

## NUPTIAL COLORS IN THE CHRYSOMELIDÆ.

[Coleoptera.]

BY FREDERICK KNAB.

Among certain forms of Chrysomelidæ the imago takes on an entirely different appearance with the attainment of sexual maturity. Either new colors are added to the existing pattern or there is a complete change in coloration. These colors are not acquired as the result of the more or less gradual chitinization and pigmentation which follows eclosion ("Ausfärbungsprozess" of the Germans) but make their appearance only with the development of the sexual powers. This maturing of the sexual powers may be a matter of months and often it only comes about with the advent of another season, for most Chrysomelidæ are single-brooded and do not become sexually mature until after they have hibernated or aestivated. Perhaps it would be more exact to say that the physiological changes which determine sexual activity take place during the resting period (hibernation or aestivation).

One of the most striking examples of color-transformation of this character has been studied by Caulfield in a northern species of Cassidini; its significance, however, appears to have been wholly overlooked. The beetle in question is *Physonota helianthi* Randall. The difference between the parent beetles and the new generation produced from them is so great that Caulfield very naturally concluded the insect to be double-brooded and dimorphic.\* But further observation demonstrated that this insect is single-brooded and in the course of time completely changes its appearance.† The beetles which appear in the spring or early summer are brilliant golden green and so they remain until they copulate, lay their eggs, and finally die. The offspring of these golden green parents are wholly different in appearance. After emergence the pronotum and elytra are shining creamy white with translucent marginal portions and with five black spots upon the pronotum; soon, with the progressing chitinization, the elytra change to a dull blackish color with irregular ivory spots and blotches upon them. In this sober garb the beetles may be found upon their food-plant during the later part of the summer and in the autumn; they feed but little and show no sexual desires, and it is in this state that they go into hibernation. When the beetles reappear in the following spring they have assumed the

\*Can. Ent., vol. 16, p. 227 (1884).

†Can. Ent., vol. 19, p. 73 (1887).

brilliant green coloration of their parents and they are then active and intent upon reproduction. Dr. Dimmock and the writer have corroborated Caulfield's observations by rearing the beetles from the eggs and carrying them through to the following season.

Transformations of a similar character have been observed in certain species of European Cassidini, but their correlation with the physiological changes of the reproductive period appears never to have been suspected. A much less obvious case is that of another American cassidid, *Chelymorpha argus* Lichtenstein. This beetle at first shows an ochreous yellow ground-color above, and it is not until it issues from hibernation and is ready to reproduce that it shows the characteristic dull red ground-color. Incidentally it may be mentioned that at Winnipeg, Manitoba, the writer found a race of *Chelymorpha argus* which is ochreous yellow when sexually mature.

Similar changes occur in certain Chrysomelini when sexual maturity is acquired. A striking case is that of *Zygogramma signatipennis* Stål, which the writer found abundant upon a large composite plant at Cordoba, Mexico. During the winter months the beetles could be found but sparingly upon their food-plant and appeared to be very inactive. At that time the ground-color of the elytra was a dull creamy white. With the advent of warm weather and the rains the beetles became abundant; they were now active and many pairs were observed in copulation. The ground-color of the elytra had now changed to bright green-gold. In certain of our native species of *Calligrapha* the ground-color of the elytra is at first creamy white, and this takes on a silvery luster when the beetle becomes sexually mature. In *Calligrapha rhoda* Knab the contrast is enhanced by the addition of red to the elytral pattern with sexual maturity; this change takes place in a still more striking manner in *Calligrapha rozeana* Knab. As these beetles have been described in a previous article it would be superfluous to go into the details of coloration.

Tower in his book on evolution in the genus *Leptinotarsa*,\* proposes names for certain Mexican forms of this genus which he claims to be new. He states that these species show colors in life which disappear after the death of the insect and that these colors are of specific value. Doubtless in these cases also the colors in question are correlated with the sexual functions, for in all the cases previously cited, the nuptial colors

\*An Investigation of Evolution in Chrysomelid Beetles of the Genus *Leptinotarsa*. (Pub. No. 48, Carnegie Institution of Washington, 1906.)

disappear with death, as they are said to do in these species of *Leptinotarsa*. Unfortunately Tower has not specified what these colors are and how they are distributed. Should these colors prove to be of the physiological character indicated, persons studying these beetles at different seasons would naturally conclude that the differences in coloration were of specific value; or even the same individual, in ignorance of their true nature, would be led into error.

Cases of nuptial colors occur in certain species of Halticini, although they appear to be much less frequent in this group than in the Cassidini or Chrysomelini. A conspicuous example is *Disonycha quinque-vittata* Say, a common species upon willows in many parts of North America. These beetles, when found in the late summer have pale yellow elytra with narrow black longitudinal stripes. When the beetles emerge from hibernation the following spring the elytra show in addition a large amount of crimson, disposed in broad stripes in the intervals between the black lines. A Mexican halticid, *Homophata abdominalis* Chevrolat, which the writer found common at Cordoba, develops nuptial colors. During the winter months these beetles were frequently found upon their food-plant. They then had dull bluish black elytra, while the pronotum and most of the legs were a pale ivory-yellow. When the season of sexual activity arrived, with the rains and the warm weather, the pronotum and the legs changed to a delicate rose-red, while the elytra showed a peculiar blue sparkle.

No indications of nuptial colors have been found in the two great groups of Camptosomata and Eupoda. While it is true that our knowledge of the biology of these groups is very incomplete, these groups, and particularly the one first mentioned, stand apart in many ways and one can hardly expect close correspondence in the more specialized traits. What does cause surprise is that the Hispini, which are so intimately linked with the Cassidini, show none of the remarkable color-changes so frequent in the latter group. But this may be due wholly to our incomplete knowledge, and perhaps, when the tropical forms have been investigated, this phenomenon will be found among the Hispini also.

These notes demonstrate how meager is our knowledge of the biology of this important group of beetles. Our literature of economic entomology abounds with more or less extended notices of the injurious species, yet it is rare to find an original observation recorded. The accounts are mostly borrowed from earlier authors, and such additions as are made, from scattered records and without critical knowledge, are, more often than not, inaccurate and misleading.