ON THE

FERTILISATION OF ORCHIDS

BY

INSECTS,

&c. &c.

INTRODUCTION.

The object of the following work is to show that the contrivances by which Orchids are fertilised, are as varied and almost as perfect as any of the most beautiful adaptations in the animal kingdom; and, secondly, to show that these contrivances have for their main object the fertilisation of the flowers with pollen brought by insects from a distinct plant. In my volume ‘On the Origin of Species’ I gave only general reasons for the belief that it is an almost universal law of nature that the higher organic beings require an occasional cross with another individual; or, which is the same thing, that no hermaphrodite fertilises itself for a perpetuity of generations. Having been blamed for propounding this doctrine without giving ample facts, for which I had not sufficient space in that work, I wish here to show that I have not spoken without having gone into details.

I have been led to publish this little treatise separately, as it is too large to be incorporated with any other subject. As Orchids are universally acknowledged to rank amongst the most singular and most
modified forms in the vegetable kingdom, I have thought that the facts to be given might lead some observers to look more curiously into the habits of our several native species. An examination of their many beautiful contrivances will exalt the whole vegetable kingdom in most persons' estimation. I fear, however, that the necessary details are too minute and complex for any one who has not a strong taste for Natural History. This treatise affords me also an opportunity of attempting to show that the study of organic beings may be as interesting to an observer who is fully convinced that the structure of each is due to secondary laws, as to one who views every trifling detail of structure as the result of the direct interposition of the Creator.

I must premise that Christian Konrad Sprengel, in his curious and valuable work, 'Des entdeckte Geheimniss der Natur,' published in 1793, gave an excellent outline of the action of the several parts in the genus Orchis; for he well knew the position of the stigma, and he discovered that insects were necessary to remove the pollen-masses.* But he overlooked many curious contrivances,—a consequence, apparently, of his belief that the stigma generally receives pollen from the same flower. Sprengel, likewise, has partially described the structure of Epipactis; but in the case of Listera he entirely misunderstood the remarkable phenomena characteristic of that genus, which has been well described by Dr. Hooker in the 'Philosophical Trans-

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* Delpino has found ('Ltt. Observazioni sulla Dicogamia,' Part ii. 1875, p. 150) a memoir by Waetz- chen, published in 1801 in Römer's 'Archiv für die Botanik,' t. ii. p. 11, which apparently has remained unknown to everyone else. In this memoir Waetzchon, who does not seem to have been acquainted with Sprengel's work, shows that insects are necessary for the fertilisation of various orchids, and describes well the wonderful structure of Neottia.
actions' for 1854. Dr. Hooker has given a full and accurate account, with drawings, of the structure of the parts; but from not having attended to the agency of insects, he did not fully understand the object gained. Robert Brown,* in his celebrated paper in the 'Linnean Transactions,' expresses his belief that insects are necessary for the fructification of most Orchids; but adds, that the fact of all the capsules on a dense spike not infrequently producing seed, seems hardly reconcilable with this belief: we shall hereafter find that this doubt is groundless. Many other authors have given facts and expressed their belief, more or less fully, on the necessity of insect-agency in the fertilisation of Orchids.

In the course of the following work I shall have the pleasure of expressing my deep obligation to several gentlemen for their unremitting kindness in sending me fresh specimens, without which aid this work would have been impossible. The trouble which several of my kind assistants have taken has been extraordinary: they have never once expressed a wish for aid or for information which has not been granted me, as far as possible, in the most liberal spirit.

EXPLANATION OF TERMS.

In case any one should look at this treatise who has never attended to Botany, it may be convenient to explain the meaning of the common terms used. In most flowers the stamens, or male organs, surround in a ring the one or more female organs, called the pistils. In all common Orchids there is only one well-developed stamen, which is confluent with the pistils, and they

form together the column. Ordinary stamens consist of a filament, or supporting thread (rarely seen in British Orchids), which carries the anther; and within the anther lies the pollen or male vivifying element. The anther is divided into two cells, which are very distinct in most Orchids, so much so as to appear in some species like two separate anthers. The pollen in all common plants consists of fine granular powder: but in most Orchids the grains cohere in masses, which are often supported by a very curious appendage, called the caudicle. This part and all the other organs will hereafter be more fully described and figured under the head of the first species, Orchis mascula. The pollen-masses, with their caudicles and other appendages, are called the pollinia.

Orchids properly have three pistils or female organs, united together, the upper and anterior surfaces of two of which form the two stigmas. But the two are often completely confluent, so as to appear as one. The stigma is penetrated in the act of fertilisation by long tubes, emitted by the pollen-grains, which carry the contents of the grains down to the ovules or young seeds in the ovarium.

The upper stigma is modified into an extraordinary organ, called the rostellum, which in many Orchids presents no resemblance to a true stigma. When mature it either includes or is altogether formed of viscid matter. In many species the pollen-masses are firmly attached to a portion of the exterior membrane, which, when insects visit the flowers, is removed, together with the pollen-masses. This removable portion consists in most British Orchids merely of a small piece of membrane, with a layer or ball of viscid matter underneath, and I shall call it the "viscid disc;" but in many exotic species the portion removed is so
large and so important, that one part must be called, as before, the viscid disc, and the other part the pedicel of the rostellum, to the end of which the pollen-masses are attached. Authors have called that portion of the rostellum which is removed, the "gland" or "retinaculum," from its apparent function of retaining the pollen-masses in their places. The pedicel, or prolongation of the rostellum, to which in many exotic species the pollen-masses are attached, seems generally to have been confounded, under the name of caudicle, with the true caudicle of the pollen-masses, though their nature and origin are totally different. The part of the rostellum which is left after the removal of the discs and viscid matter, is sometimes called the "bursicula," or "fovea," or "pouch." But it will be found convenient to avoid all these terms, and to call the whole modified stigma the rostellum—sometimes adding an adjective to define its shape; that portion of the rostellum which is removed with the pollen-masses being called the viscid disc, together in some cases with the pedicel.

Lastly, the three outer divisions of the flower are called sepals, and form the calyx; but, instead of being green, as in most common flowers, they are generally coloured, like the three inner divisions or petals of the flower. In almost all the species, one of the petals, which is properly the upper one, is larger than the others and stands on the lower side of the flower, where it offers a landing-place for insects, having been carried round by the twisting of the ovarium. It is called the lower lip or labellum, and often assumes most singular shapes. It secretes nectar for the sake of attracting insects, and is often produced into a spur-like nectary.