The various Contrivances by which Orchids are Fertilised by Insects. By Charles Darwin, M.A., F.R.S., second edition revised. London: Murray, Albemarle-street.

This book, which comes before us in a second edition, is one of which we may speak in terms of unequivocal commendation. Every one who reads it will wonder at the injustice of those who absurdly class its author with philosophers finding no God in this universe. Scrupulously careful as Mr. Darwin is to avoid breaking the third commandment, his work abounds with such terms as fill the vocabulary of natural theology. The title speaks of contrivances, and the word is evidently used advisedly. The whole tenor of the book strikingly contrasts with writings in which we meet with nothing but matter and force, being filled with details of contrivance, adaptation, and purpose. We find not only the busy bee, but moths and butterflies engaged in fertilising the flowers of orchids. Those of one species are said to be fertilised by wasps. Ever since men have cherished the hope of a future happy life, the butterfly has been regarded as its appropriate emblem, though supposed to be only engaged in trifling pleasure. Now in the brighter light of science we are invited to look on winged insects as being all ministering spirits, or, in the words of our author, marriage priests. The volume begins with an explanation of terms, and goes on to describe the organs which form the flower of the early orchid—a plant common enough in the fields and woods of Essex to be easily found by any of our readers. Then follow similar observations on other British orchids, and the winged insects that wait upon them. In discussing the secretion of nectar Mr. Darwin shows great faith in the intellect of moths, as well as in the purpose which they serve. Our common orchids appear to have empty nectaries—a fact on which Sprengel has founded a strange hypothesis. He believes that these plants exist by an organised system of deception, for he well knew that the visits of insects were indispensable to their fertilisation. Darwin, on the contrary, maintains that "as we know that the same insects visit a large number of flowers, we can hardly believe in so gigantic an imposture. He who believes in Sprengel's doctrine must rank the sense or instinctive knowledge of many kinds of insects, even bees, very low in the scale." Neither party seems to have suspected that bees may be actuated by a sense of duty, as taught by those philosophers who say that virtue is its own reward. But as forty-eight flowers on a single spike had been subjected to their operations, we may reasonably think that so much work without wages would be too much even for the virtue of bees, unless they were continually deceived — a doom to which bees are perhaps less liable than philosophers. Insects are not allured by a vain hope to seek for sweets which they will never find. So at least Mr. Darwin maintains, and after many experiments he found much fluid contained between the membranes of the nectary, and satisfied himself that it was obtained by insects piercing the inner membrane and sucking it. This happened only under such conditions that for insects to be delayed in obtaining the nectar would be advantageous to the plant; where no delay is needed copious nectar may be found in open nectaries. Our author concludes the chapter by saying:—"If this double relation is accidental it is a fortunate accident for the plants, but I cannot believe it to be so, and it appears to me one of the most wonderful cases of adaptation which has ever been recorded." Thus the contrivances are various for butterflies, moths, bees, and wasps to fertilise the flowers of our native plants. Other

contrivances enable other insects to fertilise the flowers of tropical orchids. Many of these beautiful exotics are cultivated in English hothouses, where there habits may be studied by those who have access to them. One of the best collections may be found in the establishment of our neighbour, Mr. R. Warner, at Broomfield, where, by the courtesy of its owner, those who read of them in Darwin's book may derive additional interest from seeing the plants in flower and examining their parts. There may now be found several forms of Phalænopsis and several other genera the mode of whose fertilisation is described in this volume, and many more of the most gorgeous flowers will blossom in the interval from now till Midsummer. including the wonderful Angræcum sesquipedale of Madagascar with such a nectary that a moth must have a trunk more than ten inches long to suck out its contents. Perhaps more wonderful is the account of the fertilisation of Coryanthes, as related on the authority of the late Dr. Cruger, director of the Botanical Gardens at Trinidad. The flowers are very large and hang downwards. A portion of the lip is in the form of a large bucket, which is full of fluid, hardly sweet enough to be called nectar. A little congregation of bees assemble on the flower and push one another into the fluid, in crawling out of which a bee catches a mass of pollen which is glued to its back. The insect comes out with its appendage to return again, when it is generally precipitated a second time into the bucket, passing out through the same opening, and so leaving the pollen mass on the stigma to fertilise the flower. The use of the fluid is to wet their wings that they may not fly away before doing their work. The chapter on the "Homologies of orchids," if perhaps uninteresting to the general reader, is of supassing interest to the students of botany, whether considered in reference to the theory of natural selection or to the natural affinities of plants independently of that or any theory. It is very remarkable that all the curious and complicated shapes in orchid flowers, springs and traps, columns, cavities, buckets, and whatever else there may be, are referred to the original fifteen leaves which form the flower of a Petaloid Eudogen. There does not appear any trace of that multiplication of organs which is conspicuous in double flowers. Perhaps this is one of the most striking differences between the results of cultivation and those of natural selection. It may also serve to explain why forms that result from cultivation tend to disappear when neglected because those productions that are developed by human art, as for instance supernumerary petals, are of no advantage to the plant. They therefore do not appear among the variations naturally preserved. The symmetry of flowers may be made the basis for a systematic arrangement of Petaloid Eudogens at least. Regarding the lily as the typical form of a regular flower, we see in the homologies of orchids how that form has been changed and modified by cohesion, adhesion, suppression, and distortion, which seems to be carried to their utmost limits in these irregular but interesting and beautiful flowers. Much as has been done by Mr. Darwin in the elucidation of adaptations and contrivances, it is evident from his concluding remarks that much remains to be done. We cannot quote his words in such a manner as to do him justice, because the meaning of every paragraph depends so much on the context. But we may say that while he regards the most elaborate contrivances as for the purpose of insuring cross fertilisation, there is a short list of about twenty species which fertilise themselves. When we set these against the number of species of orchideous plants that are supposed to exist—about 6,000—it will be apparent that the exceptional cases are few. Such as they are, careful study will doubtless throw much light upon them, and it is for this we recommend the book to the attention of our readers, for those who make themselves familiar with the facts which it relates will be in the best position for learning more.