenta. Veitch. May 27, 1863.—S. B. & S. C.
Microlepia hirsuta augusta. Veitch. May 10, 1860.—C.
Microlepia scabra. Standish. May 6, 1862.—S. C.
*Mimulus cupreus. Veitch. June 5, 1861.—B.
Mimulus (duplex). Bull. April 18, 1865.—F. C.
Mimulus maculosus (group). E. G. Henderson & Son. June 17, 1863.—C.
Mimulus maculosus Marvel. Bull. May 5, 1863.—F. C.
Mimulus Unique. Bull. May 4, 1864.—S. C.
Musa vittata. Veitch. April 1, 1862.—F. C.
Musa vittata. Bull. May 21, 1862.—S. B.
Musa vittata. Jackson. May 21, 1862.—S. B.
Musa vittata. Lee. May 21, 1862.—S. B.
Musa vittata. Low. May 21, 1862.—S. B.
Musa vittata. Veitch. May 21, 1862.—S. B.
Mutisia decurrens. Veitch. August 13, 1861.—F. C.
Myosotis rupicola. Backhouse. May 16, 1865.—F. C.
Narcissus juncifolius. Backhouse. May 2, 1865.—F. C.
Nasturtium Yellow Tom Thumb. See Tropæolum.
Nemophila discoidalis auriculæflora. Melville. July 7, 1863.—C.
Nemophila discoidalis elegans. Charlwood. July 9, 1861.—C.
Nepenthes Dominiana. Veitch. June 11, 1862.—F. C.
Nephelaphyllum pulchrum. Veitch. November 10, 1859.—C.
Nephrodium molle cristatum. Bull. June 1, 1864.—S. C.
Nephrodium molle polydactylum. Sim. July 12, 1860.—C.
Nerine coruscans major. Watson. September 27, 1864.—F. C.
Nidularium Innocentii. Williams. July 6, 1864.—F. C.
Niphobolus Lingua corymbiferus. Veitch. July 22, 1862.—C.
Nolana lanceolata. Veitch. June 11, 1862.—B.

Odontoglossum Alexandræ. Low. November 21, 1865.—F. C.
Odontoglossum Bluntii. Marshall. April 18, 1865.—F. C.
Odontoglossum cordatum. Veitch. May 16, 1865.—F. C.
Odontoglossum gloriosum. Day & Low. April 4, 1865.—F. C.
Odontoglossum Lindleyanum. Pilcher. April 4, 1865.—F. C.
Odontoglossum nævium. Stone. May 14, 1864.—Special.
Odontoglossum Pescatorei. Stone. May 4, 1864.—Special.
Odontoglossum Pescatorei. Veitch. May 2, 1865.—F. C.
Odontoglossum Pescatorei splendens. Veitch. March 7, 1865.—F. C.
Odontoglossum Phalænopsis. McMorland. December 8, 1863.—Special.
Odontoglossum radiatum. Low. November 21, 1865.—F. C.
Odontoglossum Uroskinneri. Veitch. August 11, 1859.—C.
Œnothera grandiflora (Lamarckiana). Carter. September 27, 1860.—C.
Oncidium amictum. Day. April 4, 1865.—F. C.
Ophioglossum palmatum. Bull. July 6, 1864.—F. C.
Ophiopogon Jaburan fol. variegatis. Bull. November 11, 1862.—F. C.
Oreopanax dactylifolium. Bull. February 18, 1862.—C.
Oreopanax dactylifolium. Bull. June 11, 1862.—B.
Ornithogalum thyrsoides. Carter. May 17, 1864.—Special.
Ornithogalum thyrsoides. Carter. June 1, 1864.—Special.
Osmanthus aquifolius variegatus. Standish. May 6, 1862.—S. C.
Osmanthus aquifolius variegatus aureus. Standish. May 21, 1862.—B.
Osmanthus aquifolius variegatus nanus. Standish. June 11, 1861.—F. C.
Osmunda regalis cristata. Osborne. June 11, 1862.—S. B.
Ourisia coccinea. Veitch. May 21, 1862.—S. K.
Ourisia Pearcii. Veitch. May 5, 1863.—F. C.
Ouvirandra Berneriana. Jackson. June 17, 1863.—S. K. & F. C.
Ouvirandra fenestralis. Bull. July 1, 1863.—B. & C.
Oxalis valdiviana. Veitch. June 11, 1862.—B.
Palafoxia Hookeriana. Thompson. August 8, 1865.—S. C.
Palumbina candida. Stone. June 27, 1865.—F. C.
Pancratium amboinense. Veitch. June 17, 1863.—S. K. & F. C. (Eurycles.)
Pandanus Blancoi. Bull. July 6, 1864.—S. C.
Pandanus Blancoi. Bull. June 10, 1865.—S. C.
Pandanus elegantissimus. Bull. March 18, 1863.—F. C.
Pandanus elegantissimus. Veitch. March 18, 1863.—F. C.
Pandanus glaucescens. Bull. June 10, 1865.—F. C.
Panicum capillare. Carter. July 28, 1859.—C.
Pansy Exquisite. Turner. April 15, 1863.—C.
Pansy Snowball. Hooper. July 6, 1864.—F. C.
Pansy (fancy) Aurea marginata. Downie. May 21, 1862.—F. C.
Pansy (fancy) Bob Ridley. Bragg. June 17, 1863.—C.
Pansy (fancy) Dazzle. Bragg. June 17, 1863.—C.
Pansy (fancy) Feu de Joie. Turner. April 15, 1863.—C.
Pansy (fancy) Harlequin. Bragg. June 17, 1863.—C.
Pansy (fancy) Mrs. H. Dombrain. Downie. May 4, 1864.—S. C.
Pansy (fancy) Pallas. Lowe. June 17, 1863.—C.
Pansy (fancy) Princess Alice. Dean. May 28, 1861.—C.
Parochetus communis. Osborn. November 7, 1865.—S. C.
Pea (Sweet) Scarlet Invincible. Brown. July 11, 1865.—F. C.
Pectis angustifolia. Thompson. August 8, 1865.—S. C.
Pelargonium Achilles. Hoyle. June 17, 1863.—F. C.
Pelargonium Amazon. Beck. May 28, 1861.—C.
Pelargonium ardens. Beck. June 11, 1862.—F. C.
Pelargonium Aristides. Hoyle. June 17, 1863.—S. C.
Pelargonium Artist. Hoyle. May 27, 1863.—F. C.
Pelargonium Bellatrix. Beck. June 11, 1862.—F. C.
Pelargonium Belle of the Ball. Foster. May 21, 1862.—F. C.
Pelargonium British Sailor. Hoyle. June 1, 1864.—S. C.
Pelargonium Canopus. Beck. June 11, 1862.—F. C.
Pelargonium Censor. Foster. June 11, 1862.—S. C.
Pelargonium Charles Turner. Hoyle. May 30, 1865.—F. C.

Pelargonium Clipper. Bull. May 17, 1864.—F. C.
Pelargonium Colossus. Hoyle. June 11, 1862.—F. C.
Pelargonium Conflagration. Foster. May 21, 1862.—F. C.
Pelargonium Cynosure. Beck. June 11, 1862.—S. C.
Pelargonium Diadem. Hoyle. May 27, 1863.—F. C.
Pelargonium elegans. Nye. May 30, 1865.—F. C.
Pelargonium Espérance. Beck. June 11, 1862.—S. C.
Pelargonium Eurydice. Beck. June 11, 1862.—F. C.
Pelargonium Exhibitor. Hoyle. June 1, 1864.—C.
Pelargonium filipendulifolium. Green. April 4, 1865.—Special.
Pelargonium Illuminator. Foster. June 11, 1862.—F. C.
Pelargonium Improvement. Foster. May 21, 1862.—F. C.
Pelargonium John Hoyle. Hoyle. June 1, 1864.—F. C.
Pelargonium lateripes "Silver Gem." Lloyd. May 2, 1865.—S. C.
Pelargonium lateripes "Silver Gem." Bull. June 10, 1865.—S. C.
Pelargonium Lord Palmerston. Hoyle. June 11, 1862.—F. C.
Pelargonium Maid of Honour. Beck. June 17, 1863.—C.
Pelargonium Mary Hoyle. Hoyle. June 14, 1864.—S. C.
Pelargonium Merrimac. Foster. June 11, 1862.—F. C.
Pelargonium Modesty (Beck). Turner. June 28, 1860.—C.
Pelargonium Nymph. Beck. June 11, 1862.—S. C.
Pelargonium Oriana. Beck. June 11, 1862.—F. C.
Pelargonium peltatum elegans. E. G. Henderson & Son. June 10, 1865.—F. C.
Pelargonium Penelope. Hoyle. May 27, 1863.—C.
Pelargonium Perdita (Foster). Turner. June 28, 1860.—F. C.
Pelargonium Profusion. Hoyle. June 1, 1864.—S. C.
Pelargonium Prince of Wales. Beck. May 27, 1863.—S. C.
Pelargonium Princess of Wales. Beck. May 27, 1863.—S. C.
Pelargonium Progress. Hoyle. May 30, 1865.—F. C.
Pelargonium Publicola. Hoyle. June 14, 1864.—S. C.
Pelargonium Regina formosa. Beck. June 11, 1862.—F. C.
Pelargonium Royal Albert. Hoyle. May 21, 1862.—F. C.
Pelargonium Royalty. Foster. June 11, 1862.—F. C.
Pelargonium Sunny Memories. Hoyle. June 1, 1864.—S. C.
Pelargonium The Prince. Hoyle. May 27, 1863.—C.
Pelargonium William Hoyle. Hoyle. May 30, 1865.—F. C.
Pelargonium (decorative) Lady Churston. Veitch. June 11, 1861.—C.
Pelargonium (decorative) Mrs. Ponsonby Moore. Veitch. May 14, 1861.—C.
Pelargonium (decorative) Theophraste. Bull. June 26, 1862.—C.
Pelargonium (fancy) Ann Page. Turner. June 1, 1864.—F. C.
Pelargonium (fancy) Arabella Goddard. Turner. June 28, 1860.—F. C.
Pelargonium (fancy) Edgar. Turner. June 14, 1864.—S. C.
Pelargonium (fancy) Miss-in-her-Teens. Turner. June 11, 1862.—S. C.
Pelargonium (fancy) Mrs. Dorling. Turner. June 1, 1864.—S. C.
Pelargonium (fancy) Silver Mantle. Turner. June 14, 1864.—S. C.
Pelargonium (fancy) The Rover. Turner. June 14, 1864.—F. C.
Pelargonium (forcing) floribundum. F. & A. Smith. April 9, 1861.—C.
Pelargonium (forcing) Mrs. Lewis Loyd. Jackson. March 31, 1863.—C.
Pelargonium (forcing) Snowdrop. F. & A. Smith. April 9, 1861.—C.
Pelargonium (hybrid nosegay) Amy Hogg. W. Paul. June 29, 1864.—F. C.
Pelargonium (hybrid nosegay) Beauty of Waltham. W. Paul. June 29, 1864.—S. C.
Pelargonium (hybrid nosegay) Dowager Duchess of Sutherland. Fleming. July 11, 1865.—F. C.
Pelargonium (hybrid nosegay) Duchess. W. Paul. June 27, 1865.—F. C.
Pelargonium (hybrid nosegay) Indian Yellow. W. Paul. June 27, 1865.—F. C.
Pelargonium (hybrid nosegay) Lady Constance. Fleming. July 11, 1865.—F. C.
Pelargonium (hybrid nosegay) Rebecca. W. Paul. June 29, 1864.—F. C.
Pelargonium (marbled) Sheen Rival. Kinghorn. September 22, 1859.—C.
Pelargonium (nosegay) Stella Variegated. August 4, 1863.—C.
Pelargonium (scarlet) Achilles. Bull. June 14, 1864.—S. C.
Pelargonium (scarlet) Lady Cowper. Francis. July 1, 1863.—C.
Pelargonium (scarlet) Lady Cowper. Francis. August 4, 1863.—S. C.

Pelargonium (scarlet) Volcano. Wills. September 22, 1863.—C.
Pelargonium (scarlet) Waltham Pet. W. Paul. May 21, 1862.—F. C.
Pelargonium (scented-leaved) Madame Csillag. Bragg. July 26, 1860.—C.
Pelargonium (spotted) Butterfly. Beck. June 11, 1862.—S. C.
Pelargonium (spotted) Caliban. Beck. June 11, 1862.—S. C.
Pelargonium (spotted) International. Bull. June 26, 1862.—S. C.
Pelargonium (spotted) Landseer. Foster. June 11, 1862.—S. C.
Pelargonium (spotted) Monitor. Foster. June 11, 1862.—S. C.
Pelargonium (spotted) Viceroy of Egypt. Bull. June 26, 1862.—S. C.
Pelargonium (variegated) Argus. G. Smith. August 9, 1860.—F. C.
Pelargonium (variegated) Capt. Meade. E. G. Henderson & Son. June 14, 1864.—F. C.
Pelargonium (variegated) Clara. Turner. April 23, 1861.—C.
Pelargonium (variegated) Delicata. E. G. Henderson. August 27, 1861.—C.
Pelargonium (variegated) Flower of Spring. Turner. April 12, 1860.—F. C.
Pelargonium (variegated) Italia Unita. E. G. Henderson. Sept. 10, 1862.—F. C.
Pelargonium (variegated) Lady Cullum. Henderson. October 11, 1864.—F. C.
Pelargonium (variegated) Lucy Grieve. E. G. Henderson. Sept. 10, 1862.—F. C.
Pelargonium (variegated) Meteor. Parker & Williams. July 26, 1860.—C.
Pelargonium (variegated) Meteor. Saltmarsh. September 13, 1864.—F. C.
Pelargonium (variegated) Mrs. Benyon. E. G. Henderson & Son. August 25, 1863.—F. C. gold. tric.
Pelargonium (variegated) Mrs. Pollock. E. G. Henderson. Aug. 27, 1861.—F. C.
Pelargonium (variegated) Queen of Tricolors. Garaway. August 8, 1865.—S. C.
Pelargonium (variegated) Sunset. E. G. Henderson. Aug. 27, 1861.—F. C.
Pelargonium (variegated) Unique. Garaway. August 8, 1865.—S. C.
Pelargonium (zonal) Adonis. Hally. June 17, 1863.—F. C.
Pelargonium (zonal) Aurora. Hally. March 29, 1860.—C.
Pelargonium (zonal) Aurora. Hally. April 26, 1860.—F. C.
Pelargonium (zonal) Beauté de Suresnes. Salter. September 6, 1864.—F. C.
Pelargonium (zonal) Beauty. E. G. Henderson & Son. September 22, 1863.—F. C.
Pelargonium (zonal) Blackheath Beauty. Hally. August 11, 1859.—C.
Pelargonium (zonal) Chieftain. G. Smith. June 27, 1865.—F. C.
Pelargonium (zonal) Conquest of Europe. Williams. May 21, 1862.—F. C.
Pelargonium (zonal) Enamel. Hally. June 29, 1864.—C.
Pelargonium (zonal) Faust. Bull. June 29, 1864.—F. C.
Pelargonium (zonal) Firefly. G. Smith. July 23, 1861.—C.
Pelargonium (zonal) Hector. Bull. June 29, 1864.—F. C.
Pelargonium (zonal) Herald of Spring. Turner. April 23, 1861.—F. C.
Pelargonium (zonal) Highgate Rival. Windsor. July 19, 1864.—S. C.
Pelargonium (zonal) La Grande. G. Smith. June 27, 1865.—F. C.
Pelargonium (zonal) Little Treasure. Saltmarsh. September 13, 1864.—F. C.
Pelargonium (zonal) Madame Rendatler. Bull. June 29, 1864.—F. C.
Pelargonium (zonal) M. G. Nachet. Salter. July 6, 1864.—S. C.
Pelargonium (zonal) Nesfield. Turner. May 21, 1862.—S. C.
Pelargonium (zonal) Ornement de Massifs. Salter. July 6, 1864.—C.
Pelargonium (zonal) Prince of Hesse. Turner. April 23, 1861.—C.
Pelargonium (zonal) Princess of Prussia. Conway. July 12, 1860.—C.
Pelargonium (zonal) Princess of Wales. Wills. September 22, 1863.—S. C.
Pelargonium (zonal) Psyche. Bull. June 29, 1864.—S. C.
Pelargonium (zonal) Red Riding Hood. Hally. June 29, 1864.—S. C.
Pelargonium (zonal) Rising Sun. Turner. May 30, 1865.—F. C.
Pelargonium (zonal) Rosamond. Bull. June 29, 1864.—S. C.
Pelargonium (zonal) Rose Rendatler. Bull. June 29, 1864.—F. C.
Pelargonium (zonal) Sir Robert Peel. Windsor. August 8, 1865.—F. C.
Pelargonium (zonal) Venus. Hally. June 14, 1864.—F. C.
Pelargonium (zonal) Wiltshire Lass. Keynes. May 30, 1865.—F. C.
Pellæa Wrightiana. Backhouse. May 30, 1865.—F. C.
Pentstemon Blue Beauty. Downie. October 8, 1862.—C.
Pentstemon compactus. Wemyss. October 8, 1862.—S. C.
Pentstemon grandifolius. Thompson. June 10, 1865.—F. C.
Pentstemon Lobbianus. Low. August 27, 1861.—F. C.
Pentstemon Mrs. E. Clark. Downie. September 6, 1864.—S. C.

Pentstemon Mrs. Moore. Downie. September 6, 1864.—S. C.
Pentstemon Mrs. Steans. Downie. October 8, 1862.—F. C.
Pentstemon Princeps. Downie. October 8, 1862.—C.
Peperomia acuminata. Veitch. June 10, 1865.—C.
Peperomia arifolia. R. H. S. August 16, 1864.—F. C.
Peperomia maculosa. Veitch. June 10, 1865.—S. C.
Peperomia marmorata. R. H. S. May 17, 1864.—S. C.
Peperomia marmorata. R. H. S. August 16, 1864.—F. C.
Peperomia marmorata. Bull. June 10, 1865.—F. C.
Peperomia pubifolia. Veitch. June 10, 1865.—S. C.
Peperomia sp. Veitch. March 21, 1865.—C.
Petunia Butterfly. Holland. August 12, 1862.—S. C.
Petunia Eclipse. G. Smith. July 12, 1860.—C.
Petunia Eliza Mathieu. G. Smith. May 21, 1862.—F. C.
Petunia Emma. Bull. May 21, 1862.—S. C.
Petunia Fame. Smith. September 27, 1864.—S. C.
Petunia Guido. Bull. July 2, 1862.—S. C.
Petunia inimitabilis fl. pleno. Veitch. May 14, 1861.—F. C.
Petunia Madame Rendatler. Veitch. May 6, 1862.—S. C.
Petunia Mrs. Ferguson. Ferguson. May 6, 1862.—F. C.
Petunia Mrs. Sherbrook. Turner. June 17, 1863.—C.
Petunia Ruby. Bull. May 21, 1862.—S. C.
Petunia striata perfecta. Holland. Jully 19, 1864.—F. C.
Petunia Venus. Bull. June 26, 1862.—S. C.
Petunia Vernon. Bull. May 27, 1863.—C.
Phalænopsis amabilis. Williams. April 4, 1865.—F. C.
Phalænopsis grandiflora aurea. Bull. April 20, 1864.—F. C.
Phalænopsis grandiflora aurea. Williams. June 1, 1864.—F. C.
Phalænopsis intermedia. Veitch. May 27, 1863.—S. B. & S. C.
Phalænopsis Lowii. Low. October 8, 1862.—F. C.
Phalænopsis Lüddemanniana. Charles. May 2, 1865.—F. C.
Phalænopsis Lüddemanniana. Low. May 2, 1865.—F. C.
Phalænopsis Lüddemanniana. Pattison. May 2, 1865.—F. C.
Phalænopsis Lüddemanniana. Pilcher. May 2, 1865.—F. C.
Phalænopsis Lüddemanniana. Stone. May 2, 1865.—F. C.
Phalænopsis Parishii. Stone. May 2, 1865.—F. C.
Phalænopsis Rückerii. See Phalænopsis grandiflora aurea.
Phalænopsis Schilleriana. Bull. February 18, 1862.—F. C.
Phalænopsis Schilleriana. M'Morland. February 18, 1862.—F. C.
Phalænopsis Schilleriana. Warner. February 18, 1862.—F. C.
Phalænopsis Schilleriana. Sherratt. March 7, 1865.—Special.
Phalænopsis Schilleriana. Veitch. March 7, 1865.—Special.
Phalænopsis Schilleriana major. Veitch. March 7, 1865.—F. C.
Phalænopsis sumatrana. Stone. May 30, 1865.—F. C.
Philodendron sp. Veitch. May 16 and June 10, 1865.—F. C.
Phlox Edith. Turner. August 8, 1865.—F. C.
Phlox Lydia. Downie. June 25, 1861.—C.
Phlox Orion. Sankey. September 13, 1860.—C.
Phlox Reine blanche. Downie. June 25, 1861.—C.
Phœnicophorium sechellarum. Veitch. June 1, 1864.—F. C.
Phœnicophorium sechellarum. Williams. May 2, 1865.—F. C.
Phormium tenax variegatum. Williams. March 30, 1864.—F. C.
Phormium tenax variegatum. Williams. June 1, 1864.—F. C.
Phycella sp. Backhouse. See Habranthus fulgens.
Phyllagathis rotundifolia. Veitch. March 19, 1862.—F. C.
Physurus fimbrillaris. R. H. S. April 22, 1862.—F. C.
Physurus nobilis. Williams. May 30, 1865.—S. C.
Phytolacca decandra variegata. E. G. Henderson & Son. Sept. 9, 1863.—C.
*Picea sp. Vancouver's Island. Standish. June 5, 1861.—B.
Picotee Elise. Turner. August 9, 1860.—F. C.
Picotee Exhibition. Elkington. August 4, 1863.—C.
Picotee Favorita. Turner. August 9, 1860.—C.
Picotee Flower of the Day. Turner. July 23, 1861.—F. C.

Picotee Lady Elcho. Turner. July 22, 1862.—F. C.
Picotee Lucy (Taylor). Turner. July 21, 1863.—F. C.
Picotee Mrs. Hole. Turner. July 23, 1861.—C.
Picotee Princess Alice. Turner. August 2, 1860.—F. C.
Picotee Princess of Wales. Turner. July 6, 1864.—F. C.
Picotee Queen of Picotees. Keynes. August 9, 1860.—C.
Picotee Rev. A. Matthews. Turner. July 7, 1859.—C.
Picotee Rev. H. Matthews. Turner. August 2, 1860.—F. C.
Picotee Rival Purple. Turner. July 7, 1859.—C.
Picotee Rosy Circle. Turner. July 23, 1861.—F. C.
Picotee (fancy) Countess of Derby. Keynes. August 9, 1860.—C.
Picotee (yellow) Empress of India. Bragg. August 9, 1860.—C.
Picotee (yellow) Garibaldi. Bragg. August 9, 1860.—C.
Pimelea elegans. Veitch. May 14, 1861.—F. C.
Pinanga maculata. Veitch. June 17, 1863.—B. & C.
Pink Beautiful. Turner. July 12, 1860.—F. C.
Pink Bertram. Turner. June 26, 1862.—F. C.
Pink Blondin. Turner. June 26, 1862.—S. C.
Pink Bridesmaid. Turner. June 26, 1862.—F. C.
Pink Delicata. Turner. June 25, 1861.—F. C.
Pink Device. Turner. June 26, 1862.—F. C.
Pink Exquisite. Turner. June 26, 1862.—F. C.
Pink Lady Rokeby. Bragg. June 25, 1861.—F. C.
Pink Marion. Turner. June 26, 1862.—F. C.
Pink Mr. F. Coaffe. Hooper. July 2, 1862.—F. C.
Pink Mrs. Turner. Turner. June 28, 1860.—F. C.
Pink Rev. Geo. Jeans. Turner. July 1, 1863.—F. C.
Planera acuminata. Veitch. May 21, 1862.—B.
Pleione Schilleriana. Bull. June 14, 1864.—F. C.
Pleopeltis albido-squamatum. Veitch. November 10, 1863.—F. C.
Pleopeltis hastata. Walker. June 27, 1865.—F. C.
Pleroma sp. Veitch. May 16, 1865.—F. C.
Pleroma sp. Veitch. June 10, 1865.—F. C.
Podocarpus macrophyllus variegatus. Bull. June 10, 1865.—F. C.
*Podocarpus variegatus. Veitch. June 5, 1861.—B.
Pogonia discolor. Veitch. October 13, 1859.—F. C.
Pollia purpurea. Bull; Low. August 27, 1861.—C.
Polybotrya apiifolia. Veitch. July 2, 1862.—B.
Polybotrya Lowii. Low. August 27, 1861.—F. C.
Polychilus (Phalænopsis) cornu-cervi. Stone. July 6, 1864.—C.
Polychilus (Phalænopsis) cornu-cervi. Stone. June 27, 1865.—F. C.
Polygonatum oppositifolium albo-vittatum. Standish. April 22, 1862.—F.C.
Polygonum filiforme variegatum. Salter. May 16, 1865.—F. C.
Polygonum filiforme variegatum. Salter. June 10, 1865.—S. C.
Polypodium sanctum. Bull. July 11, 1865.—S. C.
Polypodium tripartitum. Clark. July 29, 1865.—F. C.
Polypodium vulgare pulcherrimum. Ivery. July 6, 1864.—F. C.
Polypodium vulgare ramosum. Cross. July 25, 1865.—F. C.
Polystichum aculeatum acrocladon. Ivery. June 1, 1864.—S. C.
Polystichum aculeatum acrocladon. Ivery. July 6, 1864.—F. C.
Polystichum aculeatum corymbiferum. Thompson. July 26, 1860.—F. C.
Polystichum angulare. Earley. September 19, 1865.—F. C.
Polystichum angulare Bayliæ. Stansfield. July 29, 1865.—F. C.
Polystichum angulare grandiceps. Ivery. November 8, 1864.—F. C.
Polystichum angulare grandiceps. Bull. June 10, 1865.—F. C.
Polystichum angulare parvissimum. Lucombe, Pince & Co.—Dec.5,1865.—F.C.
Polystichum angulare rotundatum. Ivery. November 8, 1864.—F. C.
Polystichum concavum. See Lastrea Standishii.
Polystichum munitum. Walker. June 27, 1865.—F. C.
Polystichum ordinatum. Bull. April 4, 1865.—S. C.
Polystichum ordinatum. Bull. June 10, 1865.—S. C.
Polystichum triangulare laxum. Sim. July 12, 1860.—F. C.

Polystichum vestitum venustum. Lee. April 23, 1861.—F. C.
†Pothos argyræa. Veitch. May 12, 1859.—F. C.
Prenanthes arborea. Saunders. April 23, 1861.—C.
Primula ciliata. Backhouse. May 2, 1865.—F. C.
Primula cortusoides alba. Veitch. May 2, 1865.—F. C.
Primula cortusoides albida. Veitch. April 18, 1865.—F. C.
Primula cortusoides amœna. Veitch. April 20, 1864.—S. C.
Primula cortusoides amœna. Veitch. April 18, 1865.—F. C.
Primula cortusoides grandiflora. Veitch. April 18, 1865.—F. C.
Primula farinosa acaulis. Backhouse. May 2, 1865.—F. C.
Primula Parryi. Thompson. June 10, 1865.—F. C.
Primula sinensis atro-rosea plena. Turner. March 8, 1860.—F. C.
Primula sinensis delicata. F. and A. Smith. April 1, 1862.—F. C.
Primula sinensis filicifolia. E. G. Henderson. March 26, 1861.—C.
Primula sinensis filicifolia alba. E. G. Henderson. March 31, 1863.—S. C.
Primula sinensis filicifolia rubra. E. G. Henderson. March 31, 1863.—S. C.
Primula sinensis fol. variegatis. E. G. Henderson and Son. July 1, 1863.—B. & C.
Primula sinensis Glen Eyre. Windebank and Kingsbury. Mar. 21, 1865.—F.C.
Primula sinensis kermesina splendens plena. Windebank and Kingsbury. March 21, 1865.—F. C.
Primula sinensis nivea plena. Bull. March 26, 1861.—C.
Primula sinensis rubella plena. Bull. March 26, 1861.—C.
Primula sinensis Stuartii. Windebank and Kingsbury. Mar. 21, 1865.—F. C.
Primula sinensis The Fairy. F. and A. Smith. April 9, 1862.—C.
Primula sp. (Andes). Veitch. July 9, 1861.—C.
Promenæa citrina. Williams. May 30, 1865.—F. C.
Prumnopitys elegans. Veitch. June 1, 1864.—F. C.
Pteris argyræa. Veitch. July 7, 1859.—F. C.
Pteris cretica albo-lineata. Bull. March 26, 1861.—F. C.
Pteris cretica albo-lineata. Veitch. March 26, 1861.—F. C.
Pteris cretica albo-lineata angusta. Bull. June 1, 1864.—C.
Pteris flabellata Ascensionis. Barker. August 22, 1865.—F. C.
Pteris nemoralis variegata. Cole. May 21, 1862.—B.
Pteris pellucida. See Salpichlæna volubilis.
Pteris serrulata angusta. Williams. April 18, 1865.—S. C.
Pteris serrulata cristata. Veitch. July 1, 1863.—S. K. & F. C.
Pteris tricolor. Linden. February 9, 1860.—F. C.
Quercus sempervirens. Veitch. July 2, 1862.—B.
Quercus sp. Standish. July 1, 1863.—S. B. & S. C.
Quercus sp. Standish. July 1, 1863.—B. & C.
Quercus sp. (Japan). Veitch. July 2, 1862.—S. B.
Quercus sp. (Japan). Standish. July 2, 1862.—S. B.
Quercus sp. (Japan). Veitch. July 6, 1864.—C.
Ranunculus repens fol. albo variegatis. Salter. May 4, 1864.—S. C.
Renanthera coccinea. Smith. May 16, 1865.—Special.
Retinospora leptoclada. E. G. Henderson. April 15, 1863.—F. C.
*Retinospora lycopodioides. Veitch. June 5, 1861.—B.
*Retinospora obtusa. Standish. June 5, 1861.—S. B.
Retinospora obtusa aurea. Ayres. April 18, 1865.—F. C.
Retinospora obtusa nana aurea. Veitch. May 16, 1865.—F. C.
Retinospora obtusa prona. Ayres. April 18, 1865.—F. C.
*Retinospora obtusa variegata. Standish. June 5, 1861.—B.
Retinospora pisifera. Veitch. September 11, 1861.—F. C.
Retinospora pisifera aurea. Standish. May 6, 1862.—F. C.
Retinospora squarrosa. Veitch. June 11, 1862.—S. B.
Retinospora sp. (Japan). Veitch. June 11, 1862.—S. K.
Rhaphiolepis ovata. Veitch. May 17, 1864.—F. C.
Rhaphis flabelliformis variegata. Veitch. September 10, 1862.—S. C.
Rhodanthe atrosanguinea. Thompson. July 2, 1862.—S. B.
Rhodanthe maculata. Thompson. June 25, 1861.—F. C.
Rhodanthe maculata. Thompson. July 2, 1862.—S. B.

Rhodanthe maculata alba. Thompson. June 25, 1861.—C.
Rhodea japonica argentea. Bull. June 10, 1865.—F. C.
Rhodea japonica argenteo-striata. Bull. June 10, 1865.—F. C.
Rhodea japonica aureo-striata. Bull. June 10, 1865.—F. C.
Rhododendron Brookeanum flavum. See Rhododendron Lobbianum.
Rhododendron Caractacus. Waterer and Godfrey. May 30, 1865.—F. C.
Rhododendron Charles Dickens. Waterer and Godfrey. May 30, 1865.—F. C.
Rhododendron Countess of Haddington. Parker. March 19, 1862.—F. C.
Rhododendron Denisonii. Bousie. April 9, 1862.—F. C.
Rhododendron (hardy) Amilcar. Standish. May 24, 1860.—F. C.
Rhododendron (hardy) Athenia. Standish. June 14, 1860.—C.
Rhododendron (hardy) Lady Bowring. Veitch. May 21, 1862.—S. C.
Rhododendron (hardy) Lady Lopez. Veitch. May 21, 1862.—C.
Rhododendron (hardy) maculosissimum. Standish. May 24, 1860.—F. C.
Rhododendron (hardy) ochroleucum. Veitch. May 21, 1862.—S. C.
Rhododendron (hardy) Picotee rosea. Veitch. May 5, 1863.—F. C.
Rhododendron (hardy) præcox. Davis. March 12, 1861.—C.
Rhododendron (hardy) Romain de Smet. Lee. March 18, 1863.—C.
Rhododendron (hardy) Romain de Smet. Veitch. March 18, 1863.—C.
Rhododendron (hardy) Rosabelle. Standish. May 24, 1860.—C.
Rhododendron (hardy) striatum formosissimum. Standish. May21,1862.—F.C.
Rhododendron (hardy) Suwaroff. Standish. May 21, 1862.—S. C.
Rhododendron Henryanum. Veitch. May 2, 1865.—F. C.
Rhododendron H. H. Hunnewell. Waterer and Godfrey. May 30, 1865.—F.C.
Rhododendron H. W. Sargent. Waterer and Godfrey. May 30, 1865.—F. C.
Rhododendron (jasminiflorum) Princess Alexandra. Veitch. Mar.7, 1865.—F. C.
Rhododendron (jasminiflorum) Princess Helena. Veitch, March 21,1865.—F.C.
Rhododendron jasminiflorum superbum. Veitch. August 26, 1862.—F. C.
Rhododendron Lady Clermont. Waterer and Godfrey. May 30, 1865.—F. C.
Rhododendron Lobbianum. Veitch. March 8, 1860.—F. C.
Rhododendron McNabii. Bousie. April 9, 1862.—C.
Rhododendron Mrs. John Clutton. Waterer and Godfrey. May 30, 1865.—F.C.
Rhododendron Nuttallii. Williams. April 20, 1864.—F. C.
Rhododendron Nuttallii. Williams. April 18, 1865.—Special.
Rhododendron Princess Alice. Veitch. March 19, 1862.—F. C.
Rhododendron Princess of Wales. Young. June 1, 1864.—S. C.
Rhododendron Sesterianum. Veitch. March 19, 1862.—F. C.
Rhododendron sp. (Moulmein). Veitch. March 9, 1864.—C.
Rhododendron Stella. Waterer and Godfrey. May 30, 1865.—F. C.
Rhododendron Veitchii. Veitch. May 16, 1865.—Special.
Rhus vernicifera. Veitch. August 26, 1862.—F. C.
Rhynchospermum jasminoides variegatum. A. Henderson and Co. June 17, 1863.—B. & C.
Richardia albo-maculata. E. G. Henderson and Son. June 10, 1865.—F. C.
Robinia Pseudacacia Decaisneana. Osborn. May 30, 1865.—F. C.
Rose Dr. Lindley. W. Paul. July 19, 1864.—S. C.
Rose Globosa. W. Paul. June 29, 1864.—S. C.
Rose (H. P.) Beauty of Waltham. W. Paul. June 11, 1861.—F. C.
Rose (H. P.) John Hopper. Ward. June 26, 1862.—F. C.
Rose (H. P.) Lord Macaulay. W. Paul. May 5, 1863.—F. C.
Rose (Tea) President. A. Paul and Son. March 29, 1860.—F. C.
Saccharum violaceum. Bull. October 8, 1862.—C.
Saccolabium curvifolium splendens. Veitch. May 2, 1865.—F. C.
Salisburia adiantifolia fol. variegatis. Standish. July 2, 1862.—B.
Salpichlæna volubilis. Bull. July 6, 1864.—F. C. (Shown as Pteris pellucida.)
Salpigophora chilensis. See Campsidium chilense.
Saponaria calabrica roseo-alba. Carter. August 23, 1860.—C.
Sarmienta repens. Veitch. May 21, 1862.—S. K,
Sarmienta repens. Veitch. May 5, 1863.—F. C.
Sarracenia Drummondii. Williams. March 30, 1864.—Special.
Sarracenia rubra. Williams. June 1, 1864.—F. C.
Saxifraga (japonica) tricolor. Bull. December 8, 1863.—F. C.

*Sciadopitys verticillata. Standish. June 5, 1861.—S. K.
Scilla natalensis. Green. April 18, 1865.—C.
Sedum carneum variegatum. E. G. Henderson. September 11, 1861.—C.
Sedum Sieboldii medio variegatum. Salter. May 4, 1864.—F. C.
Sedum Telephium medio variegatum. Salter. May 16, 1865.—F. C.
Sedum Telephium medio variegatum. Salter. June 10, 1865.—F. C.
Selaginella atroviridis. Veitch. July 28, 1859.—C.
Selaginella conferta. Veitch. December 8, 1859.—F. C.
Selaginella involvens. Veitch. July 7, 1863.—F. C.
Selaginella involvens variegata. Veitch. July 7, 1863.—F. C.
Selaginella japonica. Standish. July 1, 1863.—S.B. & S.C.
Selaginella Lobbii. Veitch. July 28, 1859.—F. C.
Selaginella Martensii albo-variegata. Bull. November 7, 1865.—S. C.
Selaginella sp. (India). Veitch. October 8, 1862.—S. C.
Selaginella Wallichii. Veitch. December 8, 1859.—F. C.
Selliguea pothifolia. Veitch. June 17, 1863.—S. B. & S. C.
Sempervivum aizoides variegatum. Bull. April 18, 1865.—S. C.
Sempervivum aizoides variegatum. Bull. June 10, 1865.—F. C.
Serissa fœtida marginata. Bull. May 21, 1862.—B.
Siphocampylus sp. Veitch. March 21, 1865.—F. C.
Skimmia japonica (vera). Standish. March 18, 1863.—F. C.
Skimmia oblata. Standish. September 27, 1864.—F. C.
Solanum Capsicastrum hybridum. McIntosh. October 11, 1864.—S. C.
Solanum Capsicastrum variegatum. E. G. Henderson. Sept. 23, 1862.—F. C.
Solanum vescum. McIntosh. June 27, 1865.—S. C.
Sonchus Saundersii. Green. March 7, 1865.—F. C.
Sphærogyne cinnamomea. Bull. June 10, 1865.—S. C.
Sphærogyne ferruginea. Bull. August 8, 1865.—S. C.
Sphærogyne latifolia. Veitch. May 21, 1862.—S. K.
Sphærostema marmoratum. Low. September 22, 1859.—F. C.
Spiræa Nobleana. Noble. August 9, 1860.—C.
Spiræa sp. (California). Veitch. May 27, 1863.—S. B. & S. C.
Spraguea umbellata. Veitch. July 7, 1859.—C.
Statice Frostii. Frost. July 1, 1863.—S. B. & S. C.
Statice profusa. Parker and Williams. November 8, 1860.—C.
Stangeria paradoxa (fœmina). Jackson. June 1, 1864.—S. C.
Stenogastra concinna. Veitch. June 5, 1861.—S. B.
Stenogastra concinna. Veitch. November 12, 1861.—F. C.
Stenogastra multiflora. Veitch. May 21, 1862.—B.
Stephensonia grandifolia. See Phœnicophorium sechellarum.
Swainsona violacea. E. G. Henderson. May 6, 1862.—F. C.
Symphytum tuberosum variegatum superbum. Salter. April 9, 1861.—C.
Syringa Dr. Lindley. See Lilac.
Tachiadenus carinatus. Veitch. July 26, 1860.—C.
Tapeinotes Carolinæ. Bull. August 22, 1865.—S. C.
Taxus baccata erecta. Crowder. September 27, 1860.—F. C.
Taxus hibernica fastigiata. Fisher and Co. June 17, 1863.—S. K. & F. C.
Teucrium Scorodonia crispum. Stansfield. July 29, 1865.—S. C.
Theophrasta (?) argyræa. Linden. May 10, 1860.—C.
Thibaudia macrantha. Veitch. December 13, 1860.—F. C.
Thibaudia ocanensis. Stanton. December 5, 1865.—S. C.
*Thuja pygmæa. Veitch. June 5, 1861.—B.
*Thujopsis dolabrata variegata. Standish. June 5, 1861.—S. B.
Thujopsis lætevirens. Veitch. May 21, 1862.—S. K.
Thunbergia fragrans. Earley. November 21, 1865.—S. C.
Tilia europæa fol. argenteis. E. G. Henderson. May 6, 1862.—S. C.
Todea superba. Veitch. May 28, 1861.—F. C.
Trichinium Manglesii. Thompson. July 11, 1865.—F. C.
Trichiocarpa Moorii. See Cionidium.
Trichomanes alatum. Backhouse. July 1, 1863.—B. & C.
Trichomanes anceps. Bull. February 25, 1863.—F. C.
Trichomanes crispum pilosum. Low. June 17, 1863.—S. B. & S. C.

Trichomanes floribundum. Backhouse. July 1, 1863.—B. & C.
Trichomanes Kaulfussii. Backhouse. July 1, 1863.—S. B. & S. C.
Trichomanes scandens. Backhouse. July 1, 1863.—S. K. & F. C.
Trichomanes spicatum. Bull. March 18, 1863.—F. C.
Trichopilia crispa. Veitch. April 20, 1864.—F. C.
Trichopilia picta. Williams. June 27, 1865.—S. C.
Tricyrtis grandiflora. Standish. November 11, 1862.—F. C.
Tropæolum Garibaldi. Garaway. September 27, 1860.—C.
Tropæolum Yellow Tom Thumb. Carter. August 11, 1859.—C.
Tydæa Countess of Ilchester. E. G. Henderson. December 8, 1859.—C.
Tydæa elegans. Parker and Williams. April 26, 1860.—C.
Vaccinium Vitis Idæa fol. variegatis. Salter. September 24, 1861.—C.
Valdivia Gayana. Veitch. April 15, 1863.—C.
Vallota purpurea eximia. Bull. August 25, 1863.—Special.
Verbena Annie. Cooling. August 16, 1864.—S. C.
Verbena Annie. Cooling. September 13, 1864.—F. C.
Verbena Beauty of England. Gill. June 25, 1865.—F. C.
Verbena Champion. Perry. September 5, 1865.—F. C.
Verbena Charles Turner. Perry. August 16, 1864.—F. C.
Verbena Clara. Perry. July 28, 1859.—C.
Verbena Cleopatra. Perry. August 8, 1865.—F. C.
Verbena Cruor. G. Smith. July 12, 1860.—C.
Verbena Dr. Sankey. Edmonds. August 25, 1859.—F. C.
Verbena Fairest of the Fair. G. Smith. June 28, 1860.—C.
Verbena Foxhunter. Miller. July 9, 1861.—F. C.
Verbena Glowworm. Perry. July 19, 1864.—S. C.
Verbena Grand Eastern. Woods. July 12, 1860.—C.
Verbena John Keynes. Eckford. September 5, 1865.—F. C.
Verbena Lady Jane Ellice. Eckford. August 22, 1865.—F. C.
Verbena Lilac King. Perry. August 16, 1864.—C.
Verbena Lord Craven. Downie. August 26, 1862.—F. C.
Verbena Lord Leigh. Perkins. June 11, 1862.—F. C.
Verbena Lucy Tait. Cunningham. July 26, 1860.—C.
Verbena (Maonettii) Princess Victoria. Wills. May 30, 1865.—F. C.
Verbena Mauve Queen. Perry. July 7, 1863.—C.
Verbena Minerva. Stalker. September 6, 1864.—S. C.
Verbena Mr. Gladstone. Eckford. September 5, 1865.—S. C.
Verbena Nemesis. G. Smith. August 9, 1860.—F. C.
Verbena Othello. Wills. June 17, 1863.—C.
Verbena Pink Perfection. G. Smith. August 9, 1860.—C.
Verbena (bedding) Purple Prince. Norford. September 6, 1864.—C.
Verbena Rugby Hero. Treen. September 10, 1862.—F. C. (cancelled).
Verbena Scarlet Cushion. Wills. August 22, 1865.—F. C.
Verbena Snowball. Perry. July 19, 1864.—S. C.
Verbena Velvet Cushion. E. G. Henderson and Son. June 29, 1864.—C.
Verbena William Dean. Perry. August 8, 1865.—F. C.
Veronica Chamædrys pulcherrima. Salter. April 9, 1861.—C.
Viburnum Lantana variegatum. Bull. June 10, 1865.—S. C.
Violet The Czar. Graham. March 7, 1865.—F. C.
Waitzia grandiflora. Thompson. August 16, 1864.—F. C.
Wallflower Yellow Perfection. Graham. March 31, 1863.—C.
Weigela rosea alba. Standish. May 27, 1863.—B. & C.
Weigela Stelzneri. Standish. May 6, 1862.—C.
Woodsia polystichoides Veitchii. Standish. July 1, 1863.—S. B. & S. C.
Woodsia polystichoides Veitchii. Bull. May 2, 1865.—F. C.
Woodsia polystichoides Veitchii. Standish. June 10, 1865.—F. C.
Woodwardia japonica. Standish. June 17, 1863.—S. B. & S. C.
Woodwardia orientalis. Standish. November 12, 1861.—F. C.
Xanthorrhœa australis. Williams. April 20, 1864.—F. C.
Yucca lineata lutea. Bull. February 25, 1863.—F. C.
Zinnia elegans fl. pleno. Carter. September 27, 1860.—F. C.
Zinnia elegans fl. pleno. Vilmorin. September 27, 1860.—F. C.

March 6.—The most important novelty sent to the Meeting of March 6th consisted of cut specimens of *Bougainvillea splendens*, from Mr. Daniel's garden at Swyncombe, Henley-on-Thames. This was somewhat intermediate in aspect between *B. spectabilis* and *B. glabra*, having smaller and more acuminated leaves, less hairy than those of the former, and the bracts of a brighter magenta-rose. The plant is particularly valuable as coming into bloom at an early period of the year, being succeeded in April by *B. spectabilis*, and this, again, towards autumn by *B. glabra*.

A good many interesting plants were also shown. Major Trevor Clarke, Welton Park, Daventry, sent an example of *Coburghia miniata*, which he induced to blossom by growing it in small pots, repressing its tendency to produce offsets, repotting it annually, and starting it in a stove temperature. Messrs. J. and C. Lee, of Hammersmith, had a group of several *Aucubas* well furnished with berries. In a collection of cut *Orchids* from Mr. Sherratt, gardener to J. Bateman, Esq., was a magnificent spike of *Phalænopsis Schilleriana*. Messrs. E. G. Henderson and Son, St. John's Wood, sent a very beautiful collection of *Cyclamens*, consisting of numerous varieties of *C. persicum* and of *C. Coum*, together with the intermediate *C. Atkinsii*. Cut flowering specimens of *Rhododendron Aucklandii*, from a plant 4 feet high bearing fifteen trusses of blossom, came from Mr. Brown, Elmdon Hall, Birmingham. W. Wentworth Buller, Esq., Strete Raleigh, Exeter, sent, amongst other interesting subjects, a hybrid *Rhododendron*, almost identical with Mr. Veitch's "Princess Royal," and obtained by the same cross—*R. javanieum*+*jasminiflorum*. Mr. Allis, Gunton Park, Norwich, exhibited a cut specimen of the rarely seen *Rhododendron argenteum*, the dense, many-lobed, compactly bell-shaped, white corollas of which were prettily marked at the base, inside, with radiating crimson lines.

The Society's Garden furnished a finely-grown example of *Dendrobium speciosum*, and examples of *Prunus sinensis*, *P. sinensis alba*, and *P. triloba*, all exceedingly valuable as dwarf double-flowered shrubs for early forcing; the latter is larger-flowered and of a deeper colour than *P. sinensis*.

The following communication from Major Clarke, respecting the treatment of *Coburghia miniata*, was read to the Meeting:—

This remarkably handsome bulb is rarely seen in collections, from its being shy of flowering under ordinary cultivation. The treatment is as follows, and consists in resisting the habit of making a profusion of offsets. The soil is pure loam with much

sand, and the pot as small as possible. The plant is shifted every spring, and the smallest pot it can be got into is still used. The bulb is three parts out of the ground. It will thrive thus, and it is more easy to observe and detach the offsets. One of these, however, will often start from the base of the mother bulb and grow downwards, thus escaping notice; this must be observed at the time of shifting: the small size of the pot, however, and poor soil will tend greatly to prevent the formation of offsets. If increase is wanted, a free shift into rich soil will produce a forest of them. In all other respects the habit and treatment are those of *Hippeastrum aulicum.* The temperature must be that of the stove at first, and that of the greenhouse after midsummer.

Mr. Wilson Saunders, however, stated that he grew his plants somewhat differently from Major Clarke. He gave his plants more pot room, and thus secured a great number of flowering stems, taking care that the roots should never get too dry when at rest, at which time they were kept in the greenhouse, but removed to the stove when they were ready to make a new growth.

A nice plant of *Illicium religiosum* was sent by Mr. Veitch, which differed from the more ordinary form in the slightly broader leaves. Mr. Wilson Saunders remarked that this highly fragrant plant is a great favourite of the Japanese, who place it round their temples from a feeling analogous to that which causes Yews to be planted in our churchyards. This plant may possibly succeed in the open air on the coast in the south of England, where *Pittosporum Tobira,* though in general considered a greenhouse plant, is perfectly hardy and, as at Margate, forms large bushes. The rare *Lælia furfuracea,* of which a figure was published in the 'Botanical Magazine' in 1842, was exhibited with a single flower only, and it was considered to be perfectly distinct from *L. autumnalis.* Cut specimens of *Nuttallia cerasiformis,* Torr. and Gray, were exhibited from the Society's Gardens, a plant which is figured at t. 82 of Beechey's Voyage. It is a plant of considerable interest in a botanical point of view, from its possessing the habit of a *Ribes,* its bisexual flowers, the ten stamens in the male flower being inserted in two rows (one attached to the calyx, the other to the tube of the corolla), the fleshy drupes (from two to four together), and the convolute cotyledons. As a very early flowerer, it was thought to be an acquisition to the shrubbery; and it was accordingly proposed to raise a quantity for distribution.

A beautiful feathery mould (*Botryosporium diffusum*) on the stem of some herbaceous plant having been sent up to the

Meeting, as the mould was identical with that (*B. Bassianum*) which produces the disease called Muscardine in silkworms, or a mere variety. Mr. Berkeley took occasion to make some remarks on Fungi which attack animal tissues, and cause either disease or death. It is necessary, however, to distinguish between those which merely germinate or establish themselves on moist surfaces, but never penetrate the tissues, and those which, spreading in every direction, live at their expense.

It is not uncommon to find fungi, belonging in almost every instance to those species of mould which are most widely diffused, on the mucous lining of the lungs. It does not, however, appear that they act immediately by the destruction of the tissues; but by blocking up the passages and preventing the oxidation of the blood fatal mischief may ensue. Fungi, again, occur in some of the fluids of animal frames, as, for instance, the so-called *Oïdia* in the urine, or *Sarcina* in the stomach, especially when corroded by cancer; and probably sometimes act, like other strange bodies, as irritants. There are others, however, which luxuriate in animal tissues. Some of the most obstinate cutaneous disorders either owe their origin to fungi, or are aggravated by their presence; and there are cases in which, when one or two spores of a fungus, as of the *Botryosporium* just mentioned, gain possession of the tissues, they penetrate to such an extent that death ensues, and the whole mass seems turned into a fungus. Liebig has lately endeavoured to show that this disease arises from the want of some peculiar chemical constituent which is proper to the mulberry-leaves on which silkworms live; but though this circumstance may favour the development of the mould, which the Editor was not prepared either to confirm or dispute, it is clearly not the efficient cause. There is no pretence that the silkworm must be in an unhealthy state to allow the fungus to establish itself, as a few spores, placed lightly on healthy caterpillars, have been quite sufficient to propagate the disease.

Especial attention was then drawn to the fact that in almost every case of rinderpest Dr. Lionel Beale had found organisms in the voluntary muscles and those of the heart, which were probably fungoid. The nearest resemblance is to be found in one which occurs in a fish, *Sciæna umbra*, which is most probably one of the fish-moulds. The organism in Rinderpest is probably a state of some fungus (for Dr. Cobbold is decidedly of opinion that it is no entozoon); but as the same has been observed for the last thirty years in deer, sheep, pigs, rats, &c., whether in a healthy or unhealthy state, it has clearly no specific relation to it. The muscles,

however, of the diseased cattle may possibly afford a favourable nidus for the development of the mould.

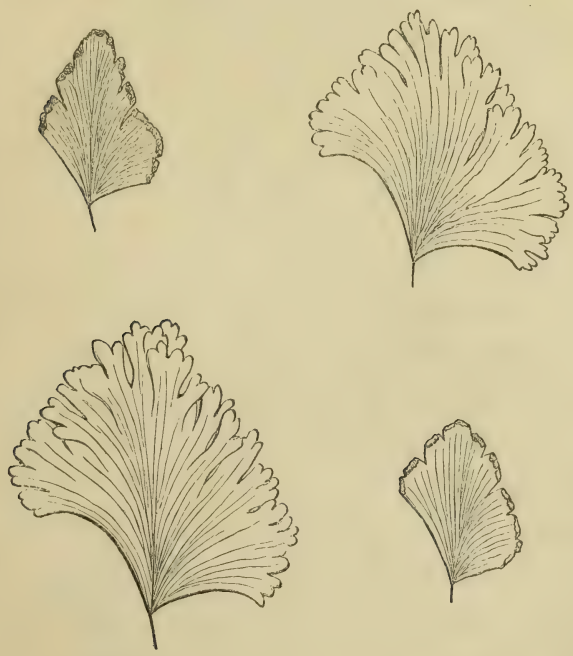
In the same number of the 'Medical Journal and Gazette' in which Dr. Lionel Beale's observations were published, a letter appeared, in which it was hinted that the Red Rust which was so prevalent last year in grass, might be the cause. It is no new idea that disease may arise from the Rust, when so abundant as to be swallowed in great quantities with the food; but there is not the slighest foundation, either from experiment or observation, for the supposition. At present it is mere matter of surmise. Be this, however, as it may, the Red Rust is so old a native, and so very frequent a visitant, that we cannot logically ascribe so formidable and little-known a complaint to such a cause. Spores of the Red Rust were, indeed, in many cases found in the passages, exactly as particles of soot or any other light substance may be inhaled; but they have never been seen to penetrate the tissues.

But very few objects were submitted to the fruit Committee: some specimens of the *Northern Greening*, a name which is often erroneously given to the Winter Greening, a very different Apple, came from the garden of Mr. Skinner, at King's Cliffe, in Northamptonshire, and from the same village a very prolific seedling, raised by Mr. Dixon, which was, however, too ripe to judge of its merits. A seedling *Apple*, somewhat resembling the Court of Wick Pippin, was sent by Mr. Christie, of Avington, near Winchester, which was thought of sufficient merit to cause a request that it might be seen again. Some excellent *Apple-Jelly*, made from Grange's Apple, was sent by Mr. Fleming, of Cliveden.

March 10.—Among the subjects shown on March 10th were three new varieties of *Hyacinth*, all possessing considerable merit. They were shown by Mr. Young, gardener to R. Barclay, Esq., Highgate. One called *Sir E. Landseer*, was of a reddish puce, with a dark stripe in the centre of each segment: it was rather short in the spike; but this appeared to be the result of some check in its development. Another, called *General Pelissier*, was of a pale gray or lilac, clearer in tint than the well-known Grand Lilas; it was an effective sort. Another, called *Mary*, was a pure white, with close spike, and broad, short segments to the corolla, and hence less coarse-looking than such otherwise fine varieties as Queen of the Netherlands, the flowers being individually smaller but closer. Mr. Bartlett, of Hammersmith, showed half-a-dozen plants of *Prunus sinensis alba*, which is one of the most chaste and beautiful of dwarf hardy shrubs adapted for forcing into

early bloom. A meritorious specimen of *Chorozema Laurenceanum*, well flowered, and trained over a balloon-shaped trellis, was sent by Mr. Beasley, gardener to Mrs. Wood, of Acton.

Adiantum Farleyense, Moore.—Few plants attracted more attention at the late International Exhibition than the truly magnificent specimen of this beautiful fern. The woodcut exhibiting the form of the pinnules was unfortunately not ready when Mr. Moore's paper was published (page 82 of this Journal). The omission is now supplied.



March 15.—This was a fine show of Hyacinths and other spring flowers. The collections of Hyacinths especially were of the highest degree of merit, the first place being taken by Mr. W. Paul. The rosy pink variety named Macauley, the lilac-blue Lord Palmerston, the white Queen of the Netherlands, the indigo King of the Blues, the canary-coloured Ida, and the pucy Hadyn, were everywhere conspicuous. Some very fine new Hyacinths were also set up. Vunxbaak, a brilliant carmine, was the brightest-coloured Hyacinth yet seen; Sir H. Havelock, a deep clear puce with darker stripe, was the finest yet seen of this colour; while Bird of Paradise was an improvement on Ida, hitherto the

best of the yellows. There were also of noteworthy sorts—Mary, white with finely shaped flowers; Princess Mary of Cambridge, grayish blue, of large size; Sir E. Landseer, a dark puce, and another of the same name, a clear rose-pink; Hogarth, a delicate but lively pink, of good quality, and Orion, a deep violet purple, with white eye, remarkable for the smooth segments of its flowers.

March 20.—Mr. W. Paul exhibited several new Roses, among which were Dr. Lindley, a noble crimson of deep tint and finely shaded; also Black Prince, a deep velvety crimson, to which latter a first-class certificate was awarded, as also to the same grower for the Hyacinths named Vunxbaak, Sir Henry Havelock, and Bird of Paradise. Mr. Toombs, gardener to W. S. Roots, Esq., furnished an acquisition in the shape of a double-blossomed, compact, free-flowering variety of *Primula filicifolia*, called *rubra plena*. Messrs. Windebank and Kingsbury, Southampton, also contributed a group of Chinese Primulas, in which *P. alba gigantea*, *P. magnifica*, a purplish crimson, and *P. filicifolia rubra*, a very fine salmon rose-coloured, were conspicuously good. A finely grown example of *Dendrobium speciosum* was furnished by W. W. Buller, Esq., of Strete Raleigh, Exeter, who stated that he had flowered it in a warm greenhouse in which Pelargoniums were kept. The only secret in regard to its successful cultivation was, he explained, not to shade it, but on the contrary to let it have as much light as possible. In an interesting collection of plants from W. Wilson Saunders, Esq., was included *Nicotiana wigandioides*, a stately variety of tobacco, with large elliptic leaves, and loose branching panicles of handsome creamy-yellow flowers.

Mr. Berkeley made several remarks on the specimens exhibited, amongst which the following seem most worthy of being recorded.

A plant of *Odontoglossum luteo-purpureum* was exhibited, in which there was a lateral fusion of spikes, similar to what so frequently takes place in Asparagus and the Ash-tree. A case of similar fusion in the Holly, where it is less frequent, was exhibited at one of the spring Meetings. A remarkable point, however, in the Orchids was, that, in consequence of the fusion, the leaves were double the usual breadth. A portion of a letter, from George Chichester Oxenden, Esq., was read, in which he writes that the rare Lizard Orchis is still to be found in some of the Kentish woods. A specimen in 1860 attained the height of 31½ inches, and bore fifty perfect flowers. A plant of *Sonchus platylepis*, one of the suffruticose species, was sent by Mr. Wilson Saunders. *Orobanche minor* had established itself on the roots of this species in his conservatory,

and defied every attempt at getting rid of the parasite, which is so common in the neighbourhood as to prevent its being an object of interest, which it might be in other localities. *Chloranthus inconspicuus* was pointed out, as of some botanical and economical interest, from its differing from Piperaceæ in its pendulous (not erect) ovules, and its being used by the Chinese for flavouring tea. A section of *Pinus Lambertiana*, from a tree in the Society's Gardens, at Chiswick, was laid on the table, in which the development of wood on the underside of the branch was much greater than that on the upper, 8½ inches against 1½. This was due perhaps partly to gravitation, and partly to the preponderance of branchlets on the lower side of the branch. Specimens of a small West-Indian mollusk, *Bulimus Goodallii*, were received from Mr. G. F. Wilson, in whose garden it was committing great ravages amongst the young Cucumber-plants. It made its appearance there for the first time three years ago; after two years' visitation the gardener thoroughly cleared out all the old mould, white-washed the brick-work, and had a fresh supply of peat from Wimbledon Common, but with no good results, for the snails are as plentiful as ever. Young Cucumbers placed before them were greedily attacked, as were the flowers and young plants; as appeared from specimens laid before the Meeting. The species has existed for many years in the nursery of Messrs. Garraway, at Bristol, where it is found principally about the roots of the pines, which, however, it does not seem to attack. The Wandsworth specimens are much larger than those from Bristol; but Mr. Jeffreys, who is the great authority on such matters, is of opinion that they are identical. The latter, however, seem to be carnivorous. It is not, however, uncommon for Helices and their allies to be carnivorous, as well as herbivorous, as was pointed out many years since by Lister. If no other food is to be had, when shut up in a box they will attack each other. Some allied mollusks are chiefly carnivorous, and *Testacella* is wholly so. Many of the *Limaces* appear to be omnivorous.

Mr. Bateman then adverted to the poisonous qualities of *Andromeda floribunda.* His attention was first called to the fact by a goat, which had eaten of it, being seized with an attack resembling an epileptic fit, but more especially from the circumstance of two cows, one of which died, having browsed on some twigs, which had been used for decorating a school at Christmas. A still more disastrous case was reported in the 'Agricultural Gazette,' March 17, in which a quantity of sheep trespassed

into an enclosure where it was planted, and many of them died in consequence. The dead and living branches are equally to be kept out of the reach of live stock. He then adverted to some fine cut specimens of *Amherstia nobilis*, which were sent from Chatsworth. The original specimens nearly fell a sacrifice to being planted in a tub whose wood was kyanized. In consequence of this, probably, Mrs. Lawrence, of Ealing, was the first who flowered it. After the Meeting the specimens were sent to Lady Sarah Hay Williams, the daughter of Lord Amherst, to whom the plant was dedicated. Mr. Bateman finally made some interesting observations on the Orchids exhibited. *Odontoglossum radiatum* and *O. hystrix* were pronounced synonymous with *O. luteo-purpureum*. As a proof that judgment respecting the real beauty of a species must not be determined from imported specimens blowing for the first time, he pointed to a single-flowered specimen of *Dendrobium luteolum* just imported, and a spike of the same species sent by Mr. Anderson, from Meadowbank. *Odontoglossum Bluntii* and *O. Alexandræ*, are identical, and the former name must give plate to the latter. *Dendrobium Hillii* and *D. speciosum*, according to Mr. W. Wentworth Buller, are the same species; *Dendrobium Dayanum* is *D. anosmum*, Lindl., while the plant which in general bears the latter name is *D. macrophyllum*. *Angræum eburneum* had been three months in flower, and was only just beginning to fade. With a judicious selection Orchids may be had in flower all the year round.

April 3.—Messrs. E. G. Henderson and Son, St. John's Wood, contributed a beautiful variegated variety of *Cynosurus cristatus*, called *foliis variegatis*; it is more freely marked with white than another variety known in gardens. A handsome tricolor-leaved Pelargonium in the way of Mrs. Pollock, named Sophia Cusack, came from the same establishment. From Messrs. Veitch came a pretty little *Angræcum*, from Madagascar, and *Maranta splendida*, with pale-green markings, on a deep-green ground-colour, a charming plant; they had also Camellia Triomphe de Lodi, with nicely cupped flesh-coloured faintly striped flowers, which was associated with the glorious Azalea *Stella*, with brilliant large orange salmon-coloured flowers, blotched in the upper petals with violet, the two colours producing a charming contrast. Mr. Watson, St. Albans, sent a promising tricolor-leaved Pelargonium, named Miss Watson, with beautifully-marked foliage, and large rosy-salmon well-formed flowers. Mr. Standish received a first-class certificate for *Rhododendron Griffithii*, a Bhotan plant with large pure-white flowers

scented like Hawthorn. It is identical with *R. oblongum*, Griff., according to Dr. Hooker, and *R. Aucklandii*, Hook. fil., is a form of the same species. Mr. Brown, of Elmdon Hall, near Birmingham, sent cut specimens of *R. Aucklandii* to the Meeting of March 6, from a plant 4 feet high, with fifteen trusses of bloom.

April 12.—The principal features of this show consisted of Azaleas, four plants of which were sent by Mr. Turner, of Slough, and smaller ones by Messrs. Lane, of Berkhampstead. Mr. Turner's principal collection, large in size and loaded with bloom, consisted of Eulalie Van Geert, Magnificans, Duc de Nassau, Perryana, Roi Leopold, Louise Von Baden, Queen Victoria, and what is termed a union plant, *i. e.* two varieties worked on one stock, a mode of treatment by which very pleasing results are often produced. Mr. Turner also showed two fine seedling Azaleas, consisting of George Eyles, large orange-scarlet, with little spotting, and Fire King, similar in colour, but not quite so large or flat, and heavily spotted in the upper petals: both promise to be acquisitions.

Roses were shown, beautifully in bloom, and formed objects of great attraction. Mr. William Paul had Madame Alfred Rougemont, a fine light-coloured Hybrid Perpetual; Madame Clémence Joigneaux, Souvenir d'un Ami, Jean Goujon, Beauty of Waltham, John Hopper, and Le Rhone. A beautiful group from Mr. Turner consisted of Madame Willermoz, Souvenir de Malmaison, Jules Margottin, Souvenir d'un Ami, Gloire de Dijon, Général Jacqueminot, Victor Verdier, Le Rhône, and *Alba rosea*, the last with white flowers, charmingly tinted in the centre with pink. From Messrs. Paul and Son came Virginal, a white Hybrid Perpetual, with a blush centre; Madame Willermoz, Charles Lawson, Lord Raglan, Anna Alexieff, Madame Damazin, John Hopper, Madame Julie Daran, and Souvenir d'un Ami. New Roses of 1865-66 came from Mr. William Paul, Messrs. Paul and Son, and Mr. Turner. Among crimson scarlets of different shades were Glory of Waltham, large and showy; Dr. André, a remarkably fine and constant variety; Dr. Lindley, a new dark rose of great promise; Madame Moreau, Charles Margottin, Prince Eugène Beauharnais, John Keynes (a beautiful velvety sort), Triomphe des Français, Madlle. Amélie Halpen, Général d'Hautpoult, Souvenir de Bernardin de St. Pierre, Duchesse de Caylus, Duc de Wellington (a velvety flower, beautiful in the bud state), and Charles Wood. Among rose and pink kinds were Joséphine Beauharnais, Marcella, and Mademoiselle Marguerite Dombrain.

Yellows were confined to Maréchal Neil, in praise of which too much cannot be said; Madame Verschaffelt was a delicate violet-shaded rose; and Rushton Radclyffe and Baronne de Maynard, the latter a pure white Hybrid Perpetual, deserve special mention. A very fine single specimen of President, with about a score of blooms on it in different stages of development, was shown by Mr. W. Paul.

Other noticeable features of the show were Cinerarias, Calceolarias, Auriculas, and Cyclamens, of each of which very fair examples were shown. The newish *Kerria japonica variegata* was in a handsome state, by Mr. Turner; its beautifully marked leaves, together with its expanded yellow blossoms, produced an admirable effect.

It has lately been suggested that figs might be grown as standards in the midland as well as the southern counties. Experience, however, is against this notion. A compartment in a garden in Northamptonshire, made in 1760, was devoted to standard figs; but though the plants were still in existence in 1820, the Editor never knew them to ripen, and he believes, from the report of those who knew them from a very early period, that they only once perfected their fruit, though protected from the frost.

Fine specimens of *Ficus Cooperi*, from Chiswick, appeared with ripe fruit, which was quite insipid. Amongst the Camellias was one named l'Insubria, which, as the classical name for Lombardy implies, was evidently of Italian origin. A curious circumstance took place a few years since with respect to Italian Camellias. One of the first nurseries in the south of England had suffered much from parasites. A little mould, belonging to the genus *Polyactis*, had attacked many of the most valuable plants, especially Conifers, inducing a loss of many hundred pounds. While this was still raging, another enemy appeared on the Camellias, doing considerable damage. Specimens were sent to Mr. Berkeley, who found that the little parasite was *Pestalozzia Guepini*, a species which had not occurred before in this country. It was asked, accordingly, if the plants were of Italian origin, and it appeared that the parasite was developed on a lot lately received from Italy; so possible is it to introduce a plague which may do enormous damage, though so minute that it can be seen only with a powerful magnifier.

As regards the *Cynosurus*, it was remarked that in certain localities everything has a tendency to become variegated. This is especially the case about Hounslow. It is curious that a tree

which is perfectly free from variation will sometimes send up variegated shoots from the roots, as appeared lately in the case of an Elm at Chiswick; and such shoots, when grafted, are permanently variegated.

A fine specimen of *Bonatea speciosa* was exhibited by Mr. Wilson Saunders, which occasioned a remark how curious that the beautiful Cape Orchids should be so much neglected, though many of them were figured by Buxbaum at the beginning of the last century, *Lachenaliæ*, however, and other allied plants, being confounded with them on account of their bulbs being somewhat similar to the Orchid tubers.

It was stated that experiments were commenced at Chiswick respecting the possibility of cultivating Truffles. Mr. G. C. Oxenden had kindly sent a small supply; and others had been procured from Mr. Charles Yates, an experienced Truffle-hunter at Winterslow. It was, however, rather late in the year to get good specimens, the season being almost over. An account was given of the different attempts by the Visconte Noe, Bornholz (supposed by some to be a myth), and others. Some attempts merely consisted in enclosing patches of ground, protecting them from the ravages of wild swine, and sprinkling the soil with water in which truffles had been rasped; others, as in Poitou, in sowing tracts of downs with acorns; while others attempted either to get the spawn to run, or to construct beds containing a proper admixture of calcareous matter—to which latter plan the attempts at Chiswick are at present confined. About ten years since, Mr. Disney, at the Hyde, near Ingatestone, made similar experiments; but as his truffles were merely the sweepings of the drawers at Fortnum and Mason's, it was not likely that they should succeed. Even there, however, probably from some fresher specimen, there seemed a tendency to form spawn; but Mr. Disney died shortly after the beds were opened, and the experiments were not followed up with better materials. The spawn is very delicate, and is said to be phosphorescent, and does not like to be disturbed. Calcareous matter is absolutely essential, and perfect drainage. It is a mistake to suppose that they will grow under beech-trees only; hazel and oak are just as good, and an admixture of firs is not injurious.

The following sensible letter on the subject was received from Charles Yates, and is very valuable as coming from a man who has been engaged in the pursuit of truffle-hunting for nearly sixty years, and who succeeded to the experience of his father and grandfather.

"The commencement of the truffle-season depends a great deal on the soil; we have some places where we get them as early as July and August, but we do not begin the general hunt till September; I depend chiefly on the weather. If we have a stormy bloomy summer, the truffles come early and fine; but if dry, they are backward and very indifferent, and get the dryrot and canker. We find the earliest truffles under the youngest trees in the truffle-grounds, where the morning sun can penetrate; but where the shade is deeper, the midwinter hunt is the best. The lighter the soil, the earlier the truffles. The latter season depends much on the weather. The very dry season we had last September spoiled the season all through, as the truffles were coming on well till the drought set in, and that killed the spawn, so that we had but a middling season. They have been more plentiful and finer the last fortnight (the first two weeks of March) than they were before. We keep on hunting as long as sufficient truffles are to be found to pay for our time. I have got them as late as May; but this is very rare; we get a few generally in March and April; but you must not go over the same ground very often late in the season—not oftener than once a fortnight. When the season is in, and the truffles tolerably plentiful, the ground should be hunted once a week, and then what you get are sound and good. The ground will be barren for years, if you lop off the lower limbs or cut down neighbouring trees or undershrubs. If it is too much trod by cattle, the truffles are sure to be small, if they do not fail entirely. As for transplanting them, I have known it tried in many ways but without any success; for as soon as they are moved, if ever so small, they cease growing. The less the ground is disturbed, the finer and better the produce."

This exactly accords with the Editor's experience, who has known a very productive ground completely destroyed by injudicious digging. The Chiswick board is by no means sanguine as to the result, but they thought it imperative on them to make the experiment. Dr. Lindley once sent the Editor a supposed brick of truffle spawn, but it came apparently from an unknown correspondent, who promised that he should have spawn for sale very shortly. Nothing, however, came of it. Success would be highly remunerative.

April 17.—At this Meeting Mr. Veitch exhibited some beautifully bloomed plants of *Trichopilia*, among which was *Trichopilia suavis superba*, a charming variety, more brightly coloured than the species. Mr. Salter produced a bright crimson Camellia

named Princess Mary, which promises to be a great acquisition, and obtained a first-class certificate. In Mr. Veitch's collection appeared *Raphiolepis ovata*, a valuable white-blossomed evergreen Japanese plant, which will probably turn out to be as hardy as the common Aucuba, as it stood the winter of 1861. Mr. Williams, Nurseryman, Fortis Green, Finchley, had two charming kinds of Tropæolum,—Beauty, with pale primrose-coloured blossoms, spotted with mulberry; and Attraction, with bright-yellow flowers, spotted with orange-red: these will, if sufficiently profuse, make valuable plants for bedding-purposes. Mr. Bull sent, amongst other things, *Rudgea macrophylla*, a fine plant with large deep-green leaves, and close terminal panicles of snowy-white blossoms, a description of which is given in this 'Journal.' Magnificent cut blooms of *Rhododendron Aucklandii*, each measuring some 5 inches across, were shown by Mr. Cox, gardener to J. Wells, Esq., of Redleaf. Those of *R. Griffithii*, shown on April 3rd, were more tubular than Mr. Cox's blossoms, which otherwise greatly resembled them. A cut specimen of *Wellingtonia gigantea*, bearing male catkins (being the second time that the *Wellingtonia* has been shown in that condition) was also sent by Mr. Cox. From the Society's Garden came two beautiful standard trees of the Persian Lilac, profusely laden with flowers, and an exhibition of cut Camellias, the produce of three plants of an old kind called the Middlemist's Red, which at one time were kept in pits under glass, but which have now for many years occupied a position in the open air on the north side of a wall, where they generally flower freely, and this season are literally masses of bloom.

A plant of the old *Crinum capense* was sent from Chiswick, and it was suggested that valuable varieties might be obtained by crossing this with some of the other species. The genus *Crinum* has now, however, gone much out of fashion; a large lot at one of Mr. Stevens's sales lately, could not meet with a purchaser at any price. The curious *Pitcairnia tabulæformis* was sent by Mr. Bull, but not yet in flower. It, however, appeared subsequently with its curious yellow blossoms. Two species of *Callixene* were brought by Mr. Bateman, a genus which deserves cultivation from its elegance of form, though the flowers are not very conspicuous. One of these was cultivated in this country at a very early period; and a beautiful figure was made of it in 1704, by a Dutch artist, Kichious (some of whose drawings are most admirable), from plants raised at Badminton, from seeds gathered in the Straits of Magellan. Its

ally *Myrsiphyllum asparagoides*, of which a figure has just appeared in the 'Botanical Magazine,' has also been too much neglected. Few plants are more elegant; and it is in high request in the south of Italy and Sicily for the decoration of rooms on festive occasions.

Mr. Edwards sent from Chiswick a basket of *Pezizæ*, which attracted much attention from their beautiful form, and the contrast between the white or cream-coloured hymenium and the rich-brown outer surface. It is curious that this species, though found in abundance under a larch by Mr. Wilson Saunders, and under cedars at Chiswick House, and which occurred earlier in the year, in profusion, at Fetcham Park, near Leatherhead, has never been recorded as British, nor indeed recorded by any botanist, though it has been observed at Fetcham annually for nearly half a century. It appears to be a distinct form of *Peziza lanuginosa* of Bulliard, which has been named after its original discoverer (Mrs. Holme Sumner) var. *Sumneri*. A figure and analysis will appear in the 'Transactions of the Linnean Society.'

It was stated by Mr. Berkeley that experiments are instituted at Chiswick towards the raising of other esculent species of Fungi than *Agaricus campestris*. Spawn of six species was sent up from Northamptonshire, part of which has been inserted in the lawn, and part treated in the usual way. Several different species appear in our Mushroom-beds—and several very distinct varieties of the common mushroom, to which sufficient attention has not hitherto been paid. Some very superior varieties occur abroad; but at present attempts at propagating them have failed. One, of which the spawn was sent from the Swan River, is said to be as superior to the common mushroom as the improved wrinkled peas are to the old Prussian. It is to be hoped, now the transit is so much more rapid, that a fresh supply of spawn may be received for experiment. Mr. Ingram has made some experiments in the same direction at Belvoir, but no report of the result has been received.

May 1.—The distinctive feature of this show was in the grand display of Auriculas from Mr. Turner, of Slough. These curious and oddly marked flowers seem to be engaging more public attention than formerly; and whatever may be thought of the green-edged and grey-edged sorts in which florists delight, there can be no question that what are called Selfs and Alpines, two groups less variegated than the others, the former, with a white mealy circle around the eye, and the latter, with a yellow circle, are amongst the most charming of spring flowers. The names of the

most prominent sorts in this collection may be worth recording. Among *Green-edged* kinds there were—Campbell's Admiral Napier, Headley's Conductor, Dickson's Duke of Wellington, Traill's General Neill, Campbell's Lord Palmerston, Ashton's Prince of Wales, Smith's Waterloo, and Leigh's Colonel Taylor. Of *Grey-edged* sorts—Waterhouse's Conqueror of Europe, Dickson's Duke of Cambridge, Cheetham's Lancashire Hero, Read's Miss Giddings, Lightbody's Richard Headley, Chapman's Sophia, Headley's Stapleford Hero, and Maclean's Unique. Of *White-edged*—Lee's Bright Venus, Summerscale's Catharina, Lightbody's Countess of Dunmore and Fair Maid, Leigh's Earl Grosvenor, Low's Maggie Lauder, Fletcher's Mary Ann, and Smith's Ne Plus Ultra. Conspicuous among *Selfs* were Spalding's Blackbird and Mary Gray, Sims's Eliza, Smith's Formosa (a fine kind), Gorton's Goldfinch, Lightbody's Meteor Flag, Martin's Mrs. Sturrock, Headley's Purple Royal and Vulcan. Of *Alpines*, Brilliant, Brutus, Conspicua, Dazzle, Defiance, and Victorious were attractive. To the last two first-class certificates were awarded: Defiance is a yellow-eyed deep-lavender-purple flower flushed with velvety crimson; Victorious has a yellow eye surrounded by rich velvety maroon.

A very pretty white-flowered hybrid, between *Rhododendron ciliatum* and *R. Edgworthii*, named Princess Alice, was sent by Messrs. Veitch. A very singular *Rubus*, with prettily clouded simple leaves, named *R. Girconditana*, came from Chiswick. It was received under this name from the Blumenstrasse at Berlin, and seems quite new. Mr. Cox sent some interesting cut specimens of Coniferæ from Redleaf, with male and female flowers. Two gourds marked with green and yellow, were exhibited by Mr. Berkeley, which had been received from M. Naudin, *Lagenaria sphærica* and *L. Monteiroi*—the former from Nice, the latter from Hyères. They were extremely ornamental and perfectly sound, though gathered in 1865; the former, *L. sphærica*, is a native of Natal, the latter, *L. Monteiroi*, of St. Paul de Loanda on the west coast of Africa. Mr. W. G. Smith brought a wonderful Morel, more than nine inches high, which he had received from Devonshire, where it was gathered at King's Kerswell. It is quite distinct from the common Morel, and proved to be *Morchella crassipes*, Ventenat. It is a very interesting addition to our flora, vying with *Helvella gigas*, which was contributed by Mr. Currey. Mr. Berkeley made some remarks on disease in Peach-trees, reading the greater part of a Report, by Mr. R. Thompson, of the condition of some at Chatsworth, which is published in this

'Journal.' The closing practical remarks, however, which were not in the copy sent to the printer, should not be omitted.

"The question now is, What is best to be done under the circumstances? The trees might partially recover, but that is not to be depended on. It will therefore be advisable to obtain the best-trained trees that can be procured for replanting the house. A week or two will be sufficient to show whether there is any hope of the regretted old specimen tree regaining sufficient vigour to maintain its vegetation. The whole of the soil in the borders will require to be thoroughly cleaned out and replaced with fresh soil. If the old specimen is saved, its roots should be partitioned off from the part of the border cleared for the fresh soil and trees. Till the new trees come into bearing, the house might be occupied with Peach- and Nectarine-trees, in pots, from which a tolerable supply may be obtained even in the current year.

"In making the new border, the soil should be laid on a bottom 18 inches or 2 feet (certainly not less than 1 foot) *above the general level of the garden.* The soil should be fresh and loamy, but not too stiff, and it should not be made very rich with manure in the first instance. The roots appear to have been well kept up at Chatsworth formerly; but these kinds of trees are frequently allowed to send their roots into a deep border of rich soil, half manure, thus rendering them very differently situated from native trees on the slopes of Asia Minor."

No information has been received lately as to the trees; but as, according to a report received from the Duke of Devonshire several weeks since, they had fruited better than could have been expected, it is greatly to be hoped that at least the specimen tree will be spared, and that some treatment like that suggested by Dr. Hogg will be successful.

Mr. Wilson Saunders produced a radish which had been tied in a natural knot by some impediment to its growth. At a subsequent Meeting, Mr. W. G. Smith brought some precisely similar specimens which he had produced artificially.

A photograph of a large Pear-tree, at Home Lacy, the seat of Sir E. F. Stanhope, Bart., was produced by Mr. Bateman. It covers nearly an acre of ground, growing after the fashion of a Banyan. From fourteen to sixteen hogsheads (of 100 gallons each) have been made from it in a single season.

Mr. Bateman, amongst other remarks on the Orchids at the Meeting, called especial attention to the rare *Epidendrum erubescens*, of which a lot was bought at one of Mr. Stevens's sales for

the small sum of 21*s.*, which Mr. Skinner recognized from a single dried flower still attached to one of the specimens. Attention was then directed to the Rainy-month flower of Ceylon (*Dendrobium M'Arthiæ*), which, though figured in the 'Botanical Magazine,' was now shown for the first time, but with a single flower only. "In colour it somewhat resembles *D. nobile*; but in form of blossom, as well as in habit, it is very different from that well-known species. In Ceylon, its pendulous shoots loaded with flowers of the most beautiful description, are said to ornament the trunks of large trees in the forests about Ratnapoora and towards Galle, where it is known under the native name of Wis-sak-mal or Rainy-month flower, on account of its blossoming during the rainy season. It was mentioned that as many as 120 inches of rain fell in the year, and of that quantity about four-fifths fell between November and May."

May 3.—This was in every way a good exhibition, Pelargoniums, Roses, Azaleas, and Orchids forming the leading features. The two former had scarcely reached their best; but the latter were in fine condition. Some admirable specimens occurred amongst the Orchids. Mr. Penny, gardener to H. H. Gibbs, Esq., of Regent's Park, had the beautiful rich-brown-and-yellow-flowered *Oncidium sarcodes*, and a splendid example of *Phalænopsis grandiflora* with two splendid spikes of bloom on it. Mr. Page, gardener to W. Leaf, Esq., Streatham, had a wonderfully fine *Oncidium ampliatum majus*, with two large branching spikes of clear-yellow flowers. Mr. Hill, gardener to R. Hanbury, Esq., The Poles, Ware, furnished a well-managed example of *Phaius grandifolius*, with ten spikes of flowers. Mr. Robinson, gardener to G. Cooper, Esq., Coburg Road, sent the beautiful *Phalænopsis Schilleriana*, with ten flowers on a spike, and the rare *P. Luddemanniana*—the last with two open blossoms. In a group contributed by Mr. Howard, gardener to J. Brande, Esq., Balham, was *Cattleya intermedia*, with eleven spikes of flowers. The Azaleas were large, well flowered, and effective. Mr. Turner had handsome pyramidal plants, some 6 feet high, of Gem, Louise Margottin, Petuniæflora, Coronata, Madame Miellez, Perryana, Mary, Holfordii, and Empress Eugénie; and Mr. Carson, Mr. Penny, and Mr. Young, also had fine plants, including an example of the double-blossomed white kind called Flag of Truce. Iveryana was shown in beautiful condition in the shape of a single specimen by Mr. Turner.

Among the miscellaneous subjects produced, Mr. Turner had

also a beautiful pot specimen of the common hardy *Trillium grandiflorum*, so large, so dense, and so profusely covered with three-petaled snowy blossoms as to be striking, even at a distance; and Mr. William Paul contributed a fine collection of Nosegay Pelargoniums, among which St. George, crimson scarlet, and Salmon Nosegay, remarkable not only for its colour but also for the size of its individual flowers and trusses, were most conspicuous.

May 12.—The Rev. G. Cheere, of Papworth Hall, sent up a meritorious exhibition of the Giant Mignonette, grown in pots.

May 15.—The blue- and the white-flowered varieties of *Myosotis sylvatica*, known as *M. intermedia*, the beautiful Forget-me-not, so much used in spring gardens, were shown by Mr. Cutbush, of Highgate. In this form they are very suitable for greenhouse decoration. A pretty cut specimen of *Rhododendron Bonplandiæflorum* was sent by Mr. Johnson, of Savernake. It is allied to *R. cinnabarinum*, *R. Roylei*, and *R. Keysii*, and, like the first, is poisonous to goats and sheep, and when used for firewood produces a disagreeable inflammation of the eyes. A cut specimen of *Rhododendron niveum* was sent by Mr. Luscomb, of Combe Royal. A fine plant of *R. Nuttallii* came from the Society's Garden. Some of the flowers had been touched with the pollen of *R. arboreum* and *R. sinense*, in the hope of obtaining some distinct varieties. Mr. Bateman sent a raceme of *Aërides Warneriana*, which is in reality a variety of *A. crispa*. It is flowering in an abnormal way: the raceme proceeds from the end of the caulescent stem instead of, as in every other case that had come within his experience, from the side opposite to the leaves. "Orchids, although they play strange pranks with their flowers, are usually constant enough in their way of producing them. Here, however, is a remarkable exception." A fine plant, of the variety Dr. Lindley, of the common lilac, of which a great deal has been said lately, came from Chiswick, and, to compare with it, abundant cut flowers of Charles X., which is evidently far the finest variety, and well adapted for bleaching, a practice which was lately so fashionable at Paris, the etiolated flowers being peculiarly beautiful and not speedily decaying. Some observations were made on the rat-tailed radish, of which so much has lately been said in the public journals. The seed from Messrs. Vilmorins' sent out by the Society is evidently something very different; and what the Editor has seen arrive at full growth appears to be merely the large-rooted radish commonly cultivated in India, some of the roots being white others red. In India it is said to be as large occasionally as a man's thigh.

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XXXIII. *Some account of the Fruits and Vegetables of Madeira, the Canaries, and Cape Verdes.* By R. T. Lowe, M.A.

In England, as in the greater part of continental Europe, the line between agriculture and horticulture is broadly enough marked. It is not so in the Atlantic islands above indicated—the geniality of climate and uniformity of soil superseding the various special contrivances requisite, at least in Northern Europe, for the culture of most fruits and vegetables, and breaking down most of the distinctions between the garden and the farm. Thus, while in England the turnip, carrot, bean, potatoe, apple, pear, and cherry are almost the only proper vegetables or fruits that can be said to oscillate between the separate provinces of the horticultural and agricultural occupier of the soil, in Madeira may be named, in addition to the latter five, the sweet potatoe (*Batata edulis* Thunb.), French-bean (*Phaseolus vulgaris* L.), lupine, onion, inhame (*Colocasia antiquorum* Schott), several kinds of pumpkin, coffee, sugar-cane, peach, apricot, mulberry, plum, guava, Spanish-chestnut, and, above all, the vine itself as proper field or agricultural productions of the country. In the Canaries it is much the same, though on a smaller scale, the prevalent high and sweeping winds precluding much abundance or success in cultivating fruits or vegetables; and in the Cape Verdes, the list must be extended on the one hand, if it lose somewhat on the other, in order to include the mandioc, the physic-nut (*Jatropha Curcas* L.), the cocoa-nut, two or three kinds of custard-apple, the anana, papaw and banana. Still a residuum in each of these three groups of islands may be fairly held to represent the proper fruit and vegetable inmates of our English gardens; and of this residuum a list which shall also not exclude any of the esculent or economically useful plants generally cultivated, without professing to include every casual straggler, will best convey a notion of the state of horticulture in the east Atlantic insular superequatorial region.

List *of the Fruits, Vegetables, and other Economic Plants more generally cultivated in the Madeiran, Canarian, and Cape Verde Islands.*

Anonaceæ.

1. Anona Cherimolia L.—*Custard-apple* or *Cherimoya.* In Madeira common in gardens in and about Funchal and fruiting every year from October to January abundantly, but not bearing good fruit at a higher elevation than 300 or 400 feet above the

sea. In the Canaries and Cape Verdes it is extremely rare. It is called in Madeira by the Portuguese "Anona," which in the Cape Verdes is the name of *A. reticulata* L. The fruit softens, but scarcely changes colour when ripe, only becoming a little paler green or brownish. In Madeira it does not ripen completely on the tree, but is gathered when apparently full-grown or beginning to soften, and kept several days till it becomes uniformly soft and ripe. It has a sweet creamy vinous taste, melting, rich, and juicy, and, when fine and not over ripe, is a delicious fruit. There are, however, almost as many sorts or varieties in quality as trees differing in goodness. The best are about the size of the fist, with few or scarcely any seeds.

It seems questionable whether this is more than a more pubescent, larger, and broader-leaved garden form or variety of *A. squamosa* L., due to cultivation or locality. In the Madeiran cultivated plant the leaves vary much, according to the age and vigour of the tree, in shape, size, and pubescence; whilst the smaller the fruit is, the drier and fuller it becomes of seeds, and the more regularly and extensively squamoso-tuberculate. Indeed, at an elevation of 500 or 600 feet and upwards above the sea, it may be said to pass completely into *A. squamosa* L. In the Cape Verdes it is not generally known or acknowledged as distinct from the very abundantly naturalized *A. squamosa* L. In fact I met with the real *A. Cherimolia* Mill. twice only in the Cape Verdes—viz. in the Maniche garden in S. Nicolão and in another garden at Paul in St. Antão.

The statement, therefore, in the 'Flora Nigritiana,' p. 205, that *A. Cherimolia* Mill. is "a very abundant plant and quite naturalized in the Cape de Verde Islands," and again, in Dr. J. A. Schmidt's 'Flora of the Cape Verde Islands,' p. 260, that it is "widely spread over the Island of S. Antonio" (S. Antão) "though only as a bush, seldom flowering and rarely attaining 6–8 feet in height," belong properly only to *A. squamosa* L.

2. A. SQUAMOSA L. Very common in the Cape Verdes, and perfectly naturalized, especially in St. Iago, forming thickets or jungles in the valleys of the interior, and called "Pinha;" but not distinctly recognized in either the Canaries or Madeira. The fruit is similar to that of *A. Cherimolia* L., but prominently scaly or tubercular all over, and very inferior in quality.

3. A. RETICULATA L. Only less common than *A. squamosa* L. in the Cape Verdes, and called "Anona." In Madeira it is only represented by a single tree or two, and it does not occur at all

in the Canaries. The fruit is spherical and simply areolate, like *A. Cherimolia* L., not squamoso-tuberculate. It is preferred in the Cape Verdes to the "Pinha."

4. A. MURICATA L.—*Sour-sop.* Not very common even in the Cape Verdes, where it is called "Pinhão;" and in Madeira stunted, starved, and never fruiting. The large obliquely cone-shaped softly muricate green fruit has a fine briskly sharp rather than acid taste, totally different from the creamy softness of the three preceding species; and though with a peculiar resinous or crude and slightly fishy flavour, it is a very fine refreshing fruit.

CRUCIFERACEÆ.

5. BRASSICA OLERACEA L. The various sorts of cabbage, excepting savoys, are very generally cultivated in each of the three groups of islands,—but brocoli and cauliflowers in Madeira alone, and there only occasionally. Brussels-sprouts have not yet found their way; but I cultivated successfully for some years the French or German *Chou-rave* in Madeira.

6. B. CAMPESTRIS L. β (B. RAPA L.). Turnips are now commonly grown in Madeira, and more rarely in the Canaries and Cape Verdes. In the latter, especially in the interior of St. Iago, I have seen them in gardens, of an enormous size and first-rate quality.

7. RAPHANUS SATIVUS L. Radishes are not uncommon in Madeira and the Canaries; but I have only once seen them in the Cape Verdes, in a garden at Porto Praia in St. Iago, where, however, they were remarkably fine and flourishing.

CLUSIACEÆ (GUTTIFERÆ auct.).

8. MAMMEA AMERICANA L.—*Mammee Apple*; Mamão, Port. Very rare and scarcely fruiting in Madeira. Not seen in the Canaries. General in the Cape Verdes and fruiting regularly, the fruit ripening in the summer. It is a fine evergreen tree, with large Magnolia-like stiff coriaceous shining leaves and globose fruit like a hard brown ball, said to be very good.

MALVACEÆ.

9. GOSSYPIUM PUNCTATUM Schum. et Th. This white- or pale-blush-pink-flowered cotton-plant is largely cultivated and indeed subnaturalized in the Cape Verdes, but it is not known in Madeira and the Canaries, where one or two yellow-flowered shrubby

sorts or species are occasionally seen in gardens, but do not seem to flourish much. The Ochro (*Hibiscus esculentus* L.) is not grown as an esculent in any of the islands.

Bombaceæ.

10. Adansonia digitata L.—*Calabaceira, Baobab or Monkey-bread.* Not in Madeira. A single small tree in a garden at Sta Cruz in Tenerife. Not uncommon and doubtless indigenous in St. Iago in the Cape Verdes, where it attains a considerable size, one near Porto Praia measuring 43 feet in circumference. The dryish pulp steeped in water is said to make a pleasant acid drink, like lemonade.

Sterculiaceæ.

11. Theobroma Cacao L. Of this, the chocolate-nut tree, I saw only a single plant, in the garden of my kind host Sr. Manoel dos Reis Borges at Os Orgãos in St. Iago. It did not appear to flourish, and had not produced flowers or fruit.

Malpighiaceæ.

12. Malpighia punicifolia L.—*Barbados Cherry.* Seen also once only in the Cape Verdes, in the Maniche garden in St. Nicolão. It is a pretty shrub, with small bright scarlet pendulous subacid fruit, and pomegranate-like foliage.

Aurantiaceæ.

13. Atalantia monophylla (Roxb.). Fruit sweet, the size of a small pea, transparent pearly flesh-colour.

14. Triphasia trifoliata (L.). Fruit acid, the size of a small gooseberry, oval, orange or purple, tasting like an orange.

Both these occur in gardens only, and that rarely, in the Cape Verdes (S. Nicolão, at the Maniche). They are pretty shrubs, with pleasant-tasted berries. *Triphasia* is armed with long spines; its flowers are white and like those of the Tangerine Orange.

15. Cookia punctata Retz.—*The Wampee.* Only in Madeira and very rare (Valle garden), but flourishing and fruiting abundantly and easily raised from seed. A small tree with a bushy head. Leaves odd-pinnate. Flowers small, white, in large pyramidal panicles. Fruit the size of a large or small marble, orange-yellow, with a thick tough skin and large seed, tasting like an orange.

16. Citrus medica L.—*Citron;* Port. *Cidra.* Very fine and

abundant in Madeira, some of the Canaries (Gomera, Palma) and Cape Verdes (St. Antão, St. Iago, Brava).

17. C. LIMONIUM L. *α, the Lemon*, very fine and abundant, especially in Madeira, where it is called Limão, but in the Cape Verdes Limão or Lima Francesa; *β, the Sweet Lemon*, very fine and highly esteemed in the Cape Verdes, less abundant in Madeira, called Limão Doce; *γ, the Lime or Lima de Gallinha*, very rare in Madeira, abundant and most valuable (combined either with Quinine or Brandy) in the Cape Verdes. In the Canaries these all occur, but much more rarely.

18. C. AURANTIUM L. *α, the Orange*, or *Laranja*, Port., *Naranja*, Span., abundant but not remarkable for size or goodness in Madeira or the Canaries. In the Cape Verdes, those of St. Iago and St. Antão, especially the former, are by some affirmed to be the finest in the world. *β, the Seville or Bitter Orange, Laranja Azeda*, Port., abounds in each of the three groups. It is chiefly used, at least in the Cape Verdes, medicinally.

19. C. NOBILIS Lour. *β, the Tangerine*, abundant in Madeira, rare in the Canaries and Cape Verdes. The finest fruits are produced in Madeira by grafting on the common Orange.

OLACINACEÆ.

20. XIMENIA AMERICANA L. Occasionally in the Cape Verdes only. In Fogo it is called "*Ameixieira*," and mistaken for the common European Plum (*Prunus domestica* L.). The fruit ("*Ameixa*") is yellow, of the size, shape, and aspect of a common damson plum, and is said to be sweet and palatable.

AMPELIDACEÆ.

21. VITIS VINIFERA L. The vine is now again resuming in Madeira its proper place; and in the north of the island, especially at Porto Moniz and Seixal, the ravages of the *Oidium* are being fast repaired. In the south it will be longer before the culture of the grape again supplants that of the deleterious sugar-cane, and restores alike to the Madeiran wines and climate their just character; for the atmosphere, both physical and moral, of Madeira, especially in Funchal and its neighbourhood, has not suffered less deterioration during the last ten or fifteen years from the introduction of sugar-cultivation, with its usual train of fever-miasmata, malaria, and cheap spirits, than the wines of the island have degenerated, in consequence of the temptation to supply the deficiency of genuine grape-juice by the substitution

or admixture of all sorts of spurious compounds formed with the fruit of the Japan Medlar or Nespera (*Mespilus* or *Eriobotrya japonica* Thunb.), Oranges, Pears, &c. In the Canaries much less progress has been made towards the reinstatement of the vine; and the cultivation of Cochineal had become so profitable and popular, that four or five years ago no steps at all were being made in that direction. In the Cape Verdes very little wine, comparatively speaking, and that only of very inferior quality and merely for home consumption, had ever been made before the setting in of the disease; and the vine at present exists only here and there in gardens. In one of these at Porto Praia, the capital of St. Iago, I was presented by the owner with a bunch of fine, well-flavoured grapes, though not quite ripe, in the middle of March.

The mode of cultivation in Madeira of the vine is somewhat peculiar. Across one end of the whole breadth or length of the piece of ground or terrace to be planted, a broad deep trench is excavated by a number of men (often from 10 to 20) working side by side. In this trench, which is never less than 5 or 6, and often 10 or 12 feet deep, are planted shoots of the last year's growth from 12 to 20 feet in length, the lower portions of these being laid horizontally along the bottom of the trench when their whole length exceeds, as usually it does, the depth of the latter, the longest shoots being preferred. The trench is then filled in gradually by the men working on regularly, as it were, backwards, and filling up the first by throwing up the soil all along to the same depth, till they have formed at a few feet distant another similar trench; and so on successively till the whole soil of the plot of ground has been upturned and planted. In 2 or 3 years the plants begin to bear, and in 5 or 6 are in full bearing. Their continuance in the latter state varies excessively, according to the soil, situation, or supply of water. It is rarely less than 10 or 15, and still more rarely above 30 years.

Though the roots do not usually spread below two or three feet of the surface, the long remaining part of the originally planted shoot below this depth thickens and retains a sort of vitality, and perhaps acts like the fleshy rhizomes or tubers formed by certain plants, especially in warm climates or in dry soils, to supply the roots and plant above with coolness if not moisture from the lower depth to which it reaches.

The pruning-time is in February or March, according to the elevation of the vineyard. The vines are in full leaf and flower in

May; and the vintage takes place in September in the south of Madeira, and in October in the north.

The vines are trained on low trellises of cane-work, formed of the *Arundo Donax* L., to which they are tied by bands of rushes, sedge, or banana-sheaths. In the best wine-districts of the south these trellises are only from 2 to 3 or 4 feet above the ground. In the north of the island the vines are mostly trained up trees of several kinds, which are called Balseiros.

For some account of the sorts chiefly cultivated, &c., see *Manual Flora of Madeira*, pp. 81–83.

Sapindaceæ.

22. Dimocarpus Litchi Willd.—*The Lee-chee.* Cultivated in a few gardens at Funchal in Madeira only.

Anacardiaceæ (*Terebinthaceæ* auct.).

23. Mangifera indica L. Mango-trees are now become common in Madeira, and produce fruit abundantly when they have once come into bearing, which is not till they are 10 years old or more. The oval or roundish-oval yellow fruit (ripe in Sept. or Oct.) abounds in rich juice like a nectarine, but has always somewhat more or less of a resinous or carrot-like flavour. The flowers are fragrant like minionette (*Reseda odorata* L.). The Mango is scarcely ever seen in the Canaries, and but rarely in the Cape Verdes.

24. Anacardium occidentale L.—*The Cashew-nut.* This does not grow in either the Canaries or Madeira. But in the Cape Verdes, especially in Fogo, where it is called by its French name "Acajou" (of which Cashew is doubtless a corruption) and is said to produce plentifully its reported "yellow, sweet, and very good" fruit in summer, I saw several fine tall trees, conspicuous for their pyramidal shape and handsome evergreen thick foliage. The flowers appear in March.

25. Spondias dubia Rich. Only in the Cape Verdes, and chiefly in St. Iago and Fogo; called "Manipo." A rather large deciduous tree, coming into leaf in March and producing its "acid" fruit in summer. Leaves pinnate, red or flame-colour when young. It is the *Ailanthus* of Chr. Smith; Sumach of Brunner.

Leguminosæ.

26. Lupinus Termis Forsk. This lupine is extensively cultivated both as a vineyard and field-crop in Madeira, and even more

largely grown in the Canaries (especially in Grand Canary) as a field-crop only, both for its seeds and for green fodder. It does not occur in the Cape Verdes.

27. L. LUTEUS L. is also occasionally grown for the same uses in Madeira only.

28. SAROTHAMNUS SCOPARIUS (L.). Sown all over the mountains in Madeira for burning to fertilize the ground and for brush-wood (see Fl. Mad. p. 122). It is not known in either the Canaries or Cape Verdes.

Obs. None of the trefoils are cultivated in either Madeira, the Canaries, or the Cape Verdes; but

29. COMMON LUCERNE (*Medicago sativa* L.) is now and then grown for fodder in Madeira only.

30. INDIGOFERA TINCTORIA L. and

31. I. ANIL L. Neither of these plants is found in the Canaries or Madeira, though some years ago *I. Anil* was growing plentifully in the Deanery garden near Funchal. In the Cape Verdes *I. tinctoria* L., called Tinta, is naturalized everywhere; but it is not now cultivated or employed except for home consumption. Formerly, a century or two ago, a sort of factory or company existed, founded by an Englishman, for the culture of the plant and manufacture of the dye; but it has long since come to an end.

32. ARACHIS HYPOGÆA L.—*The Ground-nut*, called in St. Iago Mandóbe or Mancára, is only cultivated as a negro luxury occasionally in the Cape Verdes, and does not occur in either the Canaries or Madeira.

33. CICER ARIETINUM L. Much cultivated both in Madeira and the Canaries under the name of *Grão de bico* (Port.) or *Garbanzo* (Span.) as an ingredient in the Sopas of the former or Pucheras of the latter. In the Cape Verde Islands I observed it in Brava only. It is sown usually amongst corn in the fields.

34. ERVUM LENS L.—"*Lentilha*" of the Portuguese. Sown as a crop, and used like the last in Madeira and the Canaries. Not seen in the Cape Verdes.

35. E. ERVILIA L. and

36. E. MONANTHOS L. are occasionally cultivated also as field-crops in Madeira only.

37. FABA VULGARIS Mnch. Very generally cultivated in Madeira and the Canaries, sown as a crop, broadcast, in fields and vineyards; but I did not observe it in the Cape Verdes, except in São Nicolão, near the English Consul's country-house. In Ma-

deira the "small early bean" is the almost universal sort. The better broader-seeded kinds (Windsor, &c.) are only grown occasionally in English gardens.

38. Pisum sativum L. Most of the best English varieties of the common garden pea are now successfully cultivated in Madeira, especially in the north of the island. Peas come into season in Madeira in November, lasting on till April or May. In the Canaries they are a much rarer vegetable, and do not occur at all in the Cape Verdes.

39. Lathyrus sativus L. is a common field-crop in Madeira and the Canaries, but is not grown in the Cape Verdes.

40. L. Cicera L. and

41. L. articulatus L. are here and there similarly cultivated in Madeira and Porto Santo only.

42. Canavalia ensiformis (L.). This is occasionally seen in gardens in the Cape Verdes only, where, although called "Fava Rica," it is little esteemed, and even said to be unwholesome.

43. Phaseolus vulgaris L. α. The ripe seeds are quite a staple article of food in Madeira (see Man. Fl. Mad. p. 222) and scarcely indeed less so in the Canaries and Cape Verdes. Five or six seeds are planted near together in a hole or hollow and then staked with three or four long poles of *Erica arborea*. The dwarf varieties (β L.) are less cultivated.

44. The Scarlet Runner (*P. coccineus* Kniph.=*P. multiflorus* Lam., Willd., DC.) is only seen sometimes in gardens.

45. Vigna sinensis (L.) is rarely cultivated in the Cape Verdes, and in them only.

46. Lablabia vulgaris Savi. Often seen in Madeira, where, however it is held in no esteem, and occasionally in the Canaries. In the Cape Verdes it is very extensively grown under the name of "Feijão," which belongs in Madeira and Portugal to *Phaseolus vulgaris* L., the latter being called "Fava" in the Cape Verdes.

47. Cajanus indicus Spr. This, the Pigeon-pea of the West Indies, is frequently grown in the Cape Verdes; but the seeds are considered unwholesome by the common black people, though I thought them excellent boiled young like peas. The plant is very seldom, if ever, seen in Madeira or the Canaries.

48. Cassia Fistula L. Seminaturalized in St. Iago, where the pulp of the long cylindric pods is used medicinally. It does not occur in either the Canaries or Madeira.

49. C. occidentalis L. In St. Antão the leaves are used me-

dicinally for senna, the plant being also often called "Cana Fistula" —a name, however, properly belonging to the foregoing species. The plant occurs in all the Cape Verdes seminaturalized, and it is also sometimes seen in gardens in the Canaries and Madeira.

50. C. BICAPSULARIS L. Extensively naturalized in each of the three groups of islands, especially in the Cape Verdes, where the sparingly produced pulp of the pod becomes sweet and eatable.

51. CERATONIA SILIQUA L. The Carob-tree also occurs occasionally in the three archipelagos; but little or no use is made in either of its pods for swine or cattle.

52. TAMARINDUS INDICA L. The short-podded variety of the Tamarind forms beautiful umbrageous spreading trees in the Cape Verdes, especially in Fogo and St. Iago; and the pods are used for cooling drinks and eaten raw by children. It occurs also occasionally in Madeiran gardens.

AMYGDALACEÆ.

53. AMYGDALUS PERSICA L. The Peach may be said to flourish too well in Madeira; for its cultivation, by the propagation of good sorts and eradication of the self-sown worthless hard-fleshed seedlings, is thus sadly neglected. Most excellent peaches of the white soft-fleshed melting kinds are, however, produced in several parts of the island away from Funchal, where the white or yellow hard-fleshed clingstone sorts almost exclusively prevail. In all cases it is grown only in the standard form, coming into flower about Christmas and ripening its fruit from July to September. In the Canaries it is much less frequent, and in the Cape Verdes it is still rarer. Indeed I only met with it once or twice in Fogo and Brava, where, however, it appeared to flourish.

The Nectarine (*A. persica* L. β) is seldom seen even in Madeira, and has not occurred either in the Canaries or Cape Verdes.

54. PRUNUS ARMENIACA L. The Apricot ("Damasco") abounds as a standard-tree in Madeira, but is somewhat rare in the Canaries, and barely exists at all in the Cape Verdes. The fruit in Madeira is usually small (the size of a walnut) and of inferior quality; for scarcely any attention at all is paid to the propagation of the better sorts.

55. P. DOMESTICA L. Numerous varieties of the Plum ("Ameixa" Port.) are cultivated in Madeira most successfully, producing abundant crops of excellent fruit (see Man. Fl. of Mad.

p. 234). The greengage, especially, flourishes as a standard tree at an elevation of three or four thousand feet above the sea at the Jardim da Serra. Plum-trees occur here and there in the Canaries: but in the Cape Verdes they can be scarcely made to grow at any height above the sea. The "Ameixa" or plum of Fogo is the fruit of *Ximenia americana* L.

56. Cerasus Avium (L.) β. Juliana Koch. The common Cherry ("Cereja") is abundant in some parts of Madeira in the months of June or July; but it is seldom seen in the Canaries, and does not occur at all in the Cape Verdes.

57. C. vulgaris Mill. var. rustica Lowe. The "Ginja" or Morella Cherry of Madeira is not found further to the south.

Rosaceæ.

58. Rubus idæus L. The Raspberry scarcely grows even in Madeira, and is not known in either the Canaries or Cape Verdes.

59. Fragaria vesca L. Strawberries both wild and cultivated abound in Madeira (see Fl. Mad. p. 247), but are not found in either the Canaries or Cape Verdes. The sort most cultivated in Madeira is the blush-coloured or white Chili (*F. chilensis* Ehrh.).

Pomaceæ.

60. Pyrus communis L. Pear-trees are common in Madeira and some of the Canary islands, especially in Grand Canary. But the fruit even of the better sorts is very inferior in quality. The tree will scarcely grow at all in the Cape Verdes.

61. P. Malus L. Apples are common, but of indifferent quality for the most part, both in Madeira and the Canaries. In the Cape Verdes they are very rare, occurring chiefly in Fogo and Brava.

62. Cydonia vulgaris Pers. I was surprised to find the Quince as fine and flourishing in the Cape Verdes (St. Antão, St. Iago, Fogo, and Brava) as it is in either the Canaries or Madeira.

63. Mespilus germanica L. The common Medlar ("Nespera") is not common in Madeira, and does not occur at all in either the Canaries or Cape Verdes.

64. M. (Eriobotrya) japonica Thunb. The Loquat or Japan Medlar ("Nespera de Japão") is now become extremely common in Madeira, producing abundantly its gratefully acidulous amber-coloured fruit from January to March. A sort

of cider is made from the fruit, for the purpose of transmutation into (so-called) Madeiran wine. In the Canaries it is scarcely found, and in the Cape Verdes it was only met with once in Brava.

Saxifragaceæ.

65. Ribes Grossularia L. The Gooseberry is grown abundantly, for the purpose of selling its unripe fruit for culinary purposes to the English, at an elevation of 2000 or 3000 feet in Madeira; but it does not occur in either the Canaries or Cape Verdes.

66. R. rubra L. (*Currants*) and

67. R. nigra L. (*Black Currants*) are merely found as curiosities in a few English gardens in Madeira.

Combretaceæ.

68. Terminalia Catappa L. This is found only in the Cape Verdes, where it forms a noble tree, equally conspicuous for its fine foliage and peculiar ramification. The branches grow in regular distant whorls extending widely all round horizontally from the straight main stem, and diminishing gradually from the bottom to the top of the tree, like a dumb-waiter. The leaves are very large, stiff, and coriaceous, like those of *Magnolia grandiflora* L., of a bright shining green, turning rich dark crimson before falling. The fruit is a large compressed almond-shaped dark crimson drupe, with a thin insipid sweetish flesh. The nut or kernel inside the hard stone is small, and eatable but not particularly good.

Myrtaceæ.

69. Psidium pyriferum L. The White Guava is extremely common in Madeira, but less so in the Canaries, and I did not find it anywhere in the Cape Verdes. From November to March the fruit abounds in the Madeiran markets and supplies the place of apples both for culinary purposes and the dessert.

70. P. pomiferum L. The Red Guava, rare in Madeira, takes entirely the place of the white guava in the Cape Verdes. It is however a very inferior fruit.

71. P. littorale Raddi. A few trees occur here and there in gardens about Funchal only in Madeira. The yellowish-green pear-shaped fruit is not good enough to cause it to be widely cultivated.

72. P. Cattleianum Sab. This, in Madeira, to which it is

confined, is a most agreeable little fruit with the flavour of the Hautboy strawberry. Its cultivation is most easy, seedlings coming into bearing in their third or fourth year and producing afterwards unfailing and abundant crops, sometimes twice a year.

73. Pimenta communis Lindl. The Allspice-tree is confined like the last to a few gardens in Madeira about Funchal, and it does not occur in either the Canaries or Cape Verdes. It is rather a handsome tree, with shining evergreen-leaves and white stem and branches bearing a profusion of small white flowers in terminal broad panicles, succeeded by the small pea-like fruit. All parts of the plant partake of the well-known "Allspice" scent and flavour of the fruit.

74. Eugenia brasiliana (L.) The Pitanga, a pretty shrub with its pendulous bright scarlet pleasantly acidulous fruit, is common in Madeira, whence it has been imported to Brava in the Cape Verdes. I did not meet with it, however, in the other Cape Verde islands or in the Canaries.

75. Jambosa vulgaris DC. This fine tree is common in Madeira and is sometimes also seen in the Canaries, but does not occur in the Cape Verdes. Its fruit is very beautiful and has a strong taste and smell of rose-water, but is somewhat dry and mawkish, the thin flesh resembling that of a bad, sweet, spongy apple steeped in rose-water.

76. J. malaccensis L. Two or three trees of this occur in Madeira; but it does not exist in the Canaries or Cape Verdes. Its fine coriaceous Magnolia-like foliage and crimson flowers and fruit render it a noble plant and well worth more attention. The latter, of the size and shape of a moderate-sized pear, is, however, in Madeira acid and austere, without any special flavour.

Granataceæ.

77. Punica Granatum L. The Pomegranate is often seen both in gardens and seminaturalized in all the three groups of islands; but the fruit is held in no esteem, and, indeed, has little to recommend it but its beauty.

Passifloraceæ.

78. Passiflora quadrangularis L. A not unfrequent plant in Madeira, but not seen either in the Canaries or Cape Verdes. The pale-green fruit, as large as a goose's egg, has a strong honey-like flavour and is agreeable enough; but it is not regularly or abundantly ripened in Madeira.

79. P. EDULIS Sims. The violet-blue or purple fruit, the size of a small hen's egg, is very abundantly produced and esteemed in Madeira for its orange-coloured pulp with an orange- and raspberry-like flavour. It does not occur in the Canaries, but I once met with it on the north side of Fogo in the Cape Verdes.

80. P. LOWEI Heer. This is the best of the three Madeiran Passion-fruits, and would be a real acquisition anywhere to the dessert. The fruit, the size of a duck's egg, is of an orange yellow, the pulp being, as in *P. quadrangularis* L., greenish white like that of a gooseberry. Though I first received in Madeira the seeds from Tenerife (see Fl. Mad. p. 296), it no longer exists in the Canaries, and is not found in the Cape Verdes.

CUCURBITACEÆ.

81. CUCURBITA MOSCHATA Duch. This Gourd or Pumpkin, in one or other of its various forms, is largely cultivated in each of the three groups of islands, but it attains by no means in any of them the excellence it possesses in Madeira (see Mad. Fl. p. 283). The long clavate-fruited variety is perhaps the commonest in the Cape Verdes.

82. C. PEPO Ser. Not uncommon in Madeira, but not observed in the Canaries or Cape Verdes.

83. C. MELANOSPERMA Braun. Universally cultivated in Madeira under the name of "Boganga," and in the Canaries, where it is called "Pantana" (see Mad. Fl. p. 289). I never met with it at all in the Cape Verdes.

84. LAGENARIA VULGARIS Ser. The Bottle-gourd is not unfrequently grown in Madeira, but occurs only rarely in the Canaries and Cape Verdes.

85. CUCUMIS SATIVUS L. Cucumbers abound in Madeira, and are only comparatively rare in the Canaries and Cape Verdes.

86. C. MELO L. Melons are good but cannot be called common in Madeira. They are still more rare in the Canaries and Cape Verdes.

87. C. CITRULLUS (L.). Water-melons (both red- and white-fleshed) are occasionally cultivated, but not frequently or successfully in any one of the three groups of islands.

The seeds of all the foregoing Cucurbitaceæ are sown in wide shallow trenches in the open air, like those of Gherkin Cucumbers in England, and the plants left to spread along the ground or trained on trellises.

88. SECHIUM EDULE (Sw.). Quite confined to Madeira, where it is a not less excellent than abundant and productive vegetable. There are two sorts, the white- and green-fruited. The latter is the best. It is propagated by planting the whole one-seeded fruit, which enlarges into a persistent corky subperennial rhizome, 6–12 inches in diameter, and sends up annually fresh shoots for several years. This is, I believe, a unique instance of such transmutation.

PAPAYACEÆ.

89. CARICA PAPAYA L. The Papaw is, except perhaps the Cocoa-nut, one of the most striking and abundant trees of the Cape Verdes; and in those islands its fruit is excellent if timely gathered, *i. e.* before it has turned completely yellow. It forms with the coffee and banana or plantain the main vegetation of the valleys or ravines in St. Antão and Brava. In Madeira and the Canaries it is merely an occasional inmate of gardens, and the fruit is not esteemed.

CACTACEÆ.

90. OPUNTIA TUNA L. Naturalized everywhere in Madeira and the Canaries, but very rarely seen in the Cape Verdes, and merely as a cultivated plant. Its cultivation for cochineal in Madeira has proved, as I always anticipated, a total failure. The fruit, however, is most excellent and valuable.

91. O. DILLENII (Ker). Naturalized everywhere in the Canaries, where its purple or crimson fruit is rarely eaten. It is not found in the Cape Verdes or Madeira.

92. O. VULGARIS Mill. Seen only here and there in gardens in Madeira. Fruit crimson or purple and pear-shaped like the last, but insipid and equally objectionable from its effects on the secretions.

93. PERESKIA ACULEATA Mill. Not uncommon in Madeira, the Canaries, and Cape Verdes. The small amber-coloured fruit (Barbados Gooseberry) is by no means unpalatable.

UMBELLACEÆ.

94. CELERY (*Apium graveolens* L.),
95. PARSLEY (*Petroselinum sativum* L.),
96. FENNEL (*Fœniculum officinale* All.),
97. CARROTS (*Daucus Carota* L.), and
98. CORIANDER (*Coriandrum sativum* L.) are all successfully

cultivated or found wild (*i. e.* 94, 95, 96, and 97 in Madeira) in each of the three groups.

Rubiaceæ.

99. Coffæa arabica L. Cultivated extensively and with great success with respect to the excellence of the produce in Madeira and the Canaries, this plant is one of the most important staple productions of the main islands (St. Antão, St. Nicolão, St. Iago, Fogo, and Brava) of the Cape Verdes. The principal valleys of the first four of these islands are often almost jungles or thickets of coffee-plantations. The berry is small, the yield most abundant, and the quality excellent.

Compositæ.

100. Carthamus tinctorius L. Bastard Saffron is grown in gardens here and there in each of the three groups of islands—the dried florets of the ray being a favourite ingredient in soups and various made dishes, to which they impart both flavour and colour.

101. Cynara Scolymus L. The Artichoke is cultivated in a few gardens (English chiefly) in Madeira.

102. Lactuca sativa L. Lettuces are grown abundantly in Madeira and the Canaries. I have also seen them occasionally in the Cape Verdes.

Vacciniaceæ.

103. Arbutus canariensis Veill. The fruit of this tree, which is peculiar to the Canaries and not found in either the Madeiran or Cape Verde islands, is called Madroño and much esteemed by the Spaniards. It is sweet and insipid, yet rather better than that of *A. Unedo* L., which it resembles in size, shape, and colour, being, however rather pale orange than scarlet.

104. Vaccinium maderense, Link. Indigenous to Madeira, but not found in either the Canaries or Cape Verdes. The fruit (called Uva da Serra) is black, with a strong glaucous bloom. It is larger and more oval or oblong than that of the English Bilberry (*V. Myrtillus* L.), and makes an excellent acidulous preserve, which, mixed with water, affords a refreshing cooling drink in feverish colds &c.

Sapotaceæ.

105. Sapota Achras Mill. The Sapodilla (Nespera of the Cape Verde Portuguese) occurs in a few gardens in St. Iago. In one at Porto Praia, the globose russet-brown fruit, about the size

of a large Walnut, appeared to be half-ripe in the middle of March, being sweet through still quite hard. The tree is very thickly bushy and leafy, resembling an Orange-tree in size and shape. The fruit is much esteemed. It will not grow in either Madeira or the Canaries.

Oleaceæ.

106. Olea europæa L. A few Olive-trees occur occasionally in gardens here and there in each of the three groups of islands; and a mostly shrubby variety with globose fruit is also found wild in Madeira and the Canaries. No use is made, however, of the plant in either state.

Convolvulaceæ.

107. Batata edulis (Thunb.). The Sweet Potato ("Batata" of Madeira, the Canaries, and Cape Verdes, "Batata doce" of Lisbon) is extensively cultivated in fields and garden-ground in all these islands, especially Madeira. The opportune introduction into the latter island fifteen or twenty years ago of the Demerara variety, producing annually two or three crops instead of one, helped greatly to alleviate the temporary distress caused first by the outbreak of the potato-disease, and afterwards continued by the destruction of the vines in 1852 and onwards. This more quickly and abundantly productive variety has now almost entirely superseded the culture of the old sort, though its tubers are less mealy and agreeable.

The Batata is propagated by planting thickly, in shallow trenches 6 or 8 inches deep, with manure at the bottom, cuttings from 1 to 3 feet long of the trailing wiry stems or branches. These or the greater part of them soon root and form tubers, which are ready for use in three or four months' time in the Demerara sort, whereas in the old kind they required five or six months to arrive at maturity. There are two subvarieties, viz. the "white," of a white, more firm or mealy substance, and the "red," with a softer, more watery, yellow, pulpy flesh.

Solanaceæ.

108. Lycopersicum cerasiforme Dun. and

109. L. esculentum Mill. Both of these, the small round-fruited and large melon- or pumpkin-shaped Tomatos, are rather naturalized than cultivated in all the islands. In St. Iago of the Cape Verdes whole mountain-tracts or elevated plains of the interior are covered for miles towards Sta. Catharina with dense

matted beds of *L. cerasiforme* Dun. intermixed with *Momordica Charantia* L., each loaded with its brilliant-coloured fruit.

110. SOLANUM TUBEROSUM L. Potatoes, called "Batatas" in Lisbon, "Semilhas" in Madeira and the Cape Verdes, and "Papas" by the Spanish in the Canaries, are very largely cultivated in the Madeiran and Canarian islands, but less generally or successfully in the Cape Verdes. In Madeira, and even still more in the Canaries, from the greater deficiency of other vegetable food, they form a most important portion of the aliment of the mass of the whole population, whose distress, during the first aggressions of the potato-disease some twenty years ago, almost approached that of the Irish under the same infliction. In Madeira the potato thrives equally well at all seasons from the lowest to the highest zone of elevation. In the Canaries and Cape Verdes it is grown chiefly at intermediate elevations (from 1000 to 3000 feet), and only in the cooler winter months or rainy season.

111. A remarkably fine subarboreous smooth or glabrescent and unarmed *Solanum*, near *S. obovatum* H. B., Dun., with fragrant pale pinkish lilac flowers in stalked superaxillary bifid corymbs, large orange-coloured ovate or ovoidal fruit the size of a hen's egg, and naked oblong leaves subcordate at the base, of the size and shape of those of *Brugmansia arborea* (L.), is occasionally cultivated in the Canaries, whence I have introduced it into Madeira: but I have not been able to identify the species, which I therefore call provisionally *S. insigne*. The very large and handsome fruit is used in cookery like Tomatos (*Lycopersicum cerasiforme* and *L. esculentum*).

112. S. MELONGENA L., the *Egg-plant* ("Beringéla, Port."), is also seen in gardens here and there both in Madeira and the Canaries, but it is scarcely ever used as a vegetable.

113. CAPSICUM FRUTESCENS L. and two other small-fruited sorts, viz.

114. C. BACCATUM L. and

115. C. CONOIDES Mill., are everywhere cultivated in all the islands,—the two latter, called in Madeira Bird-peppers, chiefly in the Cape Verdes.

116. NICOTIANA TABACUM L. The Tobacco-plant springs up everywhere in waste places about houses or in gardens, but is not cultivated or turned to any profitable account in any of these islands.

BIGNONIACEÆ.

117. CRESCENTIA CUCURBITINA L. Two or three plants of this

Calabash-tree grew formerly and may be still growing in the Deanery garden near Funchal in Madeira, producing occasionally flowers but not fruit; but I never met with it in either the Canaries or Cape Verdes.

118. C. CUJETE L. Dr. Schmidt in his 'Cape Verde Flora' speaks of this as growing "in locis lapidosis prope Ribeiram grandem ins. Sti. Antonii;" but it escaped my observation, though I heard of some such plant in the garden of Sr. Jansenio de Mello at the Chão d'Arroz in the Ribeira da Torre close to Rib. Grande, which was very probably that seen by Schmidt.

LABIATACEÆ.

119. OCIMUM BASILICUM L. and

120. O. MINIMUM L. are both much cultivated in baskets, pots, or boxes about houses in all the islands for nosegays and culinary purposes.

121. ORIGANUM MARJORANA L. (*Marjoram*),

122. THYMUS VULGARIS L. (*Thyme*) and

123. ROSMARINUS OFFICINALIS L. (*Rosemary*) are cultivated in most of the islands as in England,—the two first as pot-herbs.

124. MARRUBIUM VULGARE L., found wild in Madeira and the Canaries, has been also introduced into the gardens of Brava, one of the Cape Verdes.

POLYGONACEÆ.

125. RUMEX MADERENSIS Lowe. I advert to this common Madeiran and Canarian plant merely for the sake of pointing out that its leaves afford a much better Sorrel than the usual garden sorts (*R. Acetosa* L. and *R. hispanicus* Koch) generally cultivated for that purpose.

LAURACEÆ.

126. PERSEA GRATISSIMA Gärtn. Several trees of this, the Avocado or Alligator Pear, occur in gardens in and about Funchal in Madeira, producing occasionally ripe fruit; but they are by no means sufficiently common to warrant Dr. Grisebach's statement ('W. I. Flora,' p. 280), "naturalized in Madeira." I have also seen the tree occasionally in the Canaries (Tenerife and Palma), but never in the Cape Verdes.

EUPHORBIACEÆ.

127. CURCASIA PURGANS Medic. (JATROPHA CURCAS L.). The

Physic-nut, a merely occasional inmate of gardens in Madeira, where, however, it appears to thrive and prosper, is not only completely naturalized in the principal islands of the Cape Verdes, thickets of it filling up whole valleys, but its culture is becoming yearly an object of more increasing interest to the inhabitants. Already its nuts have become one of their most valuable exports, being sent in large quantities chiefly to Lisbon, whence the oil they yield is said to be reexported into France and to be much used in machinery; in the Cape Verdes themselves it is the universal lamp-oil. The plant is propagated with the greatest ease by planting in rows rough stakes or branches; and in this way it is employed universally for fencing-purposes. It is also self-propagating by its abundant nuts or seeds, the kernels of which are sweet and pleasant to the taste, but very soon act as both a violent emetic and cathartic.

128. Manihota Aipi Pohl. This is by far the most valuable and important vegetable esculent of the Cape Verdes, its long tubers forming together with Indian corn or maize the main food of all classes. It is grown in the fields, planted in rows, and requires a rich light soil. Cuttings of the stems or branches, about a foot long, are planted in shallow trenches in a sloping or oblique direction and pretty thickly (to allow for failures in striking), with manure at the bottom of the trench, much in the same way as the Sweet Potato. Nothing further but occasional watering is needed; and the tubers begin to form towards the end of the first year, but are not considered to be mature or large enough for use before they are two or three or even four years old. They are then often 12–18 inches long and as thick as a man's leg or arm, mostly tap-shaped, of a pale yellowish creamy white like a parsnip, and even while raw very pleasant to the taste, being crisp and juicy with a sweet creamy or nutty flavour. Boiled or toasted they resemble Spanish chestnuts in flavour, but they are much firmer in consistence though mealy. The only drawback is often a good deal of stringy fibre in the middle.

The ordinary Brazilian Manhiot or Cassava with poisonous juice (*M. utilissima* Pohl) is not cultivated in the Cape Verdes. I have formerly seen one of the two sorts (probably *M. Aipi* Pohl) apparently thriving in the Deanery garden at Funchal in Madeira.

129. Ricinus Palma Christi L. The Castor-oil-tree is completely naturalized and self-propagating in all the islands; but its oil is only partially employed domestically, whether for light or

medicine; and thus not sufficiently to make its cultivation any object.

130. CICCA DISTICHA L. fil. (AVERRHOA ACIDA L.). A common tree in gardens or about houses in the Cape Verdes, but not known in Madeira or the Canaries. Its austerely acid obtusely 5-ribbed or -angled subglobose or oval fleshy-coated yellowish-green fruit, growing in racemes clustered on the thicker branches, and about the size of a small gooseberry or marble, is called Azedinha or Groselha, *i. e.* Gooseberry, by the Portuguese. It is scarcely eaten except preserved with sugar, when it turns nearly or quite black. It has no flavour besides its acidity.

URTICACEÆ.

131. MORUS NIGRA L. The Mulberry flourishes in Madeira, producing abundantly large and most delicious fruit in July, which, however, is considered by the Portuguese to be unwholesome. In the Canaries, and especially in Palma, it is more extensively cultivated for feeding silkworms. There is a silk-manufactory at Sta Cruz, the principal town of Palma; but the silk, which is said to be of excellent quality, is chiefly exported to Lyons.

I never met with this Mulberry in the Cape Verdes, but in lieu of it

132. M. PABULARIA Dcne. This Mulberry, distinguished by its long loose weak flaunting or declining branches, and large cumbrous foliage of long-stalked cordate serrate coarsely rugose or bullate light-green leaves, is often planted about fields or houses in the Cape Verdes as well as in the Madeiras and Canaries. It is cultivated merely for its foliage, which is used as fodder. The fruit, which I have never seen, was reported to me in Fogo to be "red," *i. e.* perhaps rose- or flesh-coloured.

133. FICUS CARICA L. The common Fig in numerous varieties is most abundant in the Madeiran and Canarian groups. Indeed in some islands of the latter its fruit constitutes when dried a considerable portion of the daily food of the people. It cannot without difficulty be preserved in this way in Madeira; but the fresh figs are most abundant in quantity and of delicious quality from the end of June to October, the trees producing usually two crops within that time. In the Cape Verdes the Fig-trees are comparatively rare, and seem not to flourish.

134. F. (SYCOMORUS) GUINEENSIS Miq.? This fine tree, though indigenous in the Cape Verdes, is also frequently seen in gardens or near houses. The wood is a good timber; but the

beautiful deep-scarlet or crimson fruit, produced in vast profusion in short crowded panicles both from the trunk and towards the ends of the branches, is very worthless. It is about the size of a common fig, but more globose than usual. The thick evergreen foliage is very dark; the leaves are coriaceous, glabrescent, somewhat shining, very stiff and often harsh or scabrous. This Fig is not found in either the Canaries or Madeira.

Juglandaceæ.

135. Juglans regia L. The Walnut flourishes and abounds in Madeira. It is scarcer in the Canaries, and in the Cape Verdes is only rarely and with difficulty made to grow. I met with it once only, at an elevation of 2000 or 3000 feet, in the Ribeira das Patas in the island of St. Antão.

Cupulaceæ.

136. Castanea vulgaris Lam. The Spanish Chestnut flourishes equally in Madeira and the Canaries, producing most abundantly. It is not found in the Cape Verdes.

137. Quercus Robur L. The Oak (whether *Q. pedunculata* Ehr. or *Q. sessiliflora* Sm.) thrives wonderfully in Madeira at almost any elevation; but it is only seen occasionally in the Canaries, and not at all in the Cape Verdes.

138. Corylus avellana L. The Hazelnut or Filbert occurs here and there in Madeira; and the trees flourish, but never produce perfect fruit with kernels. They do not exist in either the Canaries or Cape Verdes.

MONOCOTYLEDONS.

Dioscoreaceæ.

139. Tamus edulis Lowe. The cultivation of this plant is quite confined to one or two parishes or districts in Madeira, those of Pto. Moniz and Ribeira da Janella. The large Bryony-like root is rendered edible by long boiling. The plant is found wild both in Madeira and the Canaries, but not in the Cape Verdes. In Madeira it is called "Norça;" in the Canaries it is scarcely used except for feeding swine.

140. Dioscorea. No species of true Yam succeeds in any of these islands. They have been often tried in Madeira, but always

unsuccessfully, the tubers yearly dwindling from the size of a child's head to that of a walnut.

Zingiberaceæ.

141. Zingiber officinale Rosc. (*Common Ginger*), and

142. Curcuma longa L. (*Turmeric*) are occasionally cultivated with facility, in gardens at Funchal in Madeira only.

Cannaceæ.

143. Canna edulis Ker. Naturalized in the Cape Verdes and capable of affording by its rhizomes in times of famine some little help against starvation, but scarcely even thus employed by the poor helpless negro population. It is not found in either the Canaries or Madeira.

144. Maranta arundinacea L. is cultivated with much success, but very locally, in Madeira only. The produce is of first-rate excellence.

Musaceæ.

145. Musa paradisiaca L. The Plantain, "Banana da Terra," of the Cape Verdes, in only less abundant than the following species in those islands. But I never met with it either in the Canaries or Madeira.

146. M. sapientium L. The Banana, "Banana de S. Thomé" of the Cape Verdes, where it is almost naturalized, filling up sometimes whole glens or gullies, is scarcely less abundant in Madeira or the Canaries, where when once planted it is self-propagating by the roots or suckers. It thrives best in sunny nooks sheltered by rocks or cliffs.

147. M. Cavendishii Paxt. is common in Madeira, but less so in the Canaries and Cape Verdes. From its low stature it is less liable to injury from winds than the plantain or banana, but its fruit is much inferior to that of the latter.

Amaryllidaceæ.

148. Agave americana L. The common American Aloe is not found in the Cape Verdes, but is very common in Madeira and the Canaries, being often used for fencing, and the thread ("Pita") or fibres of the leaves employed for sewing straw hats and bonnets and making neat little coloured mats or doilies for the table.

149. Fourcroya gigantea Vent. This is merely seen occasionally in gardens in Madeira and the Canaries; but in the Cape

Verdes it is both seminaturalized and largely cultivated, under the same name (Piteira) and for like purposes as the last, of which indeed it altogether takes the place.

Bromeliaceæ.

150. Ananassa sativa Lindl. The Pine-Apple is cultivated freely in the open air both in Madeira and the Canaries; but the plants always look yellow and sickly, and the fruit is small and fibrous though well flavoured. In St. Iago of the Cape Verdes I have seen whole fields of it growing luxuriantly, but not in the fruit-season.

Liliaceæ.

151. Phormium tenax Forst. The New-Zealand Flax-plant flourishes in a few gardens in Madeira at an elevation of 2000–4000 feet, but no use is made of its leaf-fibre.

152. Aloe vulgaris DC. The common Yellow-flowered Barbadoes Aloe is naturalized in all the three groups of islands, but little or no use is made of it.

153. Allium sativum L., and

154. A. Porrum L. Garlics and Leeks are cultivated in all the islands more or less, but nowhere extensively.

155. A. Cepa L. The common Onion is more largely cultivated in all the islands, but most in Madeira, where it is grown very extensively in fields in some districts, and where its produce, both in size and quality, can scarcely be surpassed. For instance, I had once a dozen bulbs presented to me, one of which weighed 4 lbs., and none less than 3 lbs., the whole weighing 40 lbs. Being, with two or three exceptions, of very equal size, they may be said to have thus averaged more than $3\frac{1}{4}$ lbs. a piece. These bulbs form an important article of export from Madeira, chiefly to Lisbon. From some of the Canaries, *e. g.* Palma, they are largely exported also to Havana. In the Cape Verdes they are merely grown for home consumption.

156. Asparagus officinalis L. The common Asparagus has often been tried in English gardens in Madeira, but always unsuccessfully.

157. Dracæna Draco L. The same Long-narrow-leaved Dragon-tree is perfectly indigenous in each of the three groups of islands. It is found wild still on the sea-cliffs of the Madeiran, and on the higher mountain-crags of the interior of the Canarian and Cape Verde islands; and in all it is often planted here and

there in gardens or near houses, though little or no use is now made of its medicinal gum (Dragon's-blood). The globose yellow fruit, the size of a cherry or marble, produced in vast terminal panicles, is sweetish but nauseous, and only sometimes eaten by children.

Palmaceæ.

158. Phœnix dactylifera L. The Date-Palm produces occasionally ripe fruit in Madeira of tolerable quality, but the tree is rare. In the Canaries, especially in the north of Tenerife and south of Grand Canary, it is far more common, and in Gomera its fruit is excellent and plentiful. In the Cape Verdes the tree is met with only here and there, being almost entirely superseded by

159. Cocos nucifera L. (the Cocoa-nut), which flourishes perfectly not only near the sea but running up the valleys for several miles to an elevation of 2000 feet, in St. Iago, producing most abundantly.

In the Canaries or Madeira it barely maintains its existence above six or seven years, not acquiring a stem or rising to a height of more than 8 or 10 feet, and never fruiting.

Araceæ.

160. Colocasia antiquorum Schott. This plant, the Inhame of the Portuguese, affords in Madeira to the common people a larger and more regular supply of food than any other; and it is thus perhaps the most widely cultivated and important of their esculents. It flourishes equally when grown in dry soil, in rows alternately with cabbages or French beans (*Phaseolus*), and when planted by itself in what seems its more natural locality, artificial marshes formed in every little spot available in the beds of ravines by damming up or partially diverting the torrents. When the vertical rhizome has grown to the length of 6 or 8 inches and diameter of 2 or 3 inches, the whole plant is dug up, and the lower part of the rhizome cut off one or two inches below the crown. This lower part is the esculent. The upper part or crown is then replanted in trenches with the leaves close cropped off, and bedded in a quantity of litter (fresh grass, broom-cuttings, twigs, and leaves of trees or even fern, *Pteris aquilina* L.), more to serve for shelter from evaporation than for manure. Thus a succession-crop is kept up throughout most part of the year. The leaves are gathered at all times for feeding pigs, which devour greedily

their long succulent petioles. The root requires at least six hours' slow and careful boiling. There are several varieties or "sorts." In the Canaries and Cape Verdes this plant is very partially and rarely cultivated, probably owing to the scarcity of water; for even in dry situations in Madeira it requires frequent irrigation.

Graminaceæ.

161. Zea Mays L. The cultivation of "Milho" (Maize or Indian Corn) is now, alike in all the islands, of primary consideration. In Madeira formerly it was very subordinate or partial; but since the general destruction of the vines, Milho has in the north of the island as completely taken their place as the sugar-cane has in the south; and the better supply of water renders the crop far less precarious than it is in the Cape Verdes. The mode of cultivation is most simple. Two or three seeds are planted near together in the middle of a slight hollow, or a row is sown along a shallow trench. They require no further care than weeding, watering, and thinning. The heads are gathered in Madeira in August or September.

162. Panicum maximum Jacq. (P. jumentorum Pers.). Guinea-Grass is sometimes cultivated here and there in all the islands for fodder.

163. Arundo Donax L. was formerly grown largely (or, rather, suffered to grow) in Madeira for making vine-trellises, mats, or partitions in houses, &c. It is perfectly wild or naturalized in all the islands.

164. Bambusa arundinacea L. The Bamboo flourishes particularly well in Madeira, becoming sometimes as thick as a man's thigh. It is less frequently seen in the Canaries or Cape Verdes.

165. Saccharum officinarum L. The Sugar-cane is a general object of cultivation almost equally in all the islands, though more for the sake of distilling spirits from its juice than for making sugar. When employed, however, in Madeira for this latter purpose, the produce is most excellent. In the south of this island it has for the present almost wholly taken the place of the vine. The sort most commonly cultivated and esteemed is the short-jointed. The culture is very simple. On the cutting of the canes in February or March, from 6 to 12 inches of their tops, lopped of all leaves, are planted obliquely in rows in shallow trenches when it is wished to form new plantations. The old stocks send up annually fresh shoots, after the cutting of the old, for a new

crop. In the Cape Verdes the plant is much taller and more luxuriant, rising often to heights of from 10 to 15 feet.

166. ANDROPOGON SCHŒNANTHUS L. Lemon-grass is very generally found in gardens in the Cape Verdes, but has not occurred in either the Canaries or Madeira.

167. SORGHUM SACCHARATUM L. The Sugar-grass has been lately extensively tried in Madeira as a sugar-cane, in consideration of its thriving at somewhat higher elevations than the latter. But the result has not been satisfactory, the juice being far inferior in yield and quality. It occurs occasionally both in the Canaries and Cape Verdes.

168. S. VULGARE Pers. is naturalized, and its grains are occasionally used for food, in the Cape Verdes only.

169. S. HALEPENSE (L.) is naturalized, and used for fodder in all the islands, and for grain also partially in the Cape Verdes.

CEREALIA.

170. Wheat, Barley, and Rye are grown extensively in the Madeiran and Canarian groups. In Madeira the wheat, which is the long-bearded and of the finest quality, is sown in November or December, and reaped, or rather pulled up by the hand, in June.

Above 2000 feet, rye takes its place, as barley almost altogether does in Porto Santo. Oats are not grown at all in any of the islands: nor do either wheat, barley, or rye occur in the Cape Verdes.

Lea Rectory, Sept. 26, 1866.

XXXIV. On the Botanic Garden at Breslau, and its organization. By Professor GOEPPERT, Director of the Establishment *.

ON taking a general view of the European botanic gardens, we find but a small number which really accomplish the required end, viz. to contribute, by facilities for observations on a large scale,

* As the Horticultural Society now combines with other important objects efforts towards the improvement of the education of gardeners, though its establishment at Chiswick does not profess to be a botanic garden, a translation of Dr. Goeppert's little tract on the present condition of the Botanic Garden at Breslau will be read with interest by many of its Members. Several of the suggestions are extremely interesting, and may prove useful even should it be impracticable and unadvisable to adopt all of them.—TR.

to the advancement of botany in general, to offer students in Medicine and Pharmacy sufficient materials for their studies in this delightful science, and at the same time to diffuse information on the subject to an educated and enlightened people.

In these respects our botanical establishments leave much to be desired. For example, we seldom find arrangements for displaying medicinal plants and those which are among the most important in an industrial point of view*. It ought not to be objected that some of these are difficult of acquisition. Our relations and communications at the present day with different parts of the globe are too well-established to offer in this respect serious difficulties. Moreover there is no work for the use of students to instruct them respecting the plants contained in a botanic garden —a serious inconvenience, the cause of which, in part, consists in the rapid progress of science†.

It is, then, essential to improve botanic gardens, so that studies may not only be facilitated, but adapted to the demands and high scientific position of our age. This is what we have attempted to realize in the Botanic Garden of Breslau, as is shown in the following details.

The Botanic Garden of Breslau, in an area of rather more than fifteen acres and a half, contains about 12,000 plants, classed according to their natural orders, habit, and aspect. We cannot, indeed, approve of the method of arranging plants solely according to the natural system, and placing for example side by side the herbaceous Leguminosæ and Rosaceæ with those which form trees and bushes. We are content merely to plant representatives of the different types, and to group them according to their size.

To obtain, however, a general view of vegetation on the surface of the earth, for the last nine years we have tried to group together in the open air plants which comprise a general conspectus of vegetation, thus realizing one of the important ideas of our immortal Von Humboldt, who attached so much importance to the physiognomy of vegetation. We prepare, in fact, every summer

* [It is scarcely needful to remark how much has been done in this direction at Kew, by the establishment of the noble Museum, and the appropriation of a particular house to exotic plants used in medicine or the arts. A similar collection of plants, or at least a very important contribution to one, is now in the possession of the Horticultural Society; and it is hoped that this will soon form a very important feature.—Tr.]

† [Lindley's 'Medical Botany' will in this country afford the medical student a good deal of assistance; and if he wants to enter more deeply into the matter, there are the admirable volumes of Pereira on 'Materia Medica.'—Tr.]

eighty-four groups of this character; and a synoptic table, placed at the entrance of the garden, presents the essential details. Near each group a smaller tablet is placed, which comprises the principal genera. Fifty-six of these groups belong to the principal forms of plants over the whole globe, and twenty-six to the collective plants of a single country or zone. Amongst the first are found groups of mosses, lichens, ferns of the arctic, temperate, and torrid zones, arads, orchids, climbing plants of every kind, arborescent Liliaceæ, grasses of the different zones (comprising those with an arboreous habit), Bananas, Zingiberaceæ, Cannaceæ, different kinds and forms of Ananas, Agave and Begonia, Casuarineæ, Palms, Ericeæ of different zones, Conifers of the northern and southern hemisphere (Abietineæ, Cupressineæ, Podocarpeæ, Taxineæ), Cycadeæ, Proteaceæ, Myrtaceæ, Cacti, fleshy-leaved plants (as Crassulaceæ, Aizoideæ, Mesembryanthema, Aloes, Agaves, Stapelias &c.), green trees of various species and countries—as deciduous trees, those of the temperate zone of Europe, Asia, and America, of the warmer parts of that zone in Europe and America, with simple or compound leaves; finally, evergreen trees, of the temperate zone of Europe, America, and Asia, especially China and Japan, the Alps, subtropical Asia, the Himalayas, and the torrid zone. Then follow groups of Acacia, Mimosa, and plants of the same tribes, Umbelliferæ, Malvaceæ, Solanaceæ, &c.

To give a general notion of the collective forms of plants of different zones, there are groups of plants of the arctic and subarctic zones, those of the Alps, of which we cultivate about 400 species, the groups of plants of Southern Europe, North America, Mexico, the tropics, Chili, the Canary Isles, the Cape of Good Hope, China, Japan, Australia, &c. All these groups and these general views of the vegetation of a single country may be much more complete elsewhere, according to the abundance of materials and the difference of localities.

In our garden, the label of each plant contains not only its systematic name, but also that of its natural order, country, and use in medicine or art, as:—*Rhœades, Cruciferæ: Cochlearia officinalis, L. Offic. Hb. Cochleariæ. Europ. Septentrion. litore.* Besides, as regards plants cultivated in the open air, every family possesses a special synoptic table, which is a considerable aid to the student, and undoubtedly deserves adoption in other botanic gardens.

Although, as we have already said, the natural system has served as the base and rule of all arrangements, it nevertheless

appeared desirable to find some means of giving a general notion of the vegetable kingdom—a matter of the greater difficulty on account of the enormous extent of some natural orders.

To accomplish this, 400 plants in pots are placed on the borders of the garden, representing all the important families. This arrangement has proved very instructive. A perfectly similar arrangement has been applied to the stoves of the garden, in each division of which there is a synoptical table of the contents. Officinal poisonous trees, plants important in commerce or the arts, as also plants of every climate and order, are grouped as much as possible so as to enable the student during winter to study, thanks to their concentration and mode of grouping, what is spread over the whole garden in summer.

The anatomical and physiological characters of plants deserve a not less particular attention. With this end, we have formed a physiological section, surrounded by protecting hedges, designed to show the details of the normal and pathological development of trees. The following general view will afford some notion of our plan. The normal increase is represented in part by tables, in part by vertical sections of oaks (*Quercus pedunculata*) which have attained an age of from 164 to 500 years, and of red deal, *Pinus abies* and *P. Picea.* Amongst these last we have a section of a trunk of a fir which came from Böhmerwald, 4500 feet above the level of the sea, which was 175 feet high, with 507 annual rings, and 14 feet in circumference at 5½ feet above the surface of the soil. Another trunk from the same locality presents 448 annual rings. Its height was 186 feet. A third, from Heuscheuer, in Silesia, has 395 rings.

Abnormal growth is represented by the linear fusion of branches of red and white beech, trunks of oak, larch, and linden, bent in the form of a crook, and by that of the roots of trunks a hundred years old. Then follow specimens, after the fashion of palms and screwpalms, of red and white larch, whose trunks rise from the soil, supported by pillars four or five feet long, having put forth everywhere aërial roots. The formation of veins and knots of wood is displayed on a large scale, trunks twisted to the right or left, injuries produced by insects, remarkable formations of fungi, &c. In the middle of this department there is a fossil trunk, in its original position, of *Pinites protolarix*, Goepp., 36 feet in circumference, coming from the bed of lignite at Saurau in Silesia: the interior is hollow; but, judging from what remains, it must have had from four to five thousand rings. Around the

trunk, which is quite unique, especially as regards its internal cavity, there is a very ornamental plantation of our garden ferns, and of those which flourish in the open air in the northern climes of the two hemispheres. In its neighbourhood are two similar trunks 8 feet high, and 2 feet thick, which were found in the same locality: they are still provided with numerous branches, and are of the same anatomical structure; indeed they may be regarded as branches of the above-mentioned gigantic tree. There are two other trunks close to these, 6 feet high and flattened, belonging to *Cupressinoxylon ponderosum*, Goepp. All are bound with iron rings.

By their side, we have, on pedestals, a trunk petrified with iron pyrites, another with chalcedony, besides lumps of lignite. The whole group gives a notion of the different modes of existence, and of the different degrees of preservation, of the vegetables which enter into the composition of the brown-coal formation. As the principal trunk contains no sulphate of iron, its preservation, in spite of climatic action, appears so much the more certain, inasmuch as nine winters, some of which were very sharp, and as many rainy summers have not injured it in any respect.

The ancient coal epoch, so important to Silesia in consequence of the richness of its coalfields, is represented with equal care in the garden. For this purpose a section of the whole formation has been made in porphyry raised on granite. The porphyritic cone traversed by two beds of coal from 1 to 1½ foot thick, including, in their natural state, the plants of which coal is composed, as Coniferæ, Sigillariæ, Lepidodendra, the specimens of which are finer than in any palæontological museum. The length of this section, represented by a solid wall disposed in the form of terraces, consisting of 22,100 pieces of stone, is from 9 to 12 feet by 60; the height of the cone of porphyry, from the centre of the base is 25 feet. The surface of the whole of this representation of the ancient coalfield — planted with Abietineæ, Cypresses, Ferns, Equisetes, mixed with great trunks of the fossil plants, 10 feet high—is from 19 to 20 ares (2272–2392 square yards, about half an acre). The weight of the stones amounts to 4000 quintals.

Special Arrangements.

Such are the arrangements for theoretic instruction; it remains to describe those which relate to medicine and pharmacy.

It was important to collect, not only the plants actually contained in European pharmacopœiæ; but others which are interesting

in a physiological, chemical, industrial, historic, or, indeed, any other important point of view.

Our efforts have been crowned with success, insomuch that out of 900 officinal plants which are actually prescribed by doctors we have 780, and no European garden possesses the 120 which are deficient.

We cultivate, besides, 1800 species of the second category, so that there are in the Breslau garden 2500 plants of interest under one or the other of the different divisions mentioned above. As we have already said, all are fully marked with the name of the family, genus, species, locality, and country, with the indication of their use, and of the officinal and technical terms under which they are generally known, as for example—

"Discantheæ. Araliaceæ. *Aralia papyrifera*, Lindl.
Pith. Velvet Paper. China."

Though no botanic garden contains a similar collection, it appears to me insufficient for practical purposes, if the nature of the produce is not added to the general appearance of the plant. For this end, we have placed in the open air by the side of the plants, their produce in well-chosen specimens, enclosed in glass cases and ticketed, either on wire stages, or on pedestals. We have extended this method of arrangement to the artificial products, such as matters for dyeing, tissues, &c., and also to the flowers and fruit of rare tropical plants (as *Myristica*, *Caryophyllus*, *Theobroma*, *Cinchona*, &c.), and, finally, to the representatives of families and genera, all enclosed in glass vessels. We have also established a Botanical Museum of nearly a thousand specimens, in the immediate neighbourhood of the corresponding plants. Amongst these are objects of such rarity that they would be the ornament of any museum. At present the mode of preservation has been so perfect that we have not lost a single specimen. The people of Breslau appreciate the abundant materials for instruction which are thus offered, and in fine weather the garden is constantly crowded.

Botanic gardens with more ample funds might offer something more perfect; but we shall be gratified if our example is followed and if this mode of arrangement, which is attended with so much practical good, should be generally adopted.

[A list of some of the rarer officinal plants is added, for which we must refer to Goeppert's 'Die offizinellen und technisch-wichtigen Pflanzen unserer Gärten, insbesondere des botanischen Gartens der Universität Breslau,' &c.—Tr.]

XXXV. On some Experiments in Temperature.

By G. Hadwen, Esq., F.H.S.

Being interested in horticulture, yet, unfortunately, denied a climate suitable for trying out-of-door experiments, it occurred to me that if I made an application to the Council of the Royal Horticultural Society, they might, perhaps, permit my experiment to be tried at their Garden at Chiswick, already rendered famous by the valuable thermometrical readings that have been taken there for so many years. I therefore wrote and asked that a few additional daily observations might be taken for me. This application they in the kindest manner acceded to, and the subject was warmly taken up by Mr. Robert Thompson, who was only too glad, he wrote me, to be of service to horticulture. My application was that, in addition to the daily maxima and minima in the open air, the maxima and minima of a south wall should be taken, and the maxima and minima of the large conservatory. In this latter case I asked that the progress of the crop should be noted, as also when fire heat was used. Thus the matter rested till I went up to the great International Flower Show, where I encountered the Rev. M. J. Berkeley, who invited me to write a few notes explanatory of my reasons for making this request, so that when the result of the observations was published in the Journal of the Society, the Fellows would be better able to understand the value of the tables. This, I thought, was more than I was able to perform; but, subsequently, I have seen in the Journal of the Society the paper on "Border-heating," by the Rev. W. Kingsley, and his concluding remarks have not only accorded with my own opinion, when he says, "I am sure that unless our experiments are based upon some principle to begin with, they will never be of value for making correct inductions: and so I shall be glad to give some time to experiments of a scientific kind in order to obtain results that, as an individual, I should never live long enough to see, but which by the united efforts of many may be arrived at in a few seasons,"—but I have also felt such a strong desire to assist him in his laudable efforts, that I have concluded to write a few notes to try and draw the attention of the Fellows, not only to the value of such scientific experiments, but also to point out to them my reasons for thinking the garden of the Society at Chiswick possesses peculiar advantages for such experiments. The first is, that to be of any use to horticulturalists, it is of the utmost importance that the experiments should be made by some one of experience, whose interest in horticulture is un-

doubted, who has time carefully to observe all changes, and in whom every confidence can be placed, as having no previous prejudices that could warp his judgment, and so prevent him having the full benefit of all his perceptive faculties; secondly, that the experiments could be tried in a suitable locality; thirdly, that the place should be the one where the experiments could be tried at the least possible expense. I think that all who know the garden of the Society at Chiswick, will join with me in thinking it offers all these advantages,—in its staff employed under the Garden-Committee — in its climate, as we are told that in July the valley of the Thames is as warm as any part of England, not excepting the southern coast of Devonshire and Cornwall; and since the garden has all the sorts of houses required for the experiments, it would only need a light expense, such as making a warm border, buying wall-sheeting, and supplying the thermometers to carry out any experiments that might be required. I am one, if more can be found, willing to join in the expense of the following experiments, say, for two or three years.

That the maxima be taken each day and the minima each night, —in the open air, in the shade, on a south wall exposed to the sun, on a south wall well sheeted up each night, as also during the day, if required, which practice is to be noted,—in a heated border in the open ground at the same depth, both borders to have planted in them wall-trees and standards; the sheeted-up wall to be also used in like manner; in the orchard-house, glass wall, in the lean-to vinery, and large conservatory. In each case the progress of the crop to be mentioned, and when fire-heat is used in those that have it. My reason for making this proposal is, because I think we do not fully realize the power of sun-heat any more than the advantages of border-heat. Who was prepared to find what the experiment of this year has shown, that a peach-tree or vine planted against the south wall at Chiswick would, during the warm sunny days, have had a much higher temperature than was required to bring the crop of grapes to a successful maturity in the large conservatory? Turning to the minima table, I think there is every probability that if a sheet had been employed to check the loss of heat by radiation, we might have said as much for the night temperature also. The disadvantage of unheated glass walls is, that the sun in spring advances the trees, and yet the glass is not able to prevent during the night the injury from low temperatures caused either by frost or radiation during clear

nights; and the peach-trees or vines suffer from this last evil quite as much in the autumn as in the spring, for the trees are by this cause often being put to rest before the crop is ripe. Again, who was prepared to learn that a lean-to orchard-house, with the back wall facing the south, had such a manifest advantage over a span-roofed-house with the same aspect, as we must believe it has, if in the open air such a wall indicates a heat of 100° without any glass to retain the air heated by its radiation? With respect to border-heating, the Rev. W. Kingsley gives some important information from his experiments, which I can fully believe from my own, though, as I have said, my climate has confined me to experiments under glass. A few years since, I communicated to one of the papers, though at the time it attracted no attention, what very much surprised me. I planted, down the centre of a span-roofed vinery I had supplied with bottom-heat to grow Muscats in, some early French vines, with the intention of cropping them till the roof was covered. The Catalogue, from which I ordered them, said some of these very early ones would be ripe nearly two months before the Muscat of Alexandria; yet the result did not give two weeks, and I am still of opinion that with this treatment the Muscat of Alexandria is not a late grape in the meaning of that term. If I am correct, forcing should still mean what its name implies, that the crop by extra heat has been produced in an unusually short time, and not that it was commenced at an earlier date. Producing a crop in a shorter time is what we want, that our fruit may ripen while our days are still warm, and, what is as important, while the days are long. In Scotland, from this last cause it is thought, an average wheat crop can be grown at a lower temperature than in France, and, I believe, in a smaller number of days.

I had the other day an opportunity of questioning a gentleman who had just landed from Canada upon these points, as I wished to know if he would confirm what a friend of mine from St. Petersburg had previously told me, respecting the amazingly rapid growth of all the crops. He told me that he left Montreal on the 10th of August, and that the new apples were then beginning to come into the market, though they did not consider the crop to be ripe till near the 20th of August, and that this year, which was not a late one, there was not an apple-leaf to be seen on the 20th of May. I said, Do you say an apple crop can be perfected in three months? he said, Yes, you seem to overlook the length of the days, and the great heat we have, often 110° in the sun and

90° in the shade. I asked him if they found that the drainage warmed the soil and made the crops earlier; and he told me it was being largely carried on for this reason. No doubt the nature of the Canadian apples helps to explain a part of this, as all I have seen that I knew were Canadian were very light for the size. I give this for what it is worth, that it may be confirmed or disproved, but I believe it will prove to be no exaggeration. It will thus be easily seen how interested I was with this paper, "on Border-heating," by the Rev. W. Kingsley; and I think he will take as much pleasure in examining these tables collected by the Royal Horticultural Society at my suggestion.

The daily history of the life of this crop of grapes is of itself a valuable paper, and I know of no treatise on the vine that contains such a one; but yet we want still more of such; and I hope next year to obtain one from a house where no heat but sun-heat can be obtained, and which yet produces yearly a very heavy crop of good grapes: but we also want, on "standard authority," the relative advantages of the different sorts of houses now built; and I venture to think that this is as much within the sphere of usefulness of the Royal Horticultural Society, as the trials of the various merits of fruit. It is said that the Council are anxious to make their garden at Chiswick as useful as their means will permit; and I believe this is true. My intention is not to raise a discussion as to whether what I propose is within their means or not, but simply as a producer of fruit I wish to obtain this knowledge, and, as I have said, I am willing to contribute towards the expense.

XXXVI. Note on *Asplenium ebenoides*, Scott.

By the Rev. M. J. Berkeley, M.A., F.L.S.

A note by Mr. D. C. Eaton appeared in the 'Gardeners' Chronicle,' August 18, 1866, p. 780, in which he states that *Asplenium ebenoides* is the same as *A. Hendersonii.* I have not been able to obtain a specimen of that supposed species, as Mr. Henderson has unfortunately been quite incapacitated for more than a twelvemonth for making the least exertion, and what has been transmitted to me is something totally different. A simple inspection, however, of Mr. Lowe's figure, added to the fact that the plant is not proliferous, is quite sufficient to convince one that Mr. Scott's and Mr. Henderson's plants are perfectly distinct. Both were solitary specimens, the one occurring naturally, the other acci-

dentally amongst other seedlings; and both have defied all attempts at increase, and the plants themselves no longer exist. I was the more anxious to obtain a specimen of *A. Hendersonii* because I believe that its spores would prove to be imperfectly formed, like those of *A. ebenoides*. I had already ascertained this to be the case when Mr. Robinson Scott forwarded me such spores as he could obtain from the living plant; and these, submitted to the care of Mr. Bull, have not germinated.

In a criticism at page 734 of the same Journal, it is objected to the figure of the *Camptosorus* that the sori are disposed too regularly; but the figure exactly accords with specimens now before me. It is said, moreover, that *Asplenium ebenoides* wants the irregular distribution of the sori characteristic of the genus *Camptosorus*; but a glance at Mr. Fitch's figure, which is very correct, will show that they are by no means regular, but that they are occasionally placed back to back or opposed to each other.

In a late communication, Mr. Robinson Scott, together with specimens of the three species figured, has sent *Asplenium pinnatifidum*, Nutt., gathered in the same locality as *A. ebenoides*; and it must be confessed that the tapering extremity of the frond in this species, which sometimes is proliferous, bears a very striking resemblance to that of *A. ebenoides*, though there is little similarity in other respects; the sori especially are much fewer and very different. He also transmitted a singular variety of *Asplenium ebeneum* with perfectly round sori.

Mr. Scott remarks that he finds the *Camptosorus* very impatient of cultivation, and that *Asplenium pinnatifidum* is equally difficult to manage.

XXXVII. On an Imperfect Fungus producing Disease in Orchids. By the Rev. M. J. Berkeley, M.A., F.L.S.

In the first Number of the present series of the 'Journal' of the Royal Horticultural Society, I have given an account of a minute fungus which is extremely destructive to Orchids. Mr. Pilcher, the scientific gardener of Mr. Rucker, brought, early in the year, to one of the Tuesday meetings, an Orchid-leaf in an advanced state of decay, covered with a white byssoid mycelium, which he informed me is a most virulent enemy in the Orchid-house. A drawing was laid before the Society, which I have considered of sufficient interest to be reproduced here.

The snow-white mycelium runs for three or four inches over the leaf (on the under side of the specimen before me), consisting of fine branched threads composed of numerous filaments loosely intertwined, and studded everywhere with little balls, which make it an extremely pretty object.

The threads are slightly flexuous, with rather long articulations, and short obtuse branches, some of which probably are elongated as the spawn advances, though I have not been able to trace the origin of the threads. Upon the threads are scattered linear bodies disposed obliquely and generally changing their direction alternately, and a few are scattered amongst the threads. These appear to be conidia; but I have not seen them growing on the filaments. At first sight they seemed to be internal; but a nice adjustment showed them projecting beyond the threads on which they were seated. Occasionally a single thread is found with projecting knots on the sides, divided halfway down, as in the genus *Zygodesmus*, but whether accidentally present or not I am unable to determine. Short fascicles of inarticulate filaments occasionally appear, with their endochrome collected in distinct masses, which are probably the first rudiments of the little balls above mentioned. These are seated on the little creeping ropes, and under a good lens are rough everywhere with projecting processes so as to form a pretty microscopic object. On dissection, the balls are found to consist, below, of interlaced, repeatedly branched, rather irregular filaments, giving off, either at their sides or extremities, a short necklace consisting of from three to five joints, which are all more or less swollen, the terminal one being freqently rather obtusely apiculate. It is these terminal joints radiating in every direction which give the balls the rough appearance mentioned above. The basal joints are filled with a granular endochrome, the granules vanishing as the terminal joints are formed.

Unfortunately the full development of this destructive fungus has not yet been observed, which is no doubt capable of propagation, either from the oblong bodies or the deciduous joints of the balls. It is very probable that it is the spawn of some Agaric, which has spread from the *Sphagnum* about the roots of the Orchids to the leaves. I have seen an undescribed Agaric of the subgenus *Omphalia* on *Sphagnum* at Mr. Rucker's, and I am inclined to think that it is to this the mycelium belongs, but I have no proof to give that such is the case. It is undoubtedly of some importance to ascer-

tain this, and it is to be hoped that the keen eye of Mr. Pilcher will some day clear up the difficulty.

TAB. 1. Fig. *a*. Mycelium on leaf, nat. size.
b. Threads of mycelium, magnified, with conidia.
c. Inarticulate filaments described above, do.
d. One of the balls, do.
e. Structure of balls, highly magnified.

XXXVIII. On Branch Orchid-Pots.

By J. BATEMAN, Esq., M.A., F.H.S., F.R.S.

THERE are many Orchids (such as the more tender *Oncidia*) that can scarcely be induced to grow at all in baskets or pots, but which have been found to thrive if placed on a small block or

branch of hard wood, and suspended from the roof near the glass. But to this arrangement there are one or two drawbacks. In the first place, the block of wood is apt to decay; and when this takes

place the plant has of course to be shifted to another block, a change that can never be effected without a wholesale disturbance of the roots. Then again, especially if the temperature be humid, a minute kind of *Alga*, belonging apparently to the genus *Calothrix*, soon makes its appearance, which is excessively injurious to the aërial roots of tender Orchids, and which it is extremely difficult, I might almost say impossible, to keep in check. Under these circumstances, it occurred to me that nothing more was needed than to copy in hard-baked clay the sort of branch on which Orchids usually thrive, which copy would, at all events, have this advantage, that once seated upon it, they need never again be disturbed. I accordingly communicated my views to Messrs. Boone and Son (of Norton, near Burslem, Staffordshire), who had been in the habit of supplying me with garden-pots, and who speedily produced many very clever imitations of branches of wood (one of which is represented in the woodcut), and which seem to answer their purpose perfectly well*.

XXXIX. Notice of a curious Case of Lateral Fusion. By the Rev. M. J. Berkeley, M.A., F.L.S.

A curious Vegetable Marrow was produced at the Horticultural Society's Meeting, Tuesday, August 22, from the gardens at Chiswick, which deserves a short notice. It is well known that occasionally the tendrils of gourds bear fruit apparently from the fusion of an axillary bud with the tendril, a circumstance which, perhaps, may be illustrated by the fact that figs seem very frequently to be developed from a bud in the axil of the two stipules, one on either side. The fusion in the present case is with the branch itself, and must have taken place at a very early period; for though the female flower which produced the gourd must have been situated at the base of the branch with which it is confluent, it has become soldered with two or more flowers at the upper part of the branch so as to make an oblique scar running down from the apex of the fruit to the branch. It is to be observed, moreover, that the first male flower is axillary, whereas, in addition to the second axillary male flower, there is one in a line with it, fused below with the tendril, which is developed into a little leaf. The ribs of the branch above are very succulent, and perfectly united with the fruit.

* These blocks (which are of all sizes) may be had in the Arcades at South Kensington. They are not at all expensive.

XL. On Two Arads from the Society's Garden at Chiswick. By the Rev. M. J. Berkeley, M.A., F.L.S.

The two plants in question were brought from Brazil by Mr. Weir. Of one of these, several specimens have flowered either in the Society's Garden or in that of Mr. Wilson Saunders. The species is not new to science; but as there is some difference between Schott's analysis and my own, and as three different forms occur, it seems worthy of notice. Of the other, which appears to be undescribed, only a single specimen has flowered, the inflorescence of which is so curious that possibly, when other individuals flower it may not be found to be normal.

1. Dieffenbachia Weirii, n. s.

Leaves oblong, attenuated at the base, about twice as long as the petiole; lamina green, marked with elongated irregular paler spots; median nerve plane, longitudinally striate; petiole channelled above, sheathing at the base; common peduncle convex behind, plane above, costate; spathe elongated, sheathing, spotless; spadix 4 inches long; ovaria sessile, bilobed, rather rough; stigma orange; barren processes club-shaped, white, sometimes confluent with the ovaries; anthers peltate, with a dimple in the centre; secondary spathes numerous, seated behind the primary spadix, each furnished at the base with two opposite boat-shaped bracts, and developed within the preceding spathe.

The occurrence of numerous spadices within the primary spathe is very singular. The whole plant is extremely acrid.

2. Zomicarpa pythonia, Schott, Syn. p. 121, Gen. Aroidearum, tab. 23.

Arisæma pythonium, Blume.

Radical leaves simple, broadly sagittate or panduriform, mucronate, cordate at the base, with a short petiole; secondary leaves tripartite, the two lower segments with a more or less distinct lobe, upper leaves tripartite, the lower segments distinctly bipartite; segments varying much in outline, but more or less ovate and oblique; peduncle with one or two reddish dotted convolute mucronate sheaths at the base, 6 inches high: spathe cucullate, not in the least involute at the base, but exposing the ovaries, keeled; keel attenuated above into a mucro; margin slightly reflected; spadix not reaching much beyond the middle of the spathe, adnate below to about half of the part which is clothed with the anthers; ovaries 2–3; stigma orbicular, depressed in the centre, pink, with a yellow margin which at first looks furfuraceous from the abundant pollen; ovules 20, springing immediately from the basal surface, anatropous; anthers sessile, confined to one side of

the spadix; the abortive ovaries reduced to small angular prominences.

Two varieties occur—the one with broad obtuse leaflets, distinctly variegated, the other with lanceolate acute leaflets which are variegated, with the variegation on the midrib feathered.

XLI. On some Double Flowers of *Primula sinensis*. (In a Letter to the Rev. M. J. Berkeley.) By Dr. MAXWELL T. MASTERS.

MY DEAR SIR,—I have examined some twenty or more flowers of the Chinese Primrose to which you kindly drew my attention.

The structural arrangements of Primulaceæ are so remarkable that it behoves botanists to collect and observe any facts relating to them, so that we may arrive at the proper explanation of the morphology of the order.

In the flowers that I examined, there was nothing specially worthy of notice in the calyx: the number of its lobes was increased; and there were other minor deviations from the ordinary structure, which, however, do not call for comment.

The corolla was of the ordinary form, its tube traversed by ten vascular cords, and its limb divided into as many lobes, these latter again often split up into several secondary lobes.

Springing from the tube of the corolla, generally from about its centre, were a number of adventitious petals (very often five in number, sometimes more) disunited and placed in front of the normal petals, not alternate with them—in fact, in the usual position of the stamens. To the centre of the inner surface of these supernumerary petals perfect stamens were occasionally adherent. In some of the flowers there were, in addition to these, other rudimentary petaloid bodies, sometimes filiform, at other times tubular. In one or two instances the supernumerary petals, instead of being placed with their outer surface in front of the inner surface of the true petal, *dos à vis*  , were so placed that the inner (or upper) surface of one was placed in front of the corresponding surface of the other, *vis-à-vis*  . This arrangement, which occurs also in other double flowers, gives rise to a first impression that prolification, the formation of an adventitious bud either in the centre of the flower or in the axil of one of its lateral organs, is the cause of this appearance; a longitudinal section of the flower, however, soon dissipates that notion,

as no such bud is to be seen. On tracing the vascular cords up the tube of the corolla, they may be seen to divide, one division proceeding into the lobes of the primary petal, the other into the secondary petals; hence I should be inclined to attribute the formation of these latter organs (in these particular flowers) not to prolification, nor to substitution of petals for stamens (petalody), but to an exuberant growth of the primary petals, similar to what one not unfrequently sees in Cabbage-leaves, or Begonias, and such as I have seen in the Hazel and some other plants. The French botanists would attribute the formation to chorisis, a term which, in this case at least, would convey a false idea that the supernumerary organs were equivalent to so many laminæ split off from the original petals, instead of being excrescences, so to speak, from them. These adventitious petals might, at first sight, be supposed to represent the faucial scales of *Samolus*; but the latter alternate with the true petals and with stamens.

The stamens were, for the most part, absent from the flowers that I examined; but in one or two instances, as already mentioned, they were present in their ordinary guise, and were adherent to the front of the supernumerary petals.

The condition of the pistil was different in different flowers, but in all noteworthy. The simplest appearance that it presented was that of a foliaceous capsule open at the top, as in *Reseda*, and partially divided into its component carpellary leaves, the styles and stigmata being completely detached from one another. At the bottom stood up the usual free central placenta, studded over with ovules; these latter, however, were not confined to the placenta, but occurred on the inner surface of the carpellary leaves. In other cases the capsule was in form as just described, but, in place of being foliaceous, it was distintly petaloid, thus entirely resembling the corolla in all save the presence of ovules.

A third class of cases is more complex and difficult of explanation: within a foliaceous or petaloid pistil, such as those just alluded to, occurred a second pistil, sometimes closed, at other times open at the top—sometimes foliaceous, at other times petaloid,—in one flower adherent to the outer pistil, in another perfectly detached from it—now with ovules on its parietes, while in other cases those bodies were strictly confined to the usual free central placenta; this latter organ, again, was either partially adherent to the walls of the pistil or wholly detached from them.

The puzzle is, to explain the existence of this double pistillary series. The adventitious petals may be excrescences from the pri-

mary ones, or they may be petaloid substitutes for stamens: the facts will bear either interpretation; but the *pistillum in pistillo* is not so easily explained.

The difficulty arises in great measure from the impossibility, owing to the irregularities of size, adhesions, contortions, and displacement of the parts, of seeing precisely the position that these pistillary whorls occupy in reference to each other and to the other parts of the flower.

The simplest theory would be, that we have here merely a double carpellary whorl, a multiplication of the carpellary series in fact; and there is no reason, that I know of, to forbid such an hypothesis. Or it may be thought that the outer of the two capsules (when both are present) is the representative of a row of stamens; and I may here add that in these particular flowers I failed to detect any stamens, though in those blossoms where only a single carpellary series existed there were frequently one or more stamens.

Again, it may be considered that the innermost pistil is the result of median prolification; but this hypothesis involves too many assumptions to be readily accepted: thus, taking the cases where the outer of the two capsules was foliaceous, on the prolification theory this might represent either the true pistil of the primary flower or the calyx of the secondary one; and if the latter opinion were correct, we should have to assume the suppression of the corolla and stamens of the secondary flower and the production of the carpellary whorl only. This seems unlikely, the more so as no traces of the supposed suppressed organs exist.

In those instances, too, where the outer pistil is petaloid, on the prolification theory we should have to assume either that the calyx of the prolified flower was absent or that it was present in a petaloid form; in either case we should fail to account for the absence of stamens satisfactorily.

The prolification theory, then, seems objectionable from the number of pure assumptions that must be brought to support it, and also from the fact that there is little or no lengthening of the axis or thalamus of the flower, such as almost always exists to a greater or less extent in flowers subject to median prolification.

I am, dear Sir,
With much respect,
Faithfully yours,
MAXWELL T. MASTERS.

Fruit and Vegetable Committee.—March 20, 1866.—Mr. Tillyard, gardener to John Kelk, Esq., M.P., The Priory, Stanmore, exhibited the following varieties of *Grapes*:—Alicante (considered to be the Alicante of Speechly), Lady Downes, and Muscat of Alexandria. As they were in excellent condition and very fine specimens, being equally as good as fruit of the same varieties usually shown in the month of October, a Special Certificate was awarded to them.

April 3, 1866.—Mr. Balchin, Union Gardens, Dorking, exhibited a *Seedling Apple.* It was scarcely middle-sized, roundish at the base, and tapering slightly to the top, which was somewhat oblique and flattish, the fruit being higher on one side than on the other. Eye small, but open; stalk small; skin smooth, slightly streaked with red on a yellow ground. Flavour rich and very good. This Seedling Apple was named by the Committee *Balchin's Pearmain*, and a First-Class Certificate was awarded to it.

April 17, 1866.—Mr. Ruffett, gardener to the Viscountess Palmerston, Brockett Hall, exhibited the three following dishes of *Apples*:—Cox's Orange Pippin, Pine-apple Russet, and Scarlet Nonpareil, in excellent preservation, *Cox's Orange Pippin* particularly so, proving that this excellent variety may be kept for use from early autumn till late in spring. Mr. Ruffett stated that the specimens had been kept on an open wooden trellis in a low, lean-to, slate-roofed house, rather dark, through which air was constantly passing through ventilators in the bottom to an air-shaft in the roof; the temperature in the interior was kept cool, and as uniform as possible, so as not to produce condensation on the surface of the fruit. A Special Certificate was awarded.

George Blenkins, Esq., 99 Warwick Square, Pimlico, exhibited fruit of *Zizyphus vulgaris*, which is sold in Covent Garden under the name of "Japonicas." It was from a confection made of this fruit that the Jujubes of the shops were formerly prepared, and from which they received the name.

June 5, 1866.—Mr. Miller, gardener to the Earl of Craven, Coombe Abbey, Coventry, exhibited two *Queen Pine-Apples* weighing about 4 lb. 12 oz. each. They were exceedingly handsome and well-grown specimens, and were produced by plants of nineteen months' growth.

Mr. Bradley, gardener to Mrs. Norton, Elton Manor, Notts., exhibited a dish of *Sir Joseph Paxton Strawberry*, which were very handsome and well flavoured.

June 19, 1866.—Mr. Joseph Peake exhibited fruit of a *Granadilla* from Medeller, Antioquia, New Granada, stated to be the best of several sorts found there. The fruit was about 2 inches long, roundish oval, pulp greenish, sweet, and with a slight acidity.

July 3, 1866.—Mr. Turner, Royal Nurseries, Slough, exhibited a *Seedling Strawberry* named Dr. Hogg; it was raised by Mr. Bradley, gardener to Mrs. Norton, Elton Manor, Notts., the raiser of Oscar and Sir Joseph Paxton. It is of the British Queen class; but was stated to be a much better grower. Fruit large, ovate, cockscomb-shaped, or flattened in many cases towards the top. Calyx medium-sized, embracing the base of the fruit. Seeds moderately small, with polished intervals. Colour deep red, almost equally so to the point, where the British Queen has often the fault of being pale. The flavour was good, but not equal to the British Queen; it was, however, much better than many of the large new sorts. A First-Class Certificate was awarded.

Mr. Charles Oldham, Honorary Secretary to the Wrexham Horticultural Society, exhibited two *Seedling Strawberries*. One, named *Sir Watkin*, was medium-sized, ovate, and of a black or mulberry colour, like that of the black Rosebery; in flavour it was rather poor: the other, called Denbigh Seedling, had the appearance of a coarsely grown Keen's Seedling, not at all good.

July 17, 1866.—Mr. Backhouse, York, exhibited a dish of "*Goodwin's Hybrid*" *Strawberry*, raised by Mr. T. Goodwin, gardener to Miss Elizabeth Backhouse, Holgate House, from *Fragaria lucida*, crossed with pollen of the Elton Pine. The fruit was about the size of a Hautbois, the seeds rather deeply imbedded; flesh dark red next the outside, but whiter than strawberries usually are towards the centre, where there were several crack-like cavities. It did not possess sufficient merit to recommend it, but it was remarked that this singular hybrid might serve as a basis for future hybridization.

Messrs. Lee, Royal Vineyard Nurseries, Hammersmith, exhibited a plant in a pot of *Giant Orach*. It was of luxuriant growth, with thick, roundish, broadly ovate, leaves, and may be grown at any time of the year and be used as a Spinach, for which the Committee thought it a capital substitute. A First-Class Certificate was awarded.

August 7, 1866.—Mr. Carmichael, gardener to H. R. H. the Prince of Wales, Sandringham, exhibited a magnificent *Enville*

Pine-apple, weighing 7 lb. 12 oz. It was 20 inches in circumference and 12 inches in height, with a crown about 3 inches long; the fruit was very symmetrically grown and well coloured. A Special Certificate was awarded.

Mr. William Cox exhibited a *Seedling Black Grape*, raised at Madresfield Court, Great Malvern, Worcestershire, stated to be a cross between Black Alicante and Muscat of Alexandria. The bunch tapered like the Black Prince; the berries were black, oval, medium-sized; the flavour very sugary and rich.

Mr. Thomas Neale, gardener to R. A. Cartwright, Esq., Edgcote House, Banbury, exhibited twelve tubers of *Edgcote Kidney Potatoe*, the produce from a single root. This is a second early; the specimens were very clear and good, and, judging from the quantity shown, it is apparently a good cropper.

August 21, 1866.—Mr. Halliday, gardener to H. B. Walmsley, Esq., The Elms, Acton, exhibited a *Ripley Queen Pine-apple*. It weighed 6 lb. 6 oz., and was exceedingly well grown, well ripened, and of a beautiful colour; but it was almost crownless, and consequently had not so fine an appearance as it would have had with a crown of proportionately moderate size.

Mr. Bell, gardener to His Grace the Duke of Wellington, Strathfieldsaye, exhibited a fine specimen of the *Charlotte de Rothschild Pine-apple*, weighing 5¾ lb. Mr. Bell says that he can state from experience that this variety is a fast grower and fruits freely, and is also an excellent winter Pine; the fruit was cut, and proved to be of excellent quality. A Special Certificate was awarded. Mr. Bell also exhibited specimens of the *Anson Pine-apple*, an old variety with flattened pips like the Providence.

The Rev. A. Rawson, Bromley Common, exhibited fruit of the *Lawton Blackberry*. They were very handsome in appearance, but were scarcely sufficiently ripe. We learn from Mr. Rawson that the birds had destroyed all the finer specimens. It seems really worthy of cultivation.

Mr. Samuel James, gardener to the Earl of Dartmouth, Pateshall, near Wolverhampton, exhibited two *Seedling White Grapes* of tolerable merit; but the Committee were desirous of seeing them again before expressing any decided opinion on them.

September 4, 1866.—Mr. G. Craddock, gardener to Lord Willoughby de Broke, Compton Verney, Warwick, exhibited specimens of *Potatoes* of very excellent appearance, No. 1, No. 2, and No. 3. Mr. Craddock stated that they were very

productive, and finer and better than any other varieties he had seen.

Messrs. Veitch and Sons, Royal Exotic Nursery, Chelsea, exhibited the following *Collection of Onions*, as grown under their respective names in their trial ground:—Danvers's Yellow, White Globe, Strasburgh, James's Keeping, Brown Globe, Trebons, Reading, White Nocera, White Spanish, White Lisbon, Nuneham Park, Silver-skin, Welsh. The specimens were very fine and well grown; and altogether the collection was very interesting, and confirmed the conclusion which the Committee arrived at on their examination of the collection at Chiswick. A Special Certificate was awarded.

Mr. John Conning, gardener, Royston, exhibited fruit of a *Seedling Plum* called *Black Prince*, but the Committee did not consider it worthy of recommendation, being not much better than a common seedling muscle plum.

Mr. C. Dixon exhibited a *Melon* called *White Beechwood*; but it was not considered equal to the true Beechwood, which is green.

September 18, 1866.—Mr. Sifkin, Snaresbrook, exhibited a dish of *Seedling Peaches* from a tree growing as an open standard. The fruit bore considerable resemblance to the Rosanna; flesh yellow, melting; but the flavour not very rich.

Messrs. Cutbush and Sons, of Highgate, exhibited beautiful specimens of the *Nuneham Park Onion*, grown at various places, and, for comparison with it, the White Spanish or Reading, as it had been grown in the same gardens and under the same conditions. The specimens of Nuneham Park were very large and fine, while those of the White Spanish were much smaller than usual.

Messrs. Wrench and Sons, London Bridge, exhibited specimens of *Dwarf York* and *Little Pixie Cabbages* as grown on their trial ground at Norwood. The Dwarf York had the dark green fleshy foliage of the true Early York. The foliage of the Little Pixie was of a paler green, with less parenchyma, and ribs somewhat more prominent; it is quite distinct from the Early York. There were also from the same place specimens of *Santa Anna* and *St. George's Onions*, early bulbing varieties, the produce of seed from Madeira; but they have proved not to keep well. They also exhibited the *Red Italian* and *Rocco*, both from seed saved in the neighbourhood of Naples.

October 2, 1866.—Mr. Carr, gardener to P. L. Hinds, Esq.,

Byfleet Lodge, Surrey, exhibited fine fruit of the *Carica Papaya* in a ripe state, also a large fruit of *Passiflora quadrangularis.*

Mr. J. B. Whiting, the Gardens, Deepdene, Dorking, exhibited splendid specimens of the *White Spanish Onions* for comparison with the *Nuneham Park Onions*, which Messrs. Cutbush again exhibited. Mr. Drewitt, the Denbies, Dorking, also exhibited fine specimens of Nuneham Park Onions. All of them were well-grown samples. The White Spanish, from Mr. Whiting, were however the largest; but that was the only difference the Committee could detect after careful examination. They therefore decided that the Nuneham Park was not a distinct variety, but simply a well-selected stock of White Spanish.

Mr. Dean, Ealing, exhibited specimens of *Danvers's Yellow Onions,* which were remarkably fine.

Messrs. Veitch and Sons exhibited a collection of *Endives*, consisting of *Green Curled*, *Moss Curled*, *White Curled*,—and very fine specimens of the *Broad-leaved Batavian*, and of *Fraser's Improved Broad-leaved.* The latter was not so good as the former, which is the White-flowered Batavian ("the Scarole à fleur blanche" of the French) and the best variety of the Broad-leaved Endive, blanching very pure and white like ivory.

Messrs. Stewart and Mein, Kelso, exhibited the pickled pods of the Madras Radish and the Long-tailed Radish (*Raphanus caudatus*). The former were much preferred to the latter, being far more tender and crisp than those of *R. caudatus*, which were more tough and flaccid.

October 16, 1866.—Mr. Carr, gardener to P. L. Hinds, Esq., Byfleet Lodge, exhibited a fruit of *Passiflora laurifolia* or *Water-Lemon.* It was round, about 2 inches in diameter, very regularly formed, and of a beautiful pale orange colour; its pulp was of a semitransparent greenish colour, with a mawkish sweet flavour, not much relished. A First-Class Certificate was awarded to it, on account of its beautiful appearance, and its having been exhibited for the first time in this country.

Mr. Thomas Leslie, Stone House, St. Peters, Margate, exhibited two *Seedling Apples.* No. 1 was medium-sized, ovate, and of tolerably good quality. No. 2 was found to be rather acid.

Mr. H. W. Reynolds, Thame, Oxfordshire, also exhibited a *Seedling Apple.* It was about the size of a Nonsuch, roundish oblate, but scarcely so flat as the Nonsuch; skin smooth and streaked. It was thought to possess considerable merit; but the flavour was considered to be not sufficiently developed, and

therefore the Committee requested that it be sent in again in January.

Mr. Turner, Slough, exhibited a very fine dish of *British Queen Pears*. They were large, of a tapering oblong form; skin soft and smooth, covered with thin russet; flavour rich and excellent. Mr. Turner also exhibited a very good example of *Cox's Orange Pippin*.

November 6, 1866.—Mr. Henry Downing, gardener to Thomas Grissel, Esq., exhibited a collection of 12 sorts of *Apples*, consisting of very good specimens of the following sorts:—Gloria Mundi, Alexander, Wellington, Warner's King, Blenheim Orange, Alfriston, Braddick's Nonpareil, Coe's Golden Drop, Barcelona Pearmain, Court Pendu Plat, and one not known. A Special Certificate was awarded. Mr. Downing also exhibited Pomegranates; but they were not quite ripe.

Mr. John Cox, gardener to W. Wells, Esq., Redleaf, exhibited specimens of *Beurré Clairgeau Pear*. They were very large, upwards of 6 inches in length, and exceedingly handsome.

Mr. Forsyth, gardener to Baron L. de Rothschild, Gunnersbury Park, exhibited a splendid specimen of the *Charlotte de Rothschild Pine-apple*, weighing 9 lb., perfectly formed, and of a uniform rich yellow colour. It was awarded a Special Certificate. Mr. Forsyth also exhibited two very good specimens of the *Smooth-leaved Cayenne*, weighing 7 lb. each; and they also received a Special Certificate.

Mr. W. Melville, gardener to the Right Hon. the Earl of Rosebery, Dalmeny Park, exhibited a *Seedling Grape*, called the *Champion Frontignan*. The bunch was medium-sized and shouldered; the berries large, roundish, slightly ovate; skin of a brownish red colour; the flesh had a slight Muscat or Frontignan flavour. The Committee considered that it was scarcely equal to the Muscat Champion, which it somewhat resembled, and which was also raised by Mr. Melville some years ago.

G. F. Wilson, Esq., F.R.S., exhibited fine specimens of *Pears* from an orchard-house, consisting of the Triomphe de Jodoigne, the Beurré d'Anjou, and Chaumontel.

The Rev. G. Kemp, Sion College, exhibited bunches of the *Royal Muscadine Grape*, as specimens of outdoor cultivation in this unfavourable season. The bunches were as large as those generally produced on walls at Fontainebleau and Thoméry.

Mr. Taplin, gardener to his Grace the Duke of Devonshire, Chatsworth, exhibited specimens of the *Mango* grown at Chats-

worth. They were considered to be very good specimens of that fruit, similar to the Yellow Powis Mango fruited at Walcot Hall, and figured in the 'Horticultural Transactions,' 1826.

Messrs. Veitch and Sons exhibited a collection of *Beet*, accompanied by cooked specimens of each variety, for the Committee to taste. The collection consisted of the following varieties:—Veitch's Dwarf Red; Pine-apple; Nutting's Dwarf Dark; Cattell's Crimson; Dewar's Dwarf Red; Winton's Red, var. 2, var. 3; Silver or Seakail; and White Silesian,—amongst which a new sort, marked var. no. 2, was considered the best.

From the Garden of the Society, Chiswick, came specimens of *Doyenné du Comice Pear*, which the Committee considered to be one of the most delicious Pears of the season.

Nov. 20, 1866. — Mr. Ruffett, gardener to the Viscountess Palmerston, Brockett Hall, Herts, exhibited the following *collection of Apples*:—Cox's Orange Pippin, Sam Young, Margil, Court of Wick, Coe's Golden Drop, Braddick's Nonpareil, Ribston Pippin, Wyken Pippin, Fearn's Pippin. These were all first-rate sorts; the specimens of Sam Young were unusually large and fine, quite free from the defect of cracking, which this variety is very liable to. Cox's Orange Pippin was, as usual, very fine, and also Coe's Golden Drop and Fearn's Pippin. Mr. Ruffett also exhibited specimens of Chaumontel and Old Colmar Pears, both very good. A Special Certificate was awarded.

Mr. Cox, Redleaf, exhibited very beautiful specimens of *Golden Noble* and *Waltham Abbey Seedling Apples*, both first-rate kitchen Apples, and very distinct. Also specimens of *Chaumontel* and *Winter Nelis Pears*. The Chaumontel were considered richer and more juicy than those exhibited from Hertfordshire by Mr. Ruffett.

Mr. Earley, gardener to F. Pryor, Esq., Digswell, Herts, exhibited some very fine roots of *Salsafy* and *Scorzonera*. The Salsafy was from 12 to 15 inches in length, of a nice, regularly tapering form; the Scorzonera was also very good. A Special Certificate was awarded. Mr. Earley also exhibited very fine specimens of remarkably tall *Brussels Sprouts*, being upwards of 3 feet high, covered with sprouts from the ground to the top. A Special Certificate was awarded.

Messrs. Veitch and Sons exhibited the following *collection of Celery*:—Veitch's Silver White, Hood's Dwarf Red, Incomparable White, Solid Red, Paris Dwarf White, New Red, Seymour's White, Ivery's Nonsuch, Coles's Crystal White, Cole's Defiance

Red, all fairly-grown specimens. Ivery's Nonsuch was considered the best red, and the Incomparable the best white.

Floral Committee.—June 5.—Messrs. Veitch furnished a beautiful assemblage of fine plants, among which were some valuable Orchids. We may especially mention:—*Cattleya M'Morlandii*, a kind in the way of *Mossiæ*, having a large amount of orange in the lip; a singular *Lycopodium* from the Solomon Isles, with long stems clothed with Fir-like foliage, and divided at the top into many tails or rather branchlets; the handsome Bornean *Alocasia gigantea* with sagittate leaves flushed and veined with silver; *Gymnogramma Laucheana Thompsoni*, a tasselled gold Fern; *Maranta roseo-picta*, with deep-green shining leaves zoned with pink when young, and with white when old; various fine Japanese *Retinosporas*, especially *R. obtusa aurea* and *densa*; the Chilian *Athyrium latifolium*; a new *Coleus* called *Gibsonii*, from New Caledonia, with lively-green leaves blotched and veined with chocolate; and a variety of Pampas Grass with variegated leaves,—altogether a magnificent group, to which a special Certificate was deservedly awarded. From the Rev. T. Medland, Steyning Rectory, Sussex, came handsome cut specimens of *Paulovnia imperialis*. From Mr. Ball came several new Ferns, to which Certificates were awarded. Among them were:—*Nephrodium molle confluens*, *N. m. densum*, *N. m. ramosissimum*—remarkable tasselled varieties; *Athyrium proliferum*, an Indian species, proliferous at the point of the fronds; and *A. Filix-fœmina pulchrum*, a very pretty Lady-Fern. To the silver-leaved *Eranthemum argyroneurum*, a First-Class Certificate was awarded. The Garden of the Society contributed the pretty little *Oxalis rosea*, a charming pot-plant for greenhouse decoration.

With *Maranta roseo-picta*, Mr. Veitch sent *Maranta tubispatha*, which obtained a First-Class Certificate last year, but is mentioned here to identify it with *Calathea tubispatha*, Bot. Mag. tab. 5542. *Areca Verschaffelti* was worthy of especial notice for its truly triangular stem. This was sufficiently plain in the young plant exhibited; but it was peculiarly striking in an older specimen at Amsterdam last year, in which the lower leaves had fallen away. A *Cyrtanthus* was sent by Mr. Bull, which differed from the figure of *C. obliquus* in the 'Botanical Magazine' only in the smaller flowers and more obtuse leaves. It was considered a mere condition of that species. It has very much the habit of *Coburgia*, but wants the distinctive crown, besides the difference of locality.

A very interesting hybrid *Nepenthes*, with very dwarf habit, attracted much notice. It is one of Mr. Dominy's triumphs in hybridizing. An Amaranth, the seed of which was brought from the Polynesian Isles by Mr. J. Gould Veitch, bids fair, from its varied colour, narrow drooping leaves, and graceful habit, to be a great acquisition. Amongst Messrs. Osborn's interesting collection of cut specimens, were two about which information was required: the one was clearly *Cotoneaster rotundifolia*, which is even more hardy than *C. microphylla*, coming from a greater altitude; the other a peculiarly fine form of *Prunus lusitanica*, with large luxuriant foliage and flowers. It came originally from the Azores, but by no means, as was suggested, deserves to be separated even as a variety from the Portugal Laurel, which is especially luxuriant in the Canary Isles, as appears from specimens in the Kew Herbarium,

A curious species of *Dieffenbachia* came from Chiswick, which was just showing its spadix. It is one of Mr. Weir's plants, and is very remarkable from its producing many spathæ within the original one, and in consequence the spadix is much less intimately connected with the spatha than is usual in the genus; at least such is the case with the plant examined. A description of this plant appears in the present volume under the name of *D. Weirii*. It is probably like the congeneric Dumb Cane, very poisonous, even an examination of the contents of the spatha proving rather disagreeable.

Major Peach sent from Tockington, near Bristol, a specimen of the Silver Fir which was attacked by a parasitic fungus (*Peridermium elatinum*) which has the singular effect of not only deforming the foliage, but altering the character of the ramification. The part affected forms a shrubby mass, somewhat resembling mistletoe, perpendicular to the branch, and, when the young leaves are just bursting, reminding one of the golden branch of Virgil. The leaves, moreover, on it are deciduous. These curious masses are known in Germany, where they are not uncommon, under the name of Hexenbesen (Witches'-brooms).

Mr. Andrew Murray produced a large branch of Laurel which had been partially decorticated and had reproduced its bark. A somewhat similar case occurred some years since at King's Cliffe. An oak-tree by the roadside, which had repeatedly been defaced by idle boys, was at length purposely decorticated for two or three feet. The weather happened to be moist, and the denuded surface in consequence did not dry up, and a new growth commenced

from the medullary rays producing new wood and bark. The little patches gradually increased and would ultimately have become confluent; but a fresh attack on the tree, which, like Ovid's walnut, seemed the sport of every passer-by, destroyed it altogether.

Mr. Berkeley brought some cabbage-leaves from King's Cliffe, which were curiously proliferous from the midrib. In the 'Horticultural Transactions' of 1825, Monsieur DeCandolle, in a treatise on the genus *Brassica*, gives a figure of a cabbage-leaf in which trumpet-shaped processes were produced from the midrib, similar to the tubular leaves which are sometimes produced in cabbages, and perhaps more frequently in Spinach. In one part of the plate there is apparent something more than this, approaching the condition of the leaves laid before the Meeting. A series of laminæ are produced along the midrib, so that the upper surface of each lamina is always opposed to an upper surface, and the contrary, as if a number of leaves were laterally soldered together. This, however, is evidently not the case, because the vascular bundles of the lower side of the rib are neither deranged nor increased in number. Neither can there have been a fusion with axillary leaves; for though there is a series of vascular bundles on the upperside of the rib, which do not exist in the normal leaf, every part of the frond where there is a ramification of a nerve is equally disposed to become proliferous. A somewhat similar structure appears to take place normally on the underside of the leaves in *Xanthosoma appendiculatum*, and Dr. J. H. Carter has observed a similar appendage in an Indian species of *Ficus*. Besides the multiplied laminæ, there was an abundant development of tubular bodies, calling to mind very forcibly those which occur in double primroses, and extremely suggestive as to the real meaning of some phenomena in double flowers which cannot be explained on any theory of metamorphosis, or of the development of the axillary buds.

Mr. Bateman proceeded to make some remarks on some cut specimens of *Jonesia Asoca* received from Chatsworth, a plant which, with *Brownea grandiceps*, is only second in beauty to the *Amherstia*. As the petals are wholly deficient, it would, without the leaves, be scarcely recognized as leguminous; at the first glance it looks more like an *Ixora*. In some of the flowers it was observed that two ovaries were sometimes present, and occasionally the rudiment of a third. The sepals also were very variable in number, though perhaps more frequently four.

June 14.—This was a special show for prizes offered by Fellows, and, though not a gay exhibition, was one full of interest.

The President's prize for the best nine plants sent out in 1865, was won by Messrs. Veitch and Sons, whose collection contained:—a very handsome plant of *Verschaffeltia splendida*, a fine new Palm from the Seychelles; *Dieffenbachia Weirii*, one of the novelties introduced by the Society, remarkable for its prettily-marked leaves, mottled with pale yellow green on a dark ground; the very elegantly cut half-scandent Fern called *Gymnogramma flexuosa*; the distinct *Bertolonia pubescens*, a dwarf plant with deep-chocolate-coloured leaves edged with bright green; *Dracœna nigrescens*, of Australasian origin, with coloured leaves in the way of *ferrea*, but of a blackish purple hue; with some others of less importance. Mr. Bull had a collection of nearly equal merit, the most prominent plants in which were:—*Terminalia elegans*, a Madagascan shrub, with trifoliate leaves, the oblong-lanceolate leaflets of which have red midribs, and are elegantly veined; *Coprosma Baueriana*, a neat shrub, with obovate leaves clearly variegated with creamy white; *Saurauja sarapigiensis*, a large soft-leaved stove shrub; *Cycas plumosa*, having a single leaf, pinnated with numerous long filiform segments, &c.

The President's prize for the best nine plants sent out in 1864–65 brought three competitors. Mr. Williams had the best collection, which contained:—*Anthurium Scherzerianum*, with its rich scarlet spathes; *A. magnificum*, with fine heart-shaped velvety leaves, beautifully shaded and veined; *Calamus Impératrice Marie*, a very graceful small Palm; *Phalænopsis Lüddemanniania*; and the variegated forms of Pampas Grass and New Zealand Flax. In Messrs. Veitch's group was *Cypripedium Pearcei*, a new sedge-leaved species, with greenish tail-petaled flowers; and in that from Mr. Bull was the beautiful mottled-leaved *Maranta Van den Heckei*.

Very good collections of Officinal Plants, Exotic Ferns, and Bromeliads were shown in competition for the prizes respectively offered for these subjects; but the cut Roses were but of secondary merit. The ladies' indoor-plant prizes were well competed for, the winning subjects being Mrs. Dombrain's *Adiantum cuneatum*, grown in a sitting-room at Deal for two years; Mrs. Marshall's *Davallia canariensis*, grown in a sitting-room at Enfield for five years; and Miss Fisher's *Davallia canariensis*, grown in a sitting-room in the City Road for nine years. Many of the other subjects shown had apparently not been "grown" in a sitting-room,

but merely "kept" therein for about the prescribed minimum time (six weeks).

June 19.—At this meeting Messrs. Veitch and Sons exhibited the handsome golden-flowered Californian shrub called *Fremontia californica*, a plant of which, since dead, the first raised in this country, had been sold at a high price from the Society's garden during the evil days through which it had passed. The species had been reintroduced from the Rocky Mountains by Mr. Veitch, and found to be quite hardy against a wall at Coombe Wood, Surrey. Mr. Veitch also showed a beautiful new *Adiantum* (517), from Peru, having stiff bipinnate fronds, the younger ones red, beautifully contrasting with the green of those of more mature age, together with *Gloxinia Prince Teck*, a handsome variety. Mr. Bull exhibited *Athyrium costale dissectum* (a pretty bipinnate Indian Fern, with finely cut segments), and *Ophiopogon spicatum argenteo-marginatum*, having the leaves edged with white. Messrs. Osborn and Son produced good samples of *Orchis maculata superba* (rather the rare *O. latifolia*, according to Mr. Syme), a plant found in Ayrshire, and producing long dense spikes of handsomely spotted purple flowers. Along with this, Messrs. Osborn had the crested variety of *Osmunda*, called *O. regalis cristata*. From Mr. Rucker's garden came some interesting Orchids, and among them three fine varieties of *Cattleya labiata*:—*C. Warneri*, with a very rich purple and yellow lip; *C. Ruckeri*, with deep rosy sepals and petals, and a very dark lip wholly rose-colour; and *C. Pilcheri*, a paler sort, with a pale lip marked by a wedge-shaped blotch of purple. *Aërides testaceum*, a small-flowered species, with buff sepals and rosy lip, came from the same garden.

The principal display of seedling Pelargoniums took place on this occasion, Mr. Turner being the chief exhibitor. Perfection, (a rosy-pink, with white eye), Archbishop (a deep-rose, with black tip and white eye), and Milton (a very large rose, with spotted and veined lower petals, and dark spot with rosy margin to the upper petals) were considered the best. Beauty of Windsor, a very bright sort, with an orange dash over the rose tint, was approved for its colour, as also was Negress, with an intense dark blotch, and altogether very deeply coloured in a novel manner. Of the Zonal race, Madame Werle (a smooth white, with rosy eye) and Imperial (a finely formed bright scarlet), both from Mr. Salter, were much approved; while Lucy (a free-blooming bright scarlet, with good trusses and marbled leaf), Glorious (a rich scarlet), and Vandyke (with a yellowish leaf and dark bronzy zone,

and good salmon-coloured flowers), all from Messrs. F. and A. Smith, were also selected for reward. Messrs. E. G. Henderson and Son sent Pink Nosegay (with fine heads of pink flowers) and Gloire de Nancy (a deep cherry scarlet, and the best of the double-flowered sorts yet produced). A tasselled variety of *Adiantum* came from Mr. Williams, who also showed *Calamus Impératrice Marie.*

June 28.—Considering the unfavourable season, the show of Roses to which this meeting was devoted was tolerably good as to the quality of the blooms. A very large number of flowers was exhibited, the competition being between the principal southern growers in the amateur and nurserymen's classes. From among the many varieties produced, the following may be mentioned as being particularly fine:—Olivier Delhomme, crimson; Madame William Paul, purplish crimson; the glorious yellow Tea-Rose, Maréchal Niel; John Hopper, a variety which has been shown in better condition than usual this season; Princess Mary of Cambridge, pink, with a paler shade towards the extremities of the petals; Xavier Olibo, a new deep-velvety-shaded crimson, beautiful when about half-blown; Madame Boll, rose; Gloire de Santenay, rosy crimson; Rushton Radclyffe, a useful crimson kind; Prince de Porcia, crimson scarlet; Souvenir d'Elise, large and beautiful; Madame de Canrobert, blush; Comtesse de Chabrillant, large and fine; Madame Chas. Wood, bright crimson scarlet; Duc de Rohan, shaded rosy crimson; Devoniensis, in charming condition; Madame Victor Verdier, excellent; Marguerite de St. Amand, not unlike Princess Mary of Cambridge in colour; *Centifolia rosea*, rose, shading off to lilac; Madame Sertot, white; François Lacharme, bright rosy crimson; Triomphe de Rennes, yellow, beautiful when nearly half-blown; Baron A. de Rothschild, brilliant crimson scarlet; Pierre Notting, beautiful violet, shaded purplish crimson; Madlle. Bonnaire, white, tinged in the centre with pink; Duchesse de Caylus, bright crimson, quite a first-class kind; Virginal, white, with a slight tinge of pink; Madame Clémence Joigneaux, violet, shaded rose; Beauty of Waltham, bright rosy crimson; *Alba rosa*, one of the most beautiful of light-coloured Teas; and L'Enfant Trouvé, one of the best of the pale yellow Teas.

The best of the new Roses were—Charles Rouillard, lilac, with rosy centre; Alfred Colomb, large and full, bright cherry; Madame Fillion, light pink, with inner shade of rose, very double; Marguérite de St. Amand, a large silvery pink; Xavier Olibo,

deep velvety crimson; and Maréchal Niel, the best yellow Tea-Rose in cultivation.

July 3.—A variety of interesting plants was on this occasion shown by Messrs. Veitch and Sons, to whom no fewer than eight First-Class Certificates were given. *Lomaria ciliata*, one of these certificated subjects, is an elegant slender Tree Fern from New Caledonia, and is remarkable for the long spiny teeth which fringe the segments of its sterile fronds. With this were:—*Lomaria dura*, a leathery but graceful-habited Chatham-Island Fern; *Davallia alpina* and *D. parvula*, two little gems amongst hothouse creeping Ferns; *Nepenthes lanata*, a rare and valuable Pitcher plant; *Dipladenia amabilis*, a new and improved variety of this grand genus of stove-creepers, raised between *D. crassinoda*, and *D. splendens*, and proving superior to either; and *Acalypha tricolor*, a New Hebrides plant, variegated in quite a novel way, the leaves being flushed with a kind of coppery hue, and here and there splashed and streaked with clear orange red. This appears to be one of the numerous varieties of *A. hispida*, Burm. Messrs. Veitch also showed a pretty little creeping slender-stemmed *Nierembergia*, from Peru, with lilac flowers remarkable for the long slender tube, which was subsequently named *N. Veitchii*. The *Dipladenia* just mentioned was also sent, in the form of a magnificent specimen, by Messrs. Backhouse and Son, by whom the plant has been introduced to cultivation. Pelargonium Nimrod, a peculiar orange-scarlet variety of the zonal series, from Mr. Wm. Paul, was considered highly meritorious. Of the Tricolor zonate Pelargoniums, Mr. Watson showed two good and distinct forms, namely Mrs. Dix, with scarlet, and Miss Watson, with salmon-coloured flowers; and Mr. Bartleman showed a Nosegay Pelargonium called King of Nosegays, a very fine scarlet-flowered sort. A new *Caladium*, called Napoleon III., was sent by Messrs. E. G. Henderson and Son; it has the leaves prettily veined and stained with red. Mr. Brewer, gardener to J. Terry, Esq., Fulham, produced a plant of *Lilium auratum*, remarkable for the close manner in which the fine head of flowers was packed.

July 17.—Conspicuous groups of interesting plants were sent to this meeting by Mr. W. Bull, and by Messrs. Veitch and Sons. Among those from the former were the following:—fine specimens of a plant called *Amorphophallus grandis*, each with a spreading much-divided leaf on a mottled stalk some 5 feet in height; the true *Latania rubra*, a red-stalked Fan-Palm, from Madagascar; the

chocolate-coloured *Echeveria atropurpurea* with lingulate acute leaves of a dark brownish red; the beautiful little *Pandanus ornatus*; the variegated variety of *Selaginella Martensii*; *Fittonia argyroneura*, the counterpart of the plant known as *Gymnostachyum Verschaffeltii* (properly also a *Fittonia*), but with the bright green leaves very distinctly white-veined; the handsome *Maranta roseo-picta*; *Bertolonia margaritacea* with leaves ornamented with small round white spots; the red-veined *Terminalia elegans*; the singular-looking *Urospatha splendens*; *Cycas Riuminiana*, and others. Messrs. Veitch contributed the white-blossomed *Nierembergia rivularis*, a low-growing free-flowering plant, emitting roots at every node, by means of which the plant spreads out into large patches, and may be increased indefinitely. Messrs. Veitch further showed:—two of their beautiful Hybrid Rhododendrons, the rosy-pink-blossomed Princess Royal, and the pretty blush-flowered variety called Princess Alexandra; the white-blossomed *Lapageria*; an *Aphelandra* from Bolivia, with large handsome leaves conspicuously veined with yellow; a *Nepenthes*, with pitchers beautifully mottled with reddish brown; the fine-leaved *Maranta Veitchii*; the elegant Chilian fern *Lomaria Lechlerii*, and a *Polystichum* from the same country; and, lastly, *Æschynanthus Lobbianus*, one of a group of plants of great beauty but now seldom seen: it has bright scarlet blossoms issuing from chocolate-coloured sheaths.

From Messrs. E. G. Henderson and Son came a hybrid *Pelargonium* named *grande odoratum*, with scented leaves, and flowers greatly superior to those usually found on the fragrant-leaved section of this genus. In reference to this, the Chairman (Mr. W. W. Saunders) remarked that, as a cultivator of sweet-leaved Pelargoniums for many years, he was pleased to see the change in question; it had always been a matter of regret with him that the beautiful blossoms of our ordinary show Pelargoniums had not been associated with sweet-scented foliage and graceful habit, and now he thought he saw in the plant in question the beginning of a race of Pelargoniums which would prove to be great acquisitions. The variety had oak-leaved foliage, and large rosy-lilac white-eyed flowers. Mr. Stanton, gardener to J. Bateman, Esq., sent a cut specimen of *Grammatophyllum Ellisii*, in the shape of a heavy drooping raceme with green bracts, and greenish glossy flowers barred with brown. This fine species was discovered in Madagascar by the Rev. W. Ellis, and was twice sent home by him, the first importation having died. The second importation

furnished the specimen shown on this occasion. Mr. Bateman's flowering spike was accompanied by a growing plant from Mr. Veitch's collection. An *Æchmea* shown by W. Wilson Saunders, Esq., having whitish flowers, approached nearly to *Æ. pyramidalis*, of which it was possibly a variety.

Cassia floribunda, Cavanilles, a species much used as a summer plant in Paris, but requiring in winter the protection of the stove, was sent from the Garden at Chiswick. It was introduced from New Spain in 1818, and is known by several names, as *C. brasiliensis, grandiflora, elegans, buonarotiensis.*

July 21.—At this meeting the chief feature consisted of Mr. W. Chater's Hollyhocks. The more striking varieties in this collection were the following:—deep maroon, *Black Knight*; maroon, *Othello*; crimson, *Warrior*, *Crimson King*, *Rev. E. Hawke*; carmine, *Royal Scarlet*; rose, *Lady Palmerston*, *Autumn Queen*, *Erebus*; purple-rose, *Competitor*; pink, *Wellingham Defiance*, *Countess Russell*; lilac, *Advancer*, *argentea* (very pale); buff, *Fearless Improved*, *Hercules*; salmon, *Stanstead Rival*, *Chairman* (deeper); yellow, *Miss Lizzie King Improved*; white, *Cygnet.*

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