EXPERIMENTS ON A SPECIES OF MIGRATING BUTTERFLY

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A number of butterfly species have the habit of migration, perhaps the most noted of which is Pyrameis cardui, commonly known as the Painted Lady. This designation is particularly fitting on account of the gay coloration and intricate pattern of this interesting butterfly. It is a widely distributed insect occurring in most portions of the globe. Much has been written concerning its habits and life history. There are, however, several points still to be determined, some of which concern the origin of the migratory swarms that have been recorded. For this reason the author has undertaken a comprehensive study of the species.

It is obvious that in order to produce the great aggregations of butterflies, such as have been noted, the species must be very prolific. To determine this fact I secured in the spring of 1927 a number of small caterpillars for experimental breeding. To accelerate their growth these were placed in the incubator. The resulting butterflies were allowed to copulate in captivity. It was found that the species is much longer lived than the average butterfly and also that it has the peculiar habit of copulating late in the day rather than in the warm mid-day hours. This condition accounts for the fact that Pyrameis cardui is observed in flight after five o'clock P. M., while other species have settled for rest before that time. The first pair from the above hatching were observed in copulation May 11. These were put in a separate wire cage with small plants of a species of Malva. The young larvae became so numerous that the food plant had to be renewed three times. On the 19th day of May the same pair were again observed in copulation which is an unusual occurrence. The male lived until the 27th and the female was killed on the 31st, after she had ceased laying, and owing to her damaged condition. From this single female there resulted by actual count 685 caterpillars. In a state of nature it is not unlikely that even a greater number would have been produced. Thus we note not only the increased life span of this species but also the great number of progeny.

The preferred food plant of this butterfly, notably, Malva, is plentiful in this state in the early spring, but dries out during the summer. If the season happens to be favorable the spring brood of Pyrameis would occur in great numbers and the resulting larvae would soon exhaust the food plant. The following generation would find insufficient foliage on which to oviposit and would not be able to reproduce unless it migrated to a district of greater rainfall or later season. This may perhaps account for the northerly drift of great swarms of these butterflies in the spring of certain years. The scarcity of Malva and related plants through the summer and fall probably serves as a check on the reproduction of subsequent broods, hence we do not find migration occurring in the fall.

There seems to be a provision in nature for maintaining a balance between species. If a given insect occurs in abnormal numbers it is soon followed by the increase of its parasites. The butterfly under consideration has a considerable number of enemies in the form of parasitic wasps and flies.

The metamorphosis of Pyrameis cardui has been described by several authors, but a brief summary would not be out of place. The eggs are green in color, simulating the shade of immature leaves of Malva. They are deposited singly. The newly hatched larva first consumes the egg shell and then for a while feeds upon the upper surface of the leaf. Shortly it constructs a web over itself drawing the edges of the cup-shaped leaf together and thus creating a protective covering. In spite of this protection a number of minute parasites may gain access. One of the latter is shown in our figure 1 of plate VI. These parasites deposit their eggs on the dermis of the caterpillar and the larval parasite burrows in and feeds upon the tissues of its host. Cardui larvae that are parasitized by the insect previously referred to usually succumb when about one-third grown. The parasitic larva cuts its way out through the skin of its host and forms an oblong silk cocoon as shown in figure 2, plate VI. The adult parasite emerges in a few days and is ready to repeat its life cycle.

As the larva of P. cardui grows it consumes the walls of its enclosure and is then compelled to move. During this period of its exposure and before it has constructed a new abode it is subject to the attack of the small fly shown in figure 3, of plate VI. The caterpillar thus attacked may mature and form a chrysalis before the parasites emerge. Eventually, from 12 to 18 parasitic larvae emerge, and form separate brownish cocoons, as shown in figure 3, of plate VI.

The caterpillars of P. cardui are exceedingly variable in color, ranging from a silvery gray to nearly a solid black, the shade and intensity of color being influenced by the amount of sunlight they have received.

The chrysalis is protectively colored in gray and gold, and because of its inconspicuous pattern is not often observed.

When disturbed it frequently sets up a wagging motion, vigorously jerking itself from side to side, in a manner calculated to discourage the attack of smaller enemies. The chrysalis is attached at the extreme tip of the abdomen, and is suspended by a number of minute hooks fastened into a tuft of silk.

Practically all insect larvae are subject to parasitic attack. Figure 4 of our plate shows the caterpillar of a small moth with a portion of the 324 minute flies which emerged from it. Figure 5 of the same plate illustrates 20 parasitic wasps with their pupal cases, which resulted from another parasitized caterpillar. The last two figures are examples of that remarkable phenomenon of polyembryony (i.e. many individuals from a single egg) as noted by Prof. W. S. Showalter.

Pyrameis cardui can stand a wide range of temperature. I have subjected chrysalids to a continuous dry air environment at 116 degrees Fahrenheit and had them emerge in the remarkably short time of three days and twelve hours. The lightly colored example shown in figure 6 resulted from such an experiment.

In contrast to the above, figure 7, a dark example, was subjected to moist air at 40 degrees F. for four weeks, at the end of which it emerged without the temperature having been raised above that point.

When we observe the marked change in color and intensity of markings in a single generation, resulting from different temperatures, it is more easily understood that a given species, subjected to a cold climate for countless generations has a fixed color pattern differing from that of the same species residing in a location of high temperatures. Seasonal color changes are also explainable for the same reason,—since the marked contrasts between the spring and fall, or the wet and dry seasons in certain regions, would subject the seasonal broods of caterpillars to vastly different thermal influences.

Figures 8, 9, and 10 of our plate illustrate some of the interesting aberrations of P. cardui which are occasionally observed during a short period of the summer season. There has been much speculation as to the causes of these peculiar color and pattern changes. The author is carrying on a series of experiments in an effort to answer these questions, the results of which will be published in a subsequent issue of this Bulletin.