OBSERVATIONS ON THE LIFE HISTORY OF *CALLOPHRYS XAMI* (LYCAENIDAE)

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Callophrys xami (Reakirt) (=*Mitoura xami* auct.) is for the most part a Mexican species, occurring in that country in the Sierra Madre Occidental from Sonora state to Jalisco state, also in the Valley of Mexico, the Central States, the Valley of Tehuacan, the mountains of Vera Cruz, the Sierra Madre del Sur and Guerrero and Oaxaca states, always apparently in areas with a cool temperate to warm temperate climate. Since 1930, the species has been not rare in Mexico City itself, being the only Hairstreak which can be commonly encountered within the city limits. It ranges northward into the southwestern United States, having been recorded from southern Arizona and apparently now having become well established in southern Texas.

Although this species will probably not be encountered frequently by collectors north of the Mexican border, information concerning its biology should be useful as an aid in directing the search of those who have the opportunity to collect in areas where it might be found. Such information might perhaps also be of particular interest to students of the North American Hairstreaks in consequence of the bearing of such data on the systematics of this group.

A survey of the genitalia of both sexes of North American Hairstreaks, together with other considerations, has led to a proposed rearrangement and redefinition of the genera of this group (Ziegler, 1960). The demonstrated morphological gap between *C. xami* and the allied species placed in the subgenus *Mitoura* as restricted in that study had led us to suspect some ten years ago that a corresponding biological gap might also exist. This speculation received some support from the lack of records of probable association of *C. xami* with members of the family Cupressaceae, which are the known hosts of species of *C.* (*Mitoura*) (*s.s.*).

Continued observation of *C. xami* during the intervening years in and around Mexico City has now indeed confirmed this hypothesis and has led to the recognition of *Echeveria gibbiflora* De Candolle and *Sedum allantoides* Rose, both members of the family Crassulaceae, as hosts.

The family Crassulaceae comprises some 15-20 genera of succulent plants which are usually adapted to alpine, arid or otherwise inhospitable environments in various parts of the world. Some 6-7 of these genera occur in North America, with Mexico apparently forming a center of

distribution. Thus, Graf (1959) lists about 30 species of *Echeveria* and about 12 species of *Sedum* as occurring in Mexico. According to Hylander (1947), the genus *Echeveria* (Live Forevers) is confined to Mexico, southwestern United States and Central America. It forms a New World counterpart of the Old World genus *Sempervivum*, to which belong the House Leek and the Hen-and-Chickens which are commonly grown in home gardens as ornamentals. On the other hand, the genus *Sedum* (Stonecrops, Orpines) contains several hundred species which are native mostly to the colder temperate regions of the Northern Hemisphere. Many native species are found throughout the United States, particularly in the West and Southwest.

Most of what follows pertains in particular to conditions in the vicinity of Mexico City. It is to be anticipated that much of this information could be extrapolated to other parts of the range of *C. xami*.

During rearing studies on *C. xami* in New Jersey under laboratory conditions, attempts were made to feed the larvae with locally available ornamental members of the family Crassulaceae. It was found that the larvae would not accept Mossy Stonecrop (*Sedum* sp., probably *acre* L. or *mexicanum* Britton). On the other hand, they rather readily ate the common Hen and Chickens (*Sempervivum* sp.) in a fashion similar to that adopted with the true hosts, burrowing into the lower surface of a leaf near the base and proceeding to hollow out the leaf, leaving the exterior skin as a thin membrane. However, they did not survive on *Sempervivum* for more than a day or two, becoming rapidly immobilized and moribund before completing a molt.

IMMATURE STAGES

A. EGG

Generally similar in appearance to the ovum of other, related species of Hairstreaks. Roughly spherical as viewed from above, flattened laterally; about 0.7-0.8 mm. in diameter and about 0.5 mm. in height. The surface, except for the micropyle, covered with a prominent, raised network of perpendicular, flat-topped ridges, crisscrossing and mutually intersecting to form a close-packed array of irregularly-shaped cells, roughly circular to ovoid to polygonal; cell floors reflecting light with a frosted appearance. Each ridge with a central row of minute, closely-spaced dimples, parallel to sides. Ridges without raised prominences or bosses at intersections. This pattern of ridges and cells continued onto the depressed micropyle, but there reduced to a very low eminence, becoming obsolescent. Color pale green when newly-laid, becoming dull white with increasing age. Duration of stage in one individual – 7 days (September 24-October 1).

B. Larva

Scarcity of properly spaced specimens, food plant and time available for observations in the United States prevented determination of the exact number and duration of the larval instars. There are at least three, and more probably four or five. Descriptions of later instars are based on several specimens.

1. First Instar. Length approximately 0.8-1.0 mm.; ground color of body pale, dull yellow, no markings; body clothed with long, light brown hairs; head light brown; ocelli brown to black.

2. Intermediate (Penultimate?) Instar. Body color varying from chartreuse to dusky rose; when chartreuse, having a pair of mid-dorsal, longitudinal, parallel, narrow, rose-colored stripes; spiracles whitish or pale yellowish; otherwise similar to mature larva.

3. Last Instar. About 16 mm. in length; head pale, dull yellow, ocelli black; body often with pale, yellowish-chartreuse ground color; a series of rather large, mid-dorsal, rose-colored, trapezoidal (long axis at right angles to body axis) markings, each narrowing anteriorly, one per segment, becoming obsolescent toward anal extremity; on each side a lateral, sub-spiracular, bright rose-colored stripe, the two joining at the anal extremity; body coloring rather variable from specimen to specimen, one individual being almost entirely dull, old-rose in color, devoid of any but a few very ill-defined markings, another being entirely chartreuse in color without reddish markings; cervical shield ("bald patch") grayish yellow; spiracles black with light-colored rim; a mid-dorsal series of shallow depressions or pits, one per segment, rather nearer anterior edge of segment; entire body densely clothed with dark-colored hairs.

C. Pupa

Apparently rather variable in size, color and setal armature. One individual 11 mm. in length; uniformly very dark brown in color; verging on black, immaculate; spiracles light brown; almost naked except for a few sharp, brownish-black setae on dorso-anal region of abdomen and on dorsal, especially antero-dorsal region of thorax; two small, bilateral, closely spaced groups of shorter, light brown spines with flattened tips on ventro-anal region of abdomen. Another individual was 9 mm. in length; ground color of abdomen light, rather reddish brown, with dark brown blotches especially concentrated in dorsal region; thorax and wing cases dull tan, with a heavy overlay of brown blotches; spiracles not distinguishable from ground color; vestiture of setae sparsely but generally distributed over thorax and abdomen, somewhat more densely in dorsal region. Duration of pupal stage in a single individual 20 days under laboratory conditions.

HABITS AND BEHAVIOR

A. OVIPOSITION AND ACCESSORY ACTIVITIES. Under natural conditions, males were often seen perching on the apex of the tall flowering stalk of *Echeveria gibbiflora,* presumably waiting for a female to pass by. This was the species most often chosen by the female for oviposition. Having located a likely plant, the female laid her eggs singly, fluttering about the plant each time to find a good spot. Both sides of the leaf were utilized, but most often the underside, and usually very near the base. A single female has been observed to spend two entire days depositing eggs on a single plant, without once leaving the spot.

B. LARVAL FEEDING

On *Echeveria gibbiflora,* the larva burrowed completely into the leaf and fed on the fleshy pulp in the interior, during which time a honey-like liquid was seen to drip from the entrance hole. This liquid was relished by small, black ants which appeared to attend the larvae without harming them in any way. The larva was also observed to expel its feces through this same hole. Little by little the interior of the leaf was consumed until it was reduced to a thin-walled shell which turned yellowish, withered and fell to the ground beneath the plant. Not infrequently the large number of larvae harbored by a single plant completely destroyed their host.

On *Sedum allantoides,* with its smaller leaves, the mature larva was commonly observed with the anterior part of the body inside the sausage-shaped leaf and the posterior portion outside. When the larvae had completely devoured the leaves, they burrowed into the fleshy stem and continued feeding therein, finally converting the plant into a small trunk riddled with perforations which could no longer support life.

C. PUPATION AND EMERGENCE OF IMAGO

Under laboratory conditions, a mature larva was observed to take up its position on the under surface of a leaf among several on the floor of the rearing cage. It was seen to reverse its position by 180 degrees at least twice, apparently during the process of spinning a silken pad on the leaf. It finally attached itself to this pad by anal hooks posteriorly and by a silken girdle anteriorly, during the early evening of 20 September. It was unchanged on the evening of 22 September, but had completed its molt to the pupal stage by the morning of 23 September. The newly-formed pupa was quite translucent; the thoracic region was very pale straw-colored, with bright pink shades along the edges of the wing cases and also in the abdominal region. By early afternoon of the same day the color had darkened to its final brown hue. The imago, a female, emerged on 12 October.

Flight Period

The butterfly appears to have at least three broods. Our observations suggest the greatest abundance of adults near Mexico City during July to September, with another concentration during December to January and perhaps a third during April to May. Klots (1951) gives June and September-December in southern Texas, while Clench (1961) gives April, June-July and October-December in the same region. Roever (*fide* Thorne, 1963) reported fresh specimens taken in Arizona in early April, early July and early October. Actually, in view of the succulent nature of the host plants, it seems not unlikely that this butterfly might be on the wing more or less continuously in areas where the temperature permits.

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SYSSPHINX BICOLOR (SATURNIIDAE) IN ONTARIO

The southernmost part of Ontario, lying in the Austral Zone, has yielded over the years, with refined collecting methods, some surprising records, like *Lacosoma chiridota* Grote and *Cicinnus melsheimeri* Harris (Lacosomidae), *Apatelodes torrefacta* J. E. Smith and *angelica* Grote (Zanolidae), *Heteropacha rileyana* Harv. (Lasiocampidae), the Mississippi Valley subspecies of *Hemaris diffinis* Bdv. (Sphingidae), *Melalopha inclusa* Hbn., *Hyparpax aurora* J. E. Smith, and *Datana contracta* Wlk. (Notodontidae). Now it is possible to add to those the Citheroniine, *Syssphinx* (*Sphingicampa*) *bicolor* (Harris). The first known specimens are a male and a female, collected in June and July 1943 by Tom Norris in Brantford, Ont. They were detected in student collection material at McMaster University in Hamilton, Ont., by D. M. Wood in 1962 and