THE COLOUR OF FLOWERS.

There is nothing in nature which appeals more powerfully to our sense of beauty than the colours of flowers. As we wander through the fields in our summer rambles we are filled with a pure delight in contemplating the varied hues which everywhere surround us; the red and the golden, the blue and the purple, seem to blend, and, as the poet has said, "lose themselves in each other in every bud that blows." So remarkable is the effect upon us that, in the opinion of many, flowers have been specially created for no other purpose than to be things of beauty and a joy for ever to the children of men. Those who thus judge, however, are regarding nature too much from their own standpoint, and forget that there are other interests than man's to be considered. This may be, and probably is, one of the purposes for which flowers in all their loveliness were created, but it is not the primary one. Nature, with that wise economy of energy which is characteristic of all her efforts, rarely, if ever, creates beauty for its own sake alone, but combines it with purposes of utility which are as beautiful to the mental vision as the display of colour is to the physical eye, and of this combination the colour of flowers is a striking example.

As everyone knows, flowers are essentially the organs of reproduction whose function it is to perpetuate the species. Within their coloured petals or leaves there are a series of slender thread-like organs, the stamens, which have at the top a sort of sack containing a yellow or brown powder named pollen. Inside the cluster of stamens are the pistils, having at their base the seed vessels, with the ovules or rudimentary seeds. Now, before the seeds can grow they must be what is called fertilised—that is, some of the pollen from the stamens must penetrate into the pistils and reach the ovules, with which they combine. In those flowers in which both stamens and pistils grow side by side this seems simple enough; the pollen requires just to be shaken from the one on to the other. This process of self-fertilisation, as it is called, is found to occur in many cases, but if too long continued under the same conditions, it seems to be injurious to the welfare of the plant, just as too close interbreeding is found to be injurious to animals. New blood or new conditions in some way seem to be beneficial in both kingdoms. In plants, therefore, cross-fertilisation is found to be of great benefit. Cross-fertilisation just means taking the pollen from the stamens of one flower and applying it to the pistils of another, and *vice versa*. Darwin, to whom we are indebted for a great amount of information on the subject, made many experiments proving the great benefits arising from crossing. He planted self-fertilised and cross-fertilised seeds side by side in the same pot under exactly similar conditions, and at once the crossed seeds showed their superiority, the plants they produced being very much larger and stronger, and also containing more and finer seeds than those raised from self-fertilised seed. So great were the effects of crossing that he came to the conclusion that "Nature abhors self-fertilisation." If this be so, we may expect to find many arrangements among plants for preventing self-fertilisation and inducing cross-fertilisation; and in this we are not disappointed. Thus, sometimes the two organs—the stamens and pistils—on the same plant reach their maturity at different times, so that, owing to slightly different conditions, the stamens of one plant are ripe at the same time as the pistils on another, and the pollen passes from the one to the other, and we have crossing. Again, there are cases when the pistils, from their position, cannot be reached by the pollen from their accompanying stamens. This is so when the former organs grow much higher or the latter bend downwards and away from the former at the season of maturity. In some instances the male and female flowers are on different plants, and this arrangement, of course, absolutely prevents self-fertilisation. We wish, however, more particularly to direct attention to the part which insects play in carrying out nature's plan of promoting cross-fertilising among flowers. In this they act involuntarily, but at the same time accomplish the purpose in a most remarkable and satisfactory manner. They simply carry on their bodies the pollen from one flower to another, and as we watch them buzzing about, landing first on one flower and then flying off to another, we must remember that while they are feeding and enjoying themselves in what seems rather an aimless manner, they are really carrying out one of Nature's great plans for the benefit of the plants on which they regale themselves. The plants, however, have not been slow to avail themselves of these hasty visits, but have developed by natural selection, acting through long ages, various beautiful methods by which the end aimed at is more certainly attained. They have secreted at the base of their flowers supplies of sweet nectar or honey to tempt the insects to push themselves inwards until their probosces can reach the tempting food, and while they are in this position the stamens, by various contrivances, dust their bodies, &c., with the fertilising pollen, which they carry to the next flower they visit. Some of these contrivances are exceedingly curious and sometimes complicated, such as those in which the stamens are brought down by mechanical processes upon the insect on entering the flower, and the pollen scattered on its head or body in such a manner as to be carried to the pistils of the next flower, or the various traps for catching the legs of flies, butterflies, &c., or closed boxes in which the insects are kept till they have fertilised the flower, and many other mechanical arrangements. In some plants there is a sticky secretion which gets on the proboscis of the insect, causing the pollen to adhere to it. In the common cowslip and some other plants there are two or three different forms of flowers; in one the pistil is long and the stamens short; in another the reverse obtains, for the stamens are long and the pistil short. The meaning of this arrangement was not known until Darwin observed that cowslips are absolutely barren and do not reproduce themselves unless they are visited by insects, and that each form is almost sterile when fertilised by its own pollen or even by that of a similarly formed flower; but, on the other hand, perfect fertility results if the pollen from a flower having long pistils and short stamens be carried to one having short pistils and long stamens, and *vice versa*. Now, the whole arrangements are such that the insects visiting these flowers bring about this fertile intercrossing between the different forms. Not only, however, do plants adapt themselves to the habits and wants of insects to secure cross-fertilisation, but in some instances avail themselves even of the services of small birds, such as the humming-bird, for the same purpose. In these flowers pitchers and other receptacles containing nectar are formed in such a manner that birds are attracted to them, and while satisfying their appetites are dusted over with the fertilising pollen, to be carried to neighbouring flowers. It may seem strange to include in those arrangements necessary for cross-fertilisation the colour of flowers, which we are so prone to imagine was only intended for the special delectation of man; and yet it is so. There is no doubt that the visits of insects are determined to a large extent by the colour, size, &c., of the flowers. It has been determined by careful observation that the more conspicuous a flower is the more is it visited by insects. It is not supposed that insects possess that sense of beauty which distinguishes the human race, but nevertheless they are attracted by bright displays, and may even recognise differences of tint. Thus, a dozen or more species of insects have been observed to visit the more showy and handsome flowers, while those whose floral decorations were of a more sober type were visited by only about half that number, or even less. Again, white flowers, which are most easily seen at night, are often fertilised by moths; while bright red are the favourites with butterflies, and dull yellow or brown mostly attract flies, and so on, showing that insects have a discriminating power of some kind. There are several advantages, both to the plants and to the insects, which arise from this recognition of differences of colour. In the first place, there is a great saving of time, as the insects pick out at once those flowers which they wish to visit, and pass over the others, and hence can go over a great number in a short time, feeding themselves and fertilising the flowers much more rapidly than they could do without this guide. Many flowers also change their colours after being fertilised, and this is recognised by the insects, who pass over those who by this change show that they have already been visited and their nectar abstracted. Other flowers, again, have certain marks on the petals which guide the insects directly to the opening which leads to the nectar. It is evident from these and many equally remarkable facts that the colours of flowers exercise a powerful influence on their well-being, so far, at any rate, as cross-fertilisation is concerned; and as this is so, the colours must be the result of natural selection. Suppose that all flowers were at first small, and possessed of little or no colour, then the insects would choose for their visits those varieties which were perhaps a little larger and more conspicuous than their fellows. The result of this would be cross-fertilisation and strengthening of those varieties, which would thus have an advantage in the struggle for existence. This would go on and on, every succeeding generation of flowers becoming a little larger and more coloured than the preceding one, until the perfect flower in all its beauty was produced. If the insects for any reason were to cease their visits, then the beauty of the flower being of no further use would gradually fade away, although the plants might still live and be fertilised by the wind or other agency scattering their seeds. There is strong evidence that such a process as we have described has actually arisen again and again in the history of plant life. Bright and attractively-coloured flowers have been slowly developed by the agency of insects, and when that has been withdrawn the flowers have faded and degenerated into such inconspicuous forms as are seen on grasses and other plants which are fertilised by the wind alone. It is curious to think that all the beauty of form and colour which charms us so much in the flowers of the field is due to the work of insects, and that if there were no insects it would speedily disappear. In short, without insects there would be no brightly-coloured flowers at all. We must also be impressed with the fact that the utilitarian processes of feeding the insect and fertilising the plant bring about such a glorious display of loveliness fitted to please and to elevate the mind of man.