

### The Difficulties of Natural Selection

THE papers read by me before the Entomological Society "On the Relation between the Colour and the Edibility of Lepidoptera and their Larvæ" having been noticed and commented upon by Mr. A. W. Bennett and others in NATURE, I have deemed it desirable to offer a few remarks on the subject.

The object I had in making the experiments was to ascertain whether there could be proved to exist any relation between the colours of larvæ and their edibility.

The disciples of Mr. Darwin argued that the brilliant colours of so many male birds arose from sexual selection, and that the equally striking colours of flowers were but guides to insects, to enable them to distinguish, at some distance, the flowers from the leaves, and thus insure fertilisation by the interchange of pollen. Such reasons, however, were quite valueless to account for the bright colours of the asexual larvæ of many Lepidoptera, several species of which are banded and striped with blue, yellow, and red; colours which instead of concealing them by harmonising with the leaves on which they feed, are often in complete contrast with them.

Now Mr. Wallace had a theory that these gaily coloured larvæ were uneatable by birds, and that their gay colours were protective, because if they were indistinguishable from eatable species, they would be seized by birds, and though rejected afterwards, would be so much injured that the probability of their becoming imagines would be very remote, even if they were not at once killed.

This I found to be the case; in my experiments extending over many years, and most carefully made with several species of birds, I have not met with one instance in which a strikingly coloured larva was eaten. In most cases they were not even regarded when thrown into the aviary, although I had several birds always on the watch for the eatable species, with which I constantly fed them; while these latter were seized immediately they were seen.

The larva of the *Cucullia verbasci* is conspicuously coloured blue and yellow, and feeds without any attempt at concealment on several species of *Verbasicum*. I placed the plants in the aviary, and fed the *Cucullia* upon them until every leaf was devoured, and the caterpillars gnawed holes in the stem; but not one was in the slightest degree injured, yet at the same time other larvæ were greedily eaten.

On the other hand, I found that all larvæ were eagerly eaten which have soft smooth bodies and dull colours, while the hairy larvæ are rejected entirely.

These eatable species are protected in various ways; some are nocturnal in their habits, descending to the ground during the day; some feeding on the under sides of the leaves; others arrange their bodies in a line with the shoots of the plants and look like a streak of the bark; some are of precisely the colour of the leaves, or even of the corolla of the plant on which they feed; others roll themselves up in leaves, the larvæ of the *Geometridæ* are often exactly like twigs, with the terminal and side buds imitated.

This latter resemblance is so complete that, after being thirty years an entomologist, I was deceived myself, and took out my pruning scissors to cut from a plum-tree a spur which I thought I had overlooked. This turned out to be a larva of a Geometer two inches long. I showed it to several members of my family, and defined a space of four inches in which it was to be seen; but none of them could see that it was a caterpillar. Surely this was a case of protective mimicry.

All the eatable larvæ agree in not moving when there appears the least danger, and very rarely moving at all during the day.

Even if there were no cases of protective mimicry in the larval states of Lepidoptera, I do not think that would be any argument against the existence of such in the perfect state. It appears to me rather that as so few specimens become imagines in proportion to the eggs produced, the more need is there that these few should survive.

I cannot, therefore, agree with Dr. Scudder in thinking that mimicry has been supposed to exist where it is least wanted, viz., in the perfect state of Lepidoptera. Nor can I coincide with Mr. Bennett that it is a matter of indifference to the supporters of the theory of Natural Selection whether twig-like caterpillars are eaten by birds or not. My point is that they are often so like twigs that they are passed over as such by insectivorous birds, and that the closer the resemblance the better their chance of escape.

I believe myself that Mr. Darwin's theory will survive, and even be benefited by, the criticisms of its opponents; but what I do dread is the injury it may receive from the false arguments of some of its illogical supporters.

Lest I may unwittingly place myself in the latter category, I will bring my remarks to a close.

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