

## THE FERTILISATION OF PLANTS.

The following is an extended notice of the paper upon the "Fertilisation of Plants," read by the Rev. George Henslow, M.A., F.L.S., at the last meeting of the Watford Natural History Society and Hertfordshire Field Club:—In his opening remarks, Mr. Henslow said that he believed that this Society had a very laudable custom of raising a discussion after a lecture, and he should be very happy if any ladies or gentlemen would be good enough to criticise some of his remarks. What he proposed to do was to give some short account of the new work by Mr. Darwin, on "The Effect of Cross and Self-fertilisation in the Vegetable Kingdom." They were all doubtless aware that whatever he undertook to do he did it thoroughly, and this book, which came out last January, contained the observations he had been collecting from his experiments for eleven years, and in fact, a good deal longer than that. It was one mass of observations—a book that would take months to digest thoroughly. Notwithstanding the extraordinary conclusions come to, they were most satisfactory, and no one could gainsay them. On one point, however, he thought Mr. Darwin had drawn a wrong conclusion, and he should comment upon that. His first idea was to make that the subject of the lecture—"The self-fertilisation of plants," but he would take the whole subject and then put before them what he thought was Mr. Darwin's mistake. It was just 200 years ago that Sir Thomas Millington first detected the use of the pollen for the fertilisation of the stigma. The idea very soon followed that flowers were adapted to secure their own seeds by the pollen falling on the stigma. This, however, was not a universal fact, as was instanced by the case of the common Crocus. From the flowers of cucumbers, melons, and different trees, such as the willow, it was clear there was some other law in operation, and Sprengel, a German, in 1829 wrote a very interesting book, in which he showed that in a great many plants it was necessary for insects to carry the pollen from one to the other. They had to thank Mr. Darwin for bringing up and establishing as a broad general principle the necessity for insects to visit conspicuous flowers to carry the pollen. The way this was done in the case of the bee and the Crocus was here exemplified. Inter-crossing then began to be looked upon to some extent as necessary; it was a sort of general surmise that the flower was benefited if the pollen came from any other flowers than its own, but the exact value was not known. Mr. Darwin had now given, the exact value of three kinds of crossing. Starting from this point, there were four kinds of combination. The first was the pollen of flowers falling on its own stigma, which was self-fertilisation, either artificial or natural. The next was crossing flowers on the same plant. The next crossing the same sort of flowers in the same garden, from the same ancestor, and of close kinship. This Mr. Darwin called inter-crossing. Then there was crossing plants from distinct stocks, one, say, growing in Mr. Darwin's garden, and the other brought from Colchester or elsewhere. Mr. Darwin went through an elaborate series of experiments on 54 species of 30 distinct natural orders. The first experiment he attempted he carried out more fully than all the others. The flower was the *Carduus marianus*. He cultivated it for ten years, and his method was to fertilize the flowers artificially with its own pollen, and collect the seeds, which he called fertilised seed. On the other hand he took the flowers out of his own garden and crossed another flower, and called the seed obtained from it inter-crossed seed. Then he allowed them to germinate, and as soon as he got flowers exactly the same height, he planted them on opposite sides of a pot, the mould and moisture being the same, and the plant subject to the same conditions. When they were full grown he took the heights in inches, and made the height the standard of measurement. The results he obtained during the ten years showed that the inter-crossing did a great deal of good, the plants being higher than the self-fertilised. By grouping the years in threes, it was shown that the inter-crossing was beneficial for the first three years, but as time went on the benefit died out, and the plants became approximated to the self-fertilised. There was the very same result when the fertility was taken—the average number of seeds developed in the capsule. When he first cultivated the plants there was immense variety in the colours of the flowers; but as years went on the colours got less variable, the inter-crossed gradually assumed one and the same colour, but the self-fertilised continued of a deep rich purple, without any change. This brought out an important horticultural fact—that if a gardener wished to keep any particular strain he must be very particular not to cross it with other plants, but either propagate it by slips and bulbs or self-fertilise it. It seemed to fix the colour; but, when crossed, the colour was liable to be broken. The same facts were also shown by another method of considering the matter. Mr. Darwin, unfortunately, had not gone very fully into the crossing of flowers from the same plant, but the result seemed to be that it was better to self-fertilise the flower than to cross it from the same plant. The weight of the seeds also showed the same result, which was different from that anticipated—botanists having taken it for granted that it was better to cross the plants. All the plants which received any benefit were naturally self-sterile plants. The benefit derived from the introduction of new stock was very great indeed, whether in height, weight, or fertility; but there were exceptions. To sum up the results, it was found that the experiments established these important facts. Introducing a new stock benefited in every way—the plants grew higher, the leaves were larger and greener, the plants more bushy, and produced a greater profusion of flowers, the flowers being subject to a greater variation in colour. Then came self-fertilisation, and that was the place where he joined issue with Mr. Darwin. Throughout the whole of his book Mr. Darwin used the phrase "evil effects of" in regard to self-fertilisation. Of course he had proved the vast benefits of crossing; but to say that the opposite process was injurious, he thought, was misleading, because when they read of injurious effects they considered it to mean some unhealthiness. Individual cases did occur where it was very great, but to lay it down as a broad general principle he thought was misleading. There were only two reliable cases given, the common Pansy and Sweet Pea. These cases the lecturer stated and enlarged upon, and then passed on to give the grounds for believing in the benefit of self-fertilisation. They were 1. The majority of flowering plants are self-fertile. Mr. Darwin's book brought that out more than he suspected it would. 2. Very few are known to be physiologically self-sterile. It was a remarkable fact that some plants were in this condition, but put the pollen on another flower and it was useful. 3. Many are morphologically self-sterile. That meant that the pollen of a flower could not reach its own stamen until artificially put there, but it is then effective. Many of the Orchids were so. 4. Self-sterile plants may become self-fertile by (1) the withering of the corolla, (2) by its excision, (3) by loss of colour, (4) closing, (5) not opening, (6) absence of insects, (7) reduction of temperature, (8) transportation. 5. Highly self-fertile forms may arise under cultivation. 6. Special adaptations occur for self-fertilisations. 7. Inconspicuous flowers are highly self-fertile. 8. Cleistogamous flowers are always self-fertilised. 9. Conservation of energy in reduction of pollen. 10. Relative fertility may equal or surpass that of crossed plants. 11. It does not decrease in successive generations. 12. But it may increase. 13. Free from competition, self-fertilised plants equal the inter-crossed—first, as seedlings; second planted in open ground. 14. They may gain no benefit from a cross from the same or a different stock. 15. They are as healthy as the inter-crossed. 16. They may be much more productive than flowers dependant upon insects. 17. Naturalised abroad they gain great vigour, and 18, are the fittest to survive in the struggle for life.

On the motion of the President a unanimous vote of thanks was passed to Mr. Henslow for his interesting and highly instructive lecture, and some remarks were made and questions asked by the President, Mr. A. Cottam, Mr. W. L. Smith, &c.