

NOTES ON THE LIFE-HISTORY AND METHODS OF REARING THE
GIANT TIGER SWALLOWTAIL, *PAPILIO MULTICAUDATUS*

by GEORGE F. PRONIN

Among our butterflies, one of the finest species is without doubt the beautiful Swallowtail, *Papilio multicaudatus* Kirby. In California it flies in the Sierra as well as in the valleys; its large and powerful wings enable it to reach and go over the high mountain passes.

It is in the canyons which are filled with sunshine, with a very hot soil of volcanic tuffs broken down by erosion, that these butterflies love to fly. There, direct from the riven stones arise the majestic Incense Cedar (*Libocedrus decurrens* Torr.), Yellow Pine (*Pinus ponderosa* Dougl.), and robust California Black Oak, (*Quercus kelloggii* Newb.). In the open spots in direct sunshine grow bushes of Choke-cherry (*Prunus demissa* Nutt.), the best host plant for the caterpillars of the Swallowtail.

At times the butterflies use their large wings like sails, rising in the breeze or on the waves of warm air which rise from the sides of the canyons. After midday the males fly along the canyon sides, looking very attentively for young females just hatching from their chrysalids or pupae. Any yellow thing attracts the males; one was even seen to fly round and round an empty corned beef tin which had a flamboyant yellow label!

Mating begins after midday and continues for about an hour and a half. On June 19, 1951, a pair was observed in a special butterfly cage at the Hat Creek Entomological Station in Shasta County, California; the male died one hour after copulation.

Egg laying cannot begin at once after breeding, except in the case of very old females which have in their bodies overmature eggs. Females of the Giant Swallowtail usually produce about 55 eggs, but do not start to lay for two or three days after fertilization.

After mating the female visits many different kinds of flowers to obtain nectar. The favorite in the Hat Creek area is the Tiger Lily (*Lilium pardalinum* Kell.), which grows along the irrigation ditches. When ready to lay her eggs, however, she leaves the flowers and searches for open spots where young Choke-cherries grow. The female produces about 6 or 7 eggs during one day, and the egg laying period extends over some ten days. The eggs are always put on the upper side of leaves, and after laying on one tree she flies off for a considerable distance.

The females of the giant Swallowtail like very much to lay their eggs in shrubs, along irrigation ditches which are shaded from the south, also from the strongest sunshine.

In such a wood margin I have found during 1½ hours more than 22 caterpillars of *P. multicaudatus* of various ages.

The young caterpillars begin to hatch about a week after the eggs are laid. Each has on its back two little white strips, which enlarge as the caterpillar

grows, and resemble the white arms of a two-headed eagle. Immediately after hatching the caterpillar begins to eat the shell of the egg from which it came, and likewise begins to weave a silk mat on the surface of the leaf, such that the wind cannot suddenly sweep it off. Such a mat is made to the edge of the leaf, where the caterpillar begins to eat. This silk line is always made, even by big caterpillars, serving them as a thread of Ariadne, leading them to the desired spot.

At a constant temperature of 85° F., the caterpillars molt regularly at intervals of about 5 days. The following typical data are from records taken at Hat Creek, Shasta Co., California, in 1951:

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| Egg hatched | July 23 |
| 1st molt occurred | " 28 |
| 2nd " " | August 1 |
| 3rd " " | " 5 |
| 4th " " | " 9 |
| Feeding ceased | " 15 |
| Caterpillar began to change color, from green to brown | " 16 |
| Pupa formed | " 18 |

Until the 4th molt the caterpillar is of a polished black color, but after that changes to green; the white eagle-like marking becomes very pale and finally disappears entirely. By the time for pupation, the caterpillar becomes brown.

When the caterpillar is ready to pupate it makes a little silk cushion on some nearly vertical surface, to which the cremaster hooks at the tail end of the pupa will be attached. These little claws on the cremaster serve to anchor the pupa securely. After this work, the caterpillar turns with the head upward and begins to weave around its back a very thin silk girdle, which in the future will attach the pupa to its surroundings. After the final molt, which occurs after the silk has been spun, the girdle cuts very deeply under the chitinous outer skin of the pupa. If you wish to remove the pupa from its resting place, you must first very carefully cut the girdle, then try to free the cremaster hooks from the silk cushion.

To obtain eggs from *P. multicaudatus*, one must take a box about 18" by 18" and 24" high. The front can be made of glass, but the other sides must be covered with fine wire screen to enable the butterflies to climb to the top, and also to provide fresh air, for the box must be kept in bright sunshine each day. It is best to add a branch or a piece of carton, to provide some shade in the cage.

The first problem is how to keep the cut branch in a living condition, as it will be in full sunlight for some days. For this purpose I have invented an apparatus called a "Turgorator", which produces artificially an almost normal turgor in the plant tissue (*Lepid. News* 8: pp. 121-123). The Turgorator enables a city dweller to take home branches from different plants, in a normal living condition.

Working with the Turgorator, we have to be sure there is always enough water in the can, as the cherry leaves lose much moisture by transpiration. It is helpful to wrap the Turgorator in a white towel, which prevents the sun from heating the water too much, and also gives the butterflies an opportunity to crawl to the leaves or branches.

A small vessel of water must be put in the cage with the butterflies, else they will die of thirst. For feeding them we can use different flowers, such as clover or thistle, but best of all is the Tiger Lily. The flowers of this plant are so attractive to female swallowtails that those of several species (*P. multicaudatus*, *P. rutulus* Boisid., *P. eurymedon* Luc.) will even lay their eggs directly on the blossoms and leaves, though they are not suitable food for the caterpillars.

It is not enough to provide flowers for the butterflies, however; we must give also sugar dissolved in water (about a 12% solution). Drops of the solution can be put on a piece of carton waxed with paraffin, or in the glass lid of a fruit jar. The butterfly should be taken by the forewings in one hand, while with the other we roll out its coiled tongue. You can tell when it has begun to drink the sugar solution, because it bends down its antennæ and nods its head. Then the wings should be released and the butterfly allowed to feed of its own accord. When it begins to roll up the tongue again, we should wash the organ in clean water, using a tuft of cotton, or simply by putting the butterfly under a little stream of water. Such a washing of the tongue and legs is necessary, for if left on, the sugar solution will make the legs fragile and will gum up the tongue. If the females have stopped egg laying we can feed them at one-day intervals, but in this case we must be sure that there is always fresh water available for them to drink. If females do not accept the sugar solution, it is an indication that they have not yet mated, as young ones before copulation eat only a small amount of food.

In sunny weather, females begin to lay their eggs after midday, older ones starting first. Leaves with eggs on can be picked, the eggs removed very carefully and each lot put in a separate glass jar.

Eggs which are nearly ready to hatch change their color and look like ripe apricots, then become still darker. At a constant temperature of 83° F., the young caterpillars are ready to hatch in seven days. To rear them we should have ready some glass jars 6 or 7 inches high and 4 inches wide, in each a little twig of Choke-cherry in a vial of water; the mouth of the vial around the twig should be stuffed with cotton so that the larvæ cannot fall in and drown. Five or six eggs may be put on the leaves of one twig, and six or seven jars will be needed for the brood from one female; the ripe eggs can be fastened to the leaves with white-of-egg, or saliva.

The young larvæ must be kept under constant observation and handled with great care, using a camel's hair brush. If they fall from the leaves, put them back at once with the brush. In such jars the larvæ can be kept until they have changed their skins, *i.e.* molted, for the third time. Then they should be transferred to glass cylinders a foot high and 6 inches wide.

The mature larvæ change their color from green to dark brown. At that time they must be put into other jars containing branches. Once a caterpillar

has chosen a spot on a branch, spun a silk mat and attached itself by a girdle around its body, it and the twig must be placed in another glass into which no new larvæ are put. For just before their pupation, caterpillars are very uneasy, and can readily disturb those which are ready to pupate.

If we have the overwintering generation, the glass jars containing pupæ should be covered with wire netting, to prevent the entrance of mice during the winter.

The caterpillars of *P. multicaudatus* can be found on other plants as well as on Choke-cherry. But in Shasta County in northern California the females lay their eggs only on the leaves of Choke-cherry. If you want the butterflies to become constant visitors in your garden, you must try to provide suitable conditions. Thus there should be a small bed with flowers of Tiger Lily, and Choke-cherry bushes.

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FIGURES OF TYPE SPECIMENS

At the meeting of the International Union of Biological Sciences held at Nice in August 1953, a type-figuring subsection of the Entomology Section was formed. The objective of the subsection is to make information on types of insects and other animals as readily available as possible, especially by distributing figures of the type specimens, to assist in research work and to have some information available in case types are accidentally destroyed.

The activities of the subsection are directed by a committee under the chairmanship of Mr. N. D. RILEY, Keeper, Department of Entomology, British Museum (Natural History), London, S. W. 7. Other members of the committee are:

B. F. BEIRNE, I. F. B. COMMON, W. FORSTER, J. G. FRANCLEMONT, H. INOUE, A. J. T. JANSE, O. LUNDBLAD, E. G. MUNROE, J. OITICICA FO., J. F. G. CLARKE, R. N. ORFILA, C. F. DOS PASSOS, R. SPÄRCK, and P. E. VIETTE.

The aims of the subsection are: to collect in a central file negatives of photographs of type specimens, or of photographs of drawings or other illustrations of type specimens or of their parts; to catalogue these and make lists available from time to time; to make and to distribute prints of the photographs for suitable fees to those requesting them;