

be optional; but no one should be permitted to offer himself unless he had already received a certificate of having passed. As this would be one of great importance it ought not to be accessible to men under the age of 25. It should consist—1, of *Vegetable physiology* in its relation to the functions of plants; 2, of *Geography*, so far as the native countries of cultivated plants and the climate; 3, of which they are naturally exposed are concerned; 4, of *Climate*, that is to say of the influence exercised upon plants by temperature, moisture, &c. These three subjects might be taken by the Society of Arts.

LEMAYE further proposes a *Psychological Examination*, for the purpose of ascertaining the knowledge of various kinds of fruit, which he thinks Mr. Hoos as Secretary of the Psychological Committee might be induced by the Horticultural Society to undertake. And to all these he would add so much of *Mathematics* as are required for understanding the first book of Euclid; but he would allow any candidate to decline this subject without prejudice.

Such are LEMAYE'S proposals, not put altogether in his own language, which required condensation and arrangement, but expressed in a methodical way. We cannot say that we wholly concur in every part of the scheme, but we regard it as a good basis, upon which something valuable may be built, and experienced gardeners will take it sociably into consideration and point out how it may be improved.

THE EDUCATION OF GARDENERS.

The following scheme for entering to young men learning to be gardeners an economical education better suited to their wants than they can now obtain is submitted to the consideration of those who have to guide their course, whether as friends, guardians, or parents—

I.—*PRIMUM EXAMINATION.*

(To be passed at any time between the ages of 20 and 21.)

- 1. Writing
- 2. Spelling
- 3. Arithmetic, including book-keeping and timber measuring
- 4. Land measuring

Local Institutions, or Clergy.

II.—*SECUNDUM EXAMINATION.*

(To be passed between the ages of 21 and 22.)

- 5. Practical Skill in cultivation
- 6. Pruning, Staking and training plants at sight

Some 'first-class' gardeners.

III.—*EXAMINATION FOR HONOURS.*

(To be passed between the ages of 22 and 23.)

- 7. Vegetable Physiology, in its relation to cultivation
- 8. Geography, so far as it relates to vegetation
- 9. Climate, in its relation to vegetation
- 11. Mathematics (optional), not to go beyond the first book of Euclid
- 10. Penology, naming fruits at sight

Secretary of the Floral Committee of the Hort. Society of Arts.
Do.
Do.
Do.
Secretary of the Psychological Committee of the Horticultural Society of Arts.

Layover.

FERTILISATION OF BRITISH ORCHIDS BY INSECT AGENCY.

I SHOULD be extremely much obliged to any person living, where the Bee or Fly Orchid is tolerably common, who will spare the kindness to make a few simple observations on their manner of fertilising them. To render the subject clear to those who know nothing of botany, I must briefly describe what takes place in our common British Orchids. The pollen-grains form two pear-shaped masses; each bears on a foot-stalk, with a sticky gland at the end. The pollen-masses are hidden in the stigmatic opening in front. When an insect visits a flower, it almost necessarily, owing to the position of the parts, uncovers and touches the sticky glands. These firmly adhere to the head or body of the insect, and thus the pollen-masses are drawn out of their pouches, are dragged over the broad stigmatic surface, and the plant is fertilised. So beautifully are the relative positions of adhesive organs of the gland, and of the grains of pollen to each other and to the stigmatic surface naturally adapted, that an insect with an adherent pollen-mass will drag it over the stigmata of several flowers, and leave granules of pollen on each. The contrivance by which the sticky glands are prevented from drying, and so kept always viscid and ready for action, is in the two species which bear on the stigmatic surface a hemispherical cap, full of liquid, and formed of a gelatinous substance, that the silt projecting over the gateway into the nectary is ruptured transversely and depressed by the slightest touch; and thus the glands, sticky and fresh out of their bath, immediately and automatically close up, so that the pollen-mass on the body which has just ruptured the silt is certain that with next of some orchid's visits are absolutely necessary for their fertilisation.

Thus, without their agency, the pollen-masses are seen to remain as they are within their pouches. I have proved this in the case of *Orchis*, by covering by covering up plants under a bell-glass, leaving other adjoining plants uncovered; in the latter I found every morning, as the flowers became fully expanded, some of the pollen-masses removed, whereas in the plants under the glass all the pollen-masses remained undisturbed in their pouches.

Robert Brown, however, has remarked that the fact of all the orchids in a dense sylvan of certain Orchids producing seed seems hardly reconcilable with their fertilisation having been accidentally effected by insects. But I could give many facts showing how effectively insects do their work; two cases will here suffice; in a case of *Orchis* which I saw with 54 flowers open, the 12 upper ones, which were all removed, had on each two pollen-masses, and, as often, or even oftener, I found flowers with the pollen-masses removed, but with no pollen on their stigmata. These facts clearly show that each flower is often, or even generally, fertilised by the pollen brought by insects from another flower or from some other plant. After observing one *Orchis* during many years, I have never seen a bee or any other diurnal insect (excepting only a butterfly) visit them; therefore I have no doubt that swells are the priests who perform the marriage ceremony. The structure, indeed, of some *Orchids* leads to this same conclusion; for an insect without a very long and extensive proboscis could possibly reach the nectary at the bottom of the tube of a narrow *Orchis*, such as the Butterfly-*Orchis*; and, as this insect has occasionally captured moths with pollen-masses adhering to them. If any entomologist reads this, and can remember positively having caught a moth thus furnished, I hope he will give its name, and describe as exactly as he can the part of the moth's body the sticky gland adhered to.

We may now turn to the genus *Ophrys*; in the Fly *Orchis* (*Ophrys sphegodes*), the pollen-masses, furnished with sticky glands, do not naturally fall out of their pouches, nor can they be shaken out; so that insect-agency is necessary, as with the species of the other genera, for their removal. But insects here do their work far less effectually than in the case of *Orchis*; during several years, previously to 1858, I have examined of the state of the pollen-masses in well-grown flowers of those plants which I examined, and out of 102 flowers I found either one or both pollen-masses removed in 13 other ones. But in 1858 I found 57 flowers and 29 flowers had one or both pollen-masses removed; and as all the remaining 27 flowers were the upper and younger flowers, they probably would subsequently have had most of their pollen-masses removed, and thus have been fertilised. I should much like to hear how the case stands with the Fly *Orchis* in other districts; for it seems a strange fact that a plant which grows pretty well, as it does in this part of Kent, and yet during several years seldom be fertilised.

When we come to the Bee *Orchis* (*Ophrys sphegodes*), which presents a very different case; the pollen-masses are furnished with sticky glands, but differently from in all the foregoing *Orchids*; they naturally fall out of their pouches, and from being of the proper length, though still retained behind the gland, they fall on the stigmatic surface, and the plant is thus self-fertilised. During several years I have examined many flowers, and never in a single instance found even one of the pollen-masses carried away by an insect; and as the flower's own pollen-masses fall to fall the stigmata are never left unfertilised. I believe that the visits of insects would be injurious to the fertilisation of this *Orchis*; and rather anxiously imagined that the flower resembled a bee in their diller out of the pollen-masses of this *Orchis* is a very curious contrivance for its self-fertilisation; and as my own experience goes, in other British *Orchids* (infringe, for I have always found this to be the case); nevertheless a long course of observation has made me not greatly doubt whether the flowers of any kind of plant are for a perpetuity of generations fertilised by their own pollen. And what are we to say with respect to sticky glands of the Bee *Orchis*, the use and efficiency of which goes, in other British *Orchids*, are so manifest? Are we to conclude that this species is provided with these organs for no use? I cannot think so; but would rather infer that, during some years or in some other districts, insects do visit the Bee *Orchis* and occasionally transport pollen from one to another, and thus give it the advantage of an occasional cross. We have seen that the Fly *Orchis* is not in this part of the country by any means so frequently often visited by insects, though the visits of insects are indispensable to its fertilisation. So with the Bee *Orchis*, though its self-fertilisation is specially provided for, it may not exist here under the most favourable circumstances; it may be visited by insects, and in this case, as its pollen-masses are furnished with sticky glands, it would almost certainly receive the benefit of an occasional cross impregnation. It is the curious apparent contradiction in the structure of the Bee *Orchis*, which is to carry the sticky glands, being adapted for fertilisation by insect agency—another part, namely the natural falling out of the pollen-masses, being adapted for self-fertilisation without insect agency—which makes the confusion of a hour what happens to the pollen-masses of the *Orchis* in other districts or parts of England. I should be extremely much obliged to any person who will take the trouble to observe this point and to communicate the result to the *Gardener's Chronicle* or to Mr. Charles Darwin, Down, Bromley, Kent.

and in this case, as its pollen-masses are furnished with sticky glands, it would almost certainly receive the benefit of an occasional cross impregnation. It is the curious apparent contradiction in the structure of the Bee *Orchis*, which is to carry the sticky glands, being adapted for fertilisation by insect agency—another part, namely the natural falling out of the pollen-masses, being adapted for self-fertilisation without insect agency—which makes the confusion of a hour what happens to the pollen-masses of the *Orchis* in other districts or parts of England. I should be extremely much obliged to any person who will take the trouble to observe this point and to communicate the result to the *Gardener's Chronicle* or to Mr. Charles Darwin, Down, Bromley, Kent.

THE CROWN ESTATE OF CHOPWELL WOOD.

I SAW a statement in a public paper the other day showing the income and expenditure of the Crown estate of Chopwell Woods, in the county of Durham, from May 1858 to May 1859; and as it was given in such a way as to bring out the actual result of the system of management which has been pursued, compared with that which would have been the case had it been detailed in the thirty-third volume of the report of H.M. Woods and Forests, bearing date November 21, 1852, I think it right, in justice to both the Right Hon. T. Kennedy and myself, to refer very shortly to the results as now brought out.

In December 1851 Mr. Kennedy, who was then Secretary of the office of H.M. Woods and Forests, requested me to take charge of the management of the plantation at Chopwell, and to report to him my opinion in regard to them; and this I did in a report to him dated December 31 of the year last named. The substance of my recommendations in regard to this property of the Crown may be summed up thus:—“Seeing that the existing stock of wood on these lands, to the extent of 579 acres, was in a very unhealthy state, in consequence of past neglect, that the present now produce more than one-eighth of the value it would have done had it been in time attended to and well managed, I would strongly advise to have the crop on the extent above specified entirely cut down, and to plant the same with a new and more properly replanted with Larch, which I think it is well adapted.” I stated in my report that “the most valuable of the crop on the extent above to be cleared was 11,138ft., and that although it should be allowed to stand for other 20 years it could not at the end of that period be worth more than 15,100ft., while if it were now cut, and the property replanted immediately after, there would, under the best management, exist upon the same land in 20 years after the termination of planting, a crop of Larch worth at least 17,000ft.”

After a great deal of discussion with the Treasury in respect to my recommendations for the improvement of this woodland property of the Crown, Mr. Kennedy was authorized to put them in operation and to carry them out as far as the management of the estate; the result is that 15,079ft. of the wood, as estimated by the sales of the wood upon the 779 acres recommended to be cleared, which is 394ft. more than my valuation of it at the time. This difference is accounted for from the facts that in 1851, when I valued the crop in these woods, the price of such small trees as it consisted of was very low, and that in about one year afterwards it rose nearly 20 per cent. As to the Larch, however, the result is doubtless satisfactory to all parties.

With regard to the expenditure, I estimated the cost of clearing, draining, and replanting at 4765l. 14s. in all, while the actual result is an expenditure of 4702l. 6s. This, then, must also be considered satisfactory, and I am glad to see that the highly judicious and successful management of the operations he has now completed for the improvement of the Chopwell Woods; that Mr. Kennedy, in appointing him to the charge, put the right man in the right place; and that if he (Mr. Kennedy) were retained in the office of Woods, the improvements he has effected would be of great benefit to the other woodlands of the Crown. I am, therefore, glad to hear that he has been equally so satisfactorily carried out.

With regard to the crop of Larch which has been planted on the 779 acres which were cleared at Chopwell, I may only remark that it is in the most promising condition possible, and gives evidence that the land is now well stocked with trees to even more than the value which I anticipated, and which I stated in my report on the subject. In proof that the crop is making satisfactory progress, I may only state that although the oldest portion of it is only six years planted, thousands of the trees are already upwards of 25 feet tall. This extraordinary result is no more than I expected when I recommended the planting of this estate with Larch, and goes to prove the wisdom of the management through and well-conducted system of drainage in the clearing of healthy Larch plantations.

Mr. Clutton, however, did not anticipate such a state of things in regard to the clearing and replanting of the estate of Chopwell, as he states in his report on it at page 215 of the volume referred to above, “I would not advise the clearing and replanting of the ground; if it is only partially cleared and replanted, the shelter of the remains of the present crop would be found highly useful.” He does not state any exact drainage, and at page 219 he seems to infer that it