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MR DARWIN'S NEW WORK.*

MR. DARWIN remarks in his introduction to this volume that the subject ought to have been treated by a professed botanist, to which distinction he lays no claim. We should be much surprised, however, if any one were found to complain of the superficiality of his treatment, or to say that his pages are too light and popular. They are the result of hard labour on his part, and they are rather hard reading for ordinary people. In order to understand them, or, at least, to make the most of them, we must apprehend the relation in which the facts here set forth stand to that general system of opinion with which the name of Darwin is identified.

One of the most important objections to Mr. Darwin's theory of the Origin of Species by natural selection, and one of which he has from the first shown himself fully aware, is, that while varieties crossed are fully fertile, species crossed are more or less sterile. A marked distinction of this kind makes dead against Mr. Darwin's fundamental position that varieties are incipient species, and that species are neither more nor less than well-established and strongly-divergent varieties. Mr. Darwin, in his book on the "Origin of Species," devotes a chapter to the subject of sterility in crosses, and argues on various grounds that it is not of so much importance as a mark of species as has been thought. He points out that it is not a special endowment, connected with distinct organic peculiarities, but dependent upon a multitude of circumstances affecting the individual organism. It exists, he shows, in many different degrees, and is frequently occasioned by changed or unnatural conditions of life.

It is not necessary for us to pronounce here whether he succeeds or fails in his argument, but the book before us cannot be understood unless we realise how important it is for Mr. Darwin, in making it appear that species are simply varieties that have been perpetuated, and that have preserved purity of breed, to prove that fertility or non-fertility in crossing is not of much consequence as a mark of species.

The facts elicited by the patient experimenting of which the book before us is

the record, have their chief interest and significance in relation with the general question of crossing. Cowslips, primroses, several kinds of flax, and various other plants, bear flowers of two different forms on different individuals. Such plants are said to be heterostyled. Some cowslips, for example, bear flowers with stamens at the top of the tube, and short pistil; and other cowslips, admitted to be identical in species, bear flowers with a long pistil,—reaching to the mouth of the tube,—and stamens half-way down it. These two kinds of the same flower are related to each other very curiously. The pistil of each form requires to be fertilised by the pollen of the other form, in order to ensure complete fertility. When the short pistil is fertilised by pollen from the long stamens belonging to flowers of its own form, or the long pistil by the short stamens of flowers of the same form, more or less complete sterility is the result. This singular fact bears in several ways on the general Darwinian theory. In the first place, it gives us an instance of sterility resulting from certain unions of individuals of the same species. If mutual sterility were taken as the test of distinction of species, then the two forms of cowslip, if crossed in one manner, would rank as separate species. It is chiefly in this connection that Mr. Darwin points out the significance of the phenomena of heterostylism. But a second lesson may be derived from them. It is plain that heterostyled flowers are dependent on insects or the wind for their fertilisation, since each flower is incapable of fertilising itself. Now, this dependence of flowers on insects is a favourite point with the Darwinian. Mr. Darwin himself has devoted a book to the Fertilisation of Orchids, in which he shows how the whole flower has been moulded by the necessity of inducing insects to press against the sticky disks to which the pollen packets are attached. There is the honey as the enticement, and the scent and colour as advertisements; and then the insect, having alighted, is not suffered to get its prize of honey without carrying away pollen with which to fertilise the next flower it visits.

But heterostyled plants have yet another special interest for the evolutionist. The casual observer, seeing that flowers generally bear both stamens and pistils, is apt to take for granted that each flower fertilises

itself, and thus to widen in his own mind the gap between plants and animals, thinking of plants as essentially hermaphrodite and self-fertilising as compared with animals. But a more discriminating observation discovers that multitudes of plants possess contrivances for securing cross-fertilisation in preference to self-fertilisation, amongst others this of heterostylism. The contrast between animals and plants is thus lessened for us as much, perhaps, as when we first learn that some plants are insectivorous, and that others climb by slowly rotating their shoots, till they coil spirally round any support within their reach.

We have been speaking of plants of the same species which bear flowers of two different forms. But there are still more curious flowers which occur under three forms. *Lythrum Salarica* is one of these heterostyled trimorphic plants. In one form there is a long pistil and two sets of stamens—one set short and the other of middle length. Another form has one set of long stamens and another of short stamens, and a pistil of middle length. The third form has long and middle length stamens and a short pistil. In order to be perfectly fertile, the long pistil must be fertilised by pollen from the long stamens of either of the two other forms. The mid-length pistil requires pollen from mid-length stamens, which cannot be supplied by a flower of the same form, and the short pistil requires pollen from the short stamens. Such a complex arrangement is very curious, though its special utility is hard to understand, except as testing the patience of the indefatigable experimenter. "Nothing," says Mr. Darwin, after painful experience, "shows more clearly the extraordinary complexity of the reproductive system of this plant than the necessity of making eighteen distinct unions, in order to ascertain the relative fertilising power of the three forms. . . . As in fertilising flowers there will always be some failures, it would have been advisable to have repeated each of the eighteen unions a score of times; but the labour would have been too great. As it was, I made 223 unions, *i.e.*, on an average I fertilised above a dozen flowers in the eighteen different methods."

The last chapter of this book treats of a very different modification of the plant and the flower from those which we have

*The Different Forms of Flowers on Plants of the Same Species. By Charles Darwin, M.A., F.R.S. With Illustrations. John Murray. 1877.

been considering. Crosses are beneficial, and therefore insects are worth enticing, and when there is good security for their performing their part well, self-sterility may become a benefit, as rendering pollen from another individual always prepotent over pollen from the flower itself; but in cases where it is not impossible that insects may fail, it is not a bad thing to secure, at very small cost to the plant, a few good capsules of self-fertilised seeds. In hopes of a cross a prodigious sacrifice is often made; pollen is scattered to the wind in large quantities in order that some grains may reach their destination, and insects are fed and loaded with it without any promise from them that they will not fly straight home with it, or rub it off on a flower of altogether a different sort. Apart from the object of procuring a cross, all this waste might be dispensed with. No showy corolla is wanted, no honey, no smell. Accordingly, some plants, in addition to their open, insect-attracting flowers, have minute closed flowers too, in which no waste is allowed. Two or three grains of pollen do all that is needed, and a capsule of seeds is secured which will be valuable to the plant should the open flowers fail to set many seeds. The violet is one of these *Cleistogamic*, or shut-marriage plants.

We feel rebuked for our want of observation when we remember how often we have looked at and picked violets, primroses, and cowslips, without seeing any of the curious things which are to be found in them. This work of Mr. Darwin's is likely to be "caviare to the million," but all who are earnestly interested in botanical science, and all who care to trace the evidence of evolution through the various provinces of nature, will find it worth study. It is a model of that careful, candid, indefatigable research for which even his adversaries give Mr. Darwin credit. It is almost impossible to state his results in language which will be intelligible to the general reader, but to the reader instructed in science his style is as clear as his reasoning is cogent.