

ON THE AGENCY OF INSECTS IN OBSTRUCTING EVOLUTION.

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Since so much which has been learned in regard to the agency of insects in the cross fertilization of flowers, I understand the drift of scientific thought to be in the direction of the general principle, that in the hypothesis of evolution insects play an important part. It does not seem to have occurred to any observer that they may act as an obstruction to any great departure from what we may take as the normal form—that but for them variations would probably often be much greater than they are.

It has fallen to my lot to observe and to place on record in the *Proceedings of the Academy of Natural Sciences of Philadelphia*, the *American Naturalist*, and elsewhere, that art has not so much to do with garden variations as generally supposed; that variations in nature are as great as in horticulture; and that the florist's credit is chiefly due in preserving the form which unassisted nature provided for him. It was at one time part of the essential idea of a species that it would reproduce itself. If any variation occurred in nature, it was taken for granted that seedlings from this variation would revert to the parent form. But it is now known that the most marked peculiarity in variation can be reproduced in the progeny, if care be taken to provide against fertilization by another form. Thus, the blood-leaved variety of the English beech will produce blood-leaved beeches; and, as I have myself found by experiment, the very pendulous weeping peach produces from seed plants as fully characteristic as its parent; and when the double blossomed peaches bear fruit, as they sometimes do, I have it on the authority of a careful friend that the progeny is doubled as its parent was. But I need not refer particularly to this. Any intelligent florist of the present age can testify to the fact, that varieties will reproduce themselves as fully as the original forms from whence they sprung.

I do not think botanists, as such, are so fully aware of these facts as the florists are. They scarcely admit of much inherent variation in form in nature; but look rather to hybridization, and insect agency in connection therewith, to account for the changes when they occur. In order to avoid the possibility of these agencies acting as the sole factors in evolution, I have generally

taken a genus consisting of only one species in a given locality, to show how great is the variations in form, where no congenital species could mix with it. I have, for this, chosen *Epigæa repens*, *Chrysanthemum leucanthemum*, and the *Quercus neo-mexicana* (*Q. Gunnisonii*?) of the Rocky Mountains—papers which most of the readers of this will probably remember. Another familiar plant to illustrate this is the common yellow toad flax, *Linaria vulgaris*. In a handful of specimens gathered in an afternoon's walk, I find the following marked variations:—

In regard to the spur, which is generally as long as the main portion of the corolla, some have them only one-third or one-fourth as long; and in one instance the plant bears flowers *entirely spurless*. Dr. James Darrach, a member of the Academy, informs me that he believes he has, in years past, gathered a spurless form, but has neglected to place it on record. Then some plants bear flowers with spurs thick, and others with narrow ones; and while some have spurs quite straight, others curve so as to describe nearly the half of a circle. The lobing of the lower lip is various. In some cases the two lateral ones spread away from the small central one, leaving a free space all around it; at other times they overlap the central one so that it is scarcely seen. Sometimes the small central lobe is nearly wanting—often not more than half the depth of the two large lobes, and at times quite as full, when it may be linear, ovate, or nearly orbicular. The *palate*, as the deep colored process attached to the lower lip may be called, also varies. In color it is pale lemon, but often a brilliant orange. Sometimes it is but about the eighth of an inch in thickness; at others one-fourth, in flowers of the same size. In the case of the shallow flat palate, the attached lobes are patent, or even incurved; while in the thick ones they are very much reflexed. These two forms, when the extremes are selected, are as strikingly distinct as two species often are. Again, the palate is rounded and blunt at the apex; at other times almost wedge-shaped, or at least narrowing to a blunt point. The upper lip varies in proportionate length, sometimes not extending much beyond the palate, sometimes half an inch more; then the margins are sometimes bent down like the wings of a swooping bird; or upwards as in those of a rapidly descending one. Sometimes they are united and turned abruptly up at the apex, like the keel of the garden pea.

And now in regard to the bearing of all these facts on the great scientific questions of the day, we have to note first, that the plant is an introduced weed, with nothing allied to it anywhere, in the localities where we usually find it, with which it can possibly hybridize. The variations must be from some natural law of evolution inherent in the plant itself. Varieties of course may cross-fertilize as well as species; and some of these variations may be owing to one form fertilizing another form; but there can be no avoiding the fact, that at least the first pair of varying forms must have originated by simple evolution.

Now going back to our florists' experience the question occurs, that as varieties once evolved will reproduce themselves from seed, why does not some one of these *Linarias*, which has been struck off into some distinct mould, reproduce itself from seed, and establish, in a state of nature, a new race, as it would do under the florist's care? Why, for instance, is there not a spurless race? It is scarcely probable that the solitary plant, found on this afternoon's walk, is the only one ever produced. Dr. Darrach's recollection shows it is not a solitary case. The humblebee furnishes the answer. They, so far as I have been able to see, are the only insects which visit these flowers. They seem very fond of them, and enter regularly at the mouth, and stretch down deep into the spur for the sweets gathered there. The pollen is collected on the thorax, and of course is carried to the next flower. The florist, to "fix" the form, carefully isolates the plant; but in the wild state a spurless form has no chance. The bee from the neighboring flower of course fertilizing it with the pollen from any of the other forms.

If there were no bees, no agency whatever for cross fertilization, nothing but the plant's own pollen to depend on, there would undoubtedly be races of this *linaria*, which, again, by natural evolution at times changing, would produce other races; and in time the difference might be as great as to be even though generic. But we see that by the agency of the humblebee the progress of the newly evolved form is checked. The pollen of the original form is again introduced to the offspring, and it is brought back at least half a degree to its starting point.

The conclusion seems to me inevitable, that insects in their fertilizing agencies, are not always abettors, but rather at times conservators of advancing evolution.