OBSERVATIONS ON HYMENOPTEROUS PARASITES OF CERTAIN FULGORIDÆ.*

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In connection with life history studies of Fulgoridæ, the following species were reared from nymphs of Ormenis septentrionalis Spin., and Liburnia lutulenta Van D. The first two as primary parasites, and the third as a secondary parasite on Ormenis septentrionalis; the fourth and fifth as primary parasites on Liburnia lutulenta.

For the accurate identification of the first three species, I am indebted to Dr. William H. Ashmead, Assistant Curator, Department of Insects, U. S. National Museum, Washington, D. C. The third species mentioned, proved to be a new species, and was given the name below.

I. DRYINUS ORMENIDIS ASHM.

Entomological News, XIV, p. 192, 1903.

In August, 1902, while collecting the larvæ and nymphs of Ormenis septentrionalis Spin. (OHIO NATURALIST, Jan. 1903, p. 355.) some specimens were found to be infested with parasitic larvæ, which on being reared, proved to be Dryinus ormenidis Ashm.

The larva lives in a "felt-like sack protruding from a spiracle" (Ashmead) at the base of the abdomen of its host, and as the latter matures, the parasite is partially covered by the wing pads (Plate 20, Fig. 1). The full grown larva is 4–5 m m. in length, is footless, and has rudimentary mandibulate mouth parts (Plate 20, Fig. 4.). It finally causes the death of the host.; then it escapes from its sack, by the latter splitting very neatly in half, and it forms a cocoon beneath the remains of the host, on the surface of the leaf upon which the host has been feeding (Plate 20, Fig. 3). A cocoon was made in this manner, by a specimen in a breeding cage, Aug. 5.

The cocoon is oval or oblong-oval, 7 mm. x 5mm.; it is very white and semi-transparent, and of a low convex form, having the central portion which is occupied by the insect, a little more elevated (Plate 20, Fig. 2). This figure is of a cocoon, enlarged, showing the flat expanded portion, and the central part surmounted by the remains of the host, on the right side of which is shown the sack in which the parasite lived.

From August 5 to August 15, quite a number of leaves, having cocoons of this parasite, were collected from climbing bittersweet,

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dogwood, and other shrubbery, upon which nymphs of O. septentrionalis had been feeding. There were sometimes two and even three cocoons upon the same leaf (Plate 20, Fig. 3), and they usually were situated in the position that had been occupied by the host while living, as shown by the presence of the white waxy excretion with which the host surrounds itself on the leaf. The cocoon is very well hidden by this excretion, plus the remains of the host. It was evident that the O. septentrionalis nymphs were quite extensively parasitized.

Feb. 18, 1903—Examination of the above mentioned cocoons, (they having been kept in the laboratory during the winter), revealed six containing mature insects, all females (Plate 20, Fig. 6); one containing a pupa (Plate 20, Fig. 5); and in two cocoons they were still in the larval stage (Plate 20, Fig. 4). From this, inference is made that when remaining in natural situation among the fallen leaves during the winter, the larvæ wait till the following spring before transforming to pupæ, and that the adults would escape from the cocoons in the latter part of spring, or early summer.

All six adults and the one pupa were females. The adults were quite active when liberated from the cocoons, and it is probable that they would have soon liberated themselves. It was interesting to watch them rub their legs together, and rub them upon various parts of the body, to remove any fragments of exuvia or dust particles that might be present. It was particularly interesting to see the way they would clean the antennæ by drawing them through the antennal cleaners or combs situated on the fore legs (Plate 20, Fig. 7*a*). This structure consists of a curved row of closely set bristles, on the inner edge, at base of first segment of the tarsus. There is a large curved spine near the distal end of the tibia (Plate 20, Fig. 7*b*). When the leg is bent at this joint (Plate 20, Fig. 8), this spine is brought into opposition with the antennal comb in such manner as to hold the antenna against the comb whilst being drawn through. By moistening the antennæ, the insect was made to repeat this performance several times.

II. Labeo typhlocybæ Ashm.

Bull. 45, U. S. National Museum, p. 89, 1893.

In examining the same lot of cocoons from which D. Ormenidis was obtained, several specimens of this form were found: five adults, and one pupa; all males (Plate 21, Figs. 1, 2).

The cocoons from which these were taken were slightly smaller than the others. Otherwise they were similar, and the larvæ, also, it may be inferred, must have had similar habits; living in the same manner on the same species of host, and at the same time, and forming the same kind of a cocoon.

This lot of cocoons were supposedly all of the same species. That they were of different species was not known, until, on being opened, the two different species were found. Under the circumstances, the suggestion is inevitable that these must be male and female of one and the same species. The genus Labeo has heretofore been known only in the male sex, Ashmead being of the opinion that it represents the males of the genus Gonatopus. Gonatopus has wingless females, and only the females are known. Now, the difference in size and structure between Labeo and Dryinus are less than those between Labeo and Gonatopus.

Furthermore, if these specimens taken from the same lot of cocoons were of two distinct species, it seems strange that males and females should have occurred in about equal numbers (6 and 8 respectively), and that the males should all be of one species, while the females were all of the other. The evidence being, then, that these are one species, and since typhlocybæ has priority, the synonomy will stand :—

Dryinus typhlocybæ (Ashm.).

Labeo typhlocybæ Ashm., Bul. 45, U. S. Nat. Mus., p. 89, 1893.
Dryinus ormenidis Ashm., Ent. News, XIV, p. 192, 1903.

III. Cheiloneurus swezeyi Ashm.

Family—Encyrtidæ.
Sub-family—Encyrtinæ.

Entomological News, XIV, p. 193, 1903.

February 18, 1903, fourteen adults (Plate 21, Figs. 3, 4) of this chalcid-fly were found in the box containing the lot of leaves having the Dryinus ormenidis cocoons, previously mentioned in this article. Not knowing their source, it was supposed that they came from the Dryinus cocoons. Examination disclosed three Dryinus cocoons which were open, some insect or insects having escaped from them. No other insects being present, it was inferred that the Chalcids came from these three cocoons.

In opening cocoons and liberating adults of Dryinus and Labeo, as previously mentioned, one cocoon was found containing four pupæ (Plate 21, Figs. 5, 6), which in size and general structure, and particularly in shape of antennæ and the presence of tibial spines and spurs, identified them as the pupæ of the adult chalcids found in the same box. These chalcid pupæ were not enclosed in cocoons of their own. Another Dryinus cocoon contained five larvæ, which are probably Cheiloneurus larvæ.

This is rather insufficient data upon which to outline the Life History of this insect; but, in general, it probably is about as follows: The eggs most likely are deposited by the female puncturing the cocoon of Dryinus, during August; that is, soon after the cocoon is formed. A reason for thinking that the eggs are

not deposited in the larva before it has made a cocoon, is that, if the female Cheiloneurus were to try depositing eggs in the Dryinus larva while the latter was still in the sack, upon the body of the Ormenis nymph, this latter would most likely make a sudden jump, as it is accustomed to do on being disturbed, and this would dislodge the adult Cheiloneurus before she had had time to deposit the four to six eggs within the Dryinus larva The Dryinus larva supplies just about enough food for five Cheiloneurus larvæ. They very likely get their growth during the autumn; hibernate either in the larval or the pupal stage, and transform to adults early in spring. This would give time enough for more than one brood during the summer, providing its host also has more than one brood, or perhaps it is not unlikely that it finds some other host for an early summer brood.

One interesting point in connection with this species, is its parasitizing another Hymenopterous form; whereas the other species of Cheiloneurus are parasitic upon Coccidæ, and the most of the members of the same group, Encyrtinæ, are parasitic upon various species of Coccidæ and Aphididæ.

IV. Gonatopus bicolor Ashm.

V. Labeo longitarsis Ashm.

Bull. 45, U. S. National Museum, pp. 85, 88, 1893.

April 11, 1903, a nymph of Liburnia lutulenta was found infested with a parasite living in a sack protruding from the dorsal side of the abdomen (Plate 21, Fig. 13). The next day the parasitic larva escaped from the host and spun a cocoon between fragments of grass leaves.

April 14 and 20, about a dozen more similarly parasitized nymphs were obtained. In all of them the parasite had about completed its growth, and in a few days all had escaped from their hosts and spun cocoons. The cocoons were white, and some were cylindrical and formed in the groove of upper surface of grass leaves; others were made on flat surface of the breeding jar, and were similar in form to those of Dryinus ormenidis (Plate 20, Fig. 2), 5mm. long and 3 mm. wide.

May 12, the first adult appeared. It was a male Labeo longitarsis (Plate 21, Fig. 12). May 14, a female Gonatopus bicolor appeared (Plate 21, Fig. 11). These were both from cylindrical cocoons on grass leaves. May 17, another female G. bicolor, and May 18 and 19, each, a male specimen of L. longitarsis appeared. These were all that completed the transformation. None of the females came from a cocoon like Fig. 2; but one of the males did.

These parasites evidently hibernate with their host, which hibernates in the nymphal stage.

The evidence from these observations is that L. longitarsis is the male of G. bicolor, just as shown in previous part of this paper, L. typhlocybæ is undoubtedly the male of D. ormenidis.

In view of these observations and considerations, one can hardly escape the inference that the genus Labeo may, by further observations and rearing of larvæ of the different species be found to contain males of yet other genera of Dryininæ. The same might be inferred of other genera of Dryininæ that have hitherto been known only as males. Rearing larvaæ as above, or in more complete detail, will be helpful, or it may be said, in fact, necessary in properly associating the males and females of this sub-family and establishing their true generic and specific relationship.

In regard to the species under consideration, since G. bicolor and L. longitarsis have the same date of description, and since Gonatopus was the earlier of the two genera to be described, I would place the synonomy thus :—

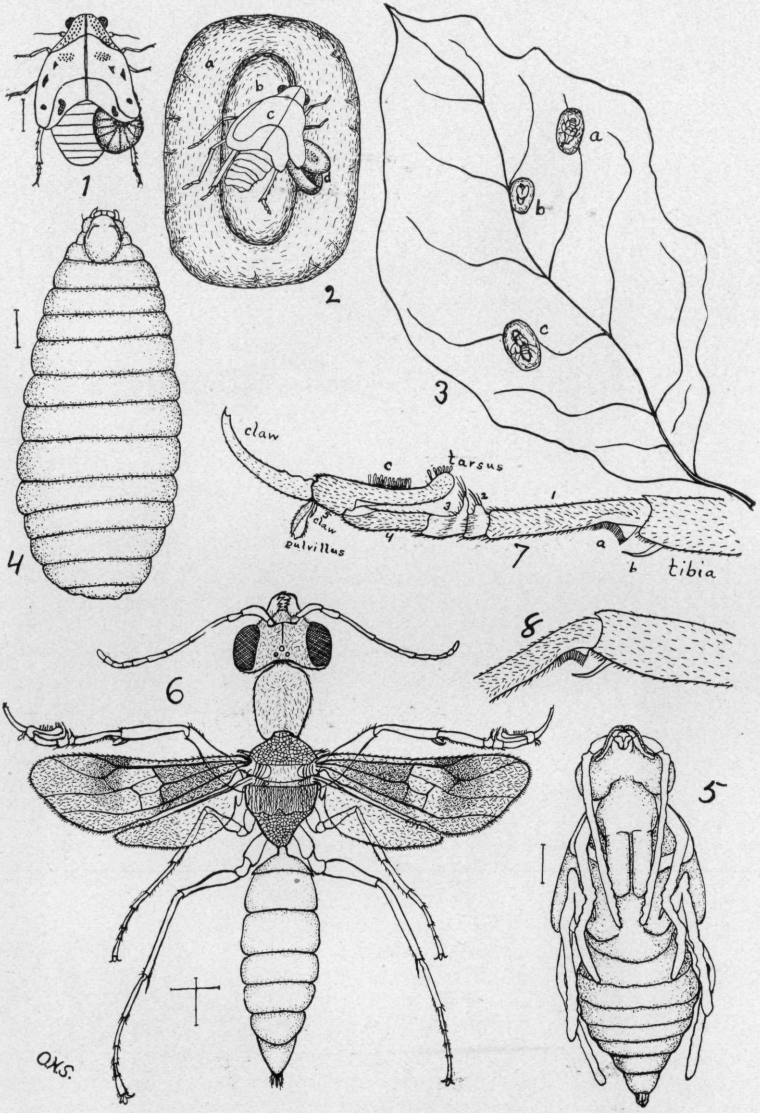
Gonatopus bicolor Ashm., Bul. 45, U. S. Nat. Mus., p. 85, 1893.

Labeo longitarsis Ashm., Bul. 45, U. S. National Mus., p. 88, 1893.

MORPHOLOGY OF THE CHELATE FORE-TARSUS OF THE FEMALES OF THE SUB-FAMILY DRYININÆ.

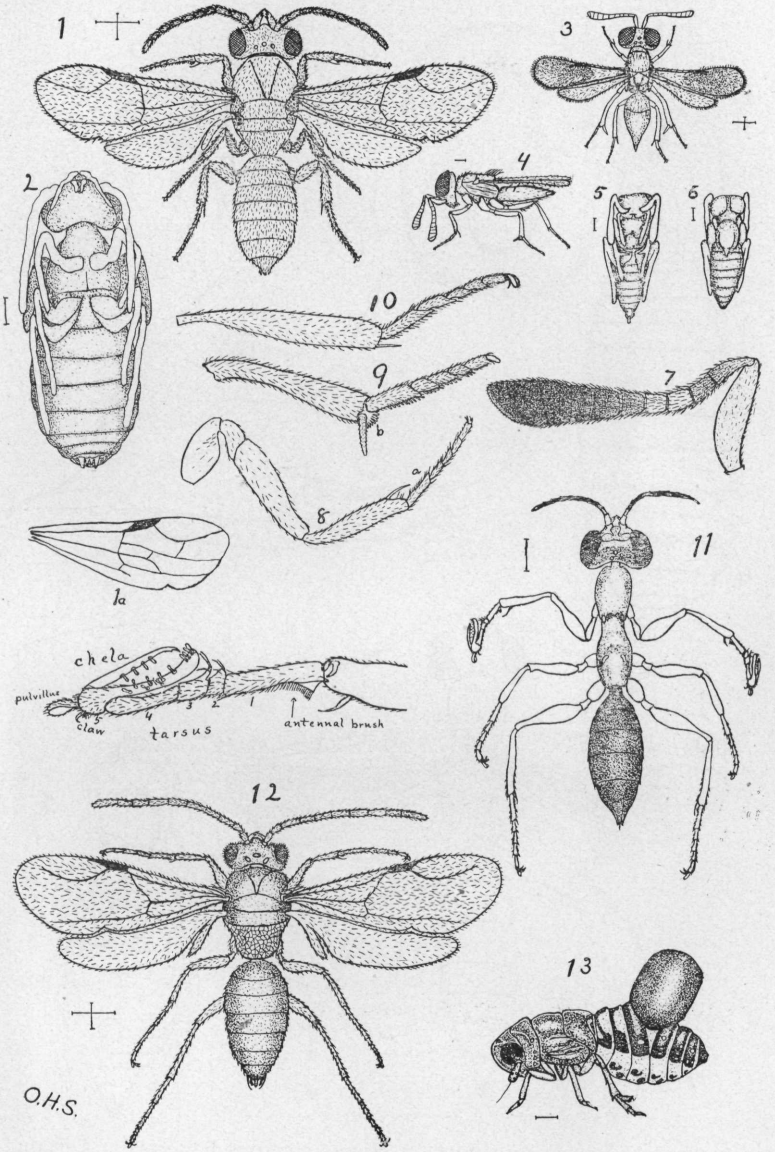
This peculiar structure is shown Plate 20, Fig. 7 and Plate 21, Fig. 14. It occurs in the females of nearly all the genera of the group. The fifth tarsal segment is enlarged and has a very peculiar elongate, backward extension from its outer side. This extends as far as to the proximal part of the second tarsal segment. It is curved, slightly tapering till near the tip where it is somewhat enlarged. At the distal end of the fifth segment are borne two claws with a pulvillus between them. The inner claw is about normal size; but the outer one is greatly elongated and articulated with the fifth segment in such a way that it may close up with the prolongation forming a forceps or chela (Plate 21, Fig. 14). The tip of the claw nearly reaches the tip of tarsal prolongation; it has a notch which forms a secondary tooth. At the tip of the tarsal prolongation and extending outward is a group of Indian-club-shaped appendages There are several of these also along its outer side, and a few on the claw as well.

"This peculiar chelate tarsus is found in no other group among the Hymenoptera" (Ashmead). No observations were made which would give one a hint of the particular use of this chela. May it be suggested, however, that it is used in some special manner in clinging to the host during the act of egg-deposition. The members of the family Proctotrypidæ are chiefly egg parasites, but this particular group of the family are parasitic upon larvæ, principally of the families Fulgoridæ, Membracidæ, and



SWEZEY on "Observations on Hymenopterous Parasites of Certain Fulgoridæ."

OHIO NATURALIST. *Plate 21.*



SWEZEY on "Observations on Hymenopterous Parasites of Certain Fulgoridæ."

Jassidæ, all of which have active jumping habits. Hence, this peculiar chela may have been developed for the special purpose of holding to the host larva while an egg is being deposited.

EXPLANATION OF PLATE 20.

Fig. 1—Nymph of Ormenis septentrionalis, showing the sack in which the larva of Dryinus ormenidis lives, protruding from beneath the right wing pads, x 5. Fig. 2—Cocoon of D. ormenidis; *a*, the flatter portion of it; *b*, the more convex portion which contains the pupa; *c*, exuvia of nymph of O. septentrionalis; *d*, the empty sack from which the Dryinus larva has escaped, x 5. Fig. 3—Leaf upon which there are three cocoons; *a* and *c*, cocoons of D. ormenidis, surmounted by exuviæ; *b*, cocoon of Labeo typhlocybæ, surmounted by larval sack, natural size. Fig. 4-8—Dryinus ormenidis. Fig. 4—Larva, x 10; Fig. 5—Ventral view of pupa, x 10; Fig. 6—adult female, x 10; Fig. 7—tarsus of fore leg; *a*, antennal brush, or comb on the first segment of tarsus; *b*, tibial spur which holds the antenna against the comb while being cleaned; *c*, peculiarly modified 5th tarsal segment, x 37. Fig. 8—Tarsus partly flexed at base to show how the spur comes into apposition and works with the antennal comb, x 37.

EXPLANATION OF PLATE 21.

Fig. 1—Adult male of Labeo typhlocybæ, x 10. Fig. 1*a*—Forewing of L. typhlocybæ, showing venation as it appeared shortly after transformation, x 10. Fig. 2—Ventral view of pupa of L. typhlocybæ, x 10. Figs. 3-10—Cheiloneurus swezeyi: Figs. 3-4—Adult female, x 10; Figs. 5-6—ventral and dorsal views of pupa, x 10; Fig. 7—antenna, x 50; Fig. 8—fore leg, at *a*, antennal comb, x 50; Figs. 9-10—tibia and tarsus of second and third legs, *b*, movable spur, x 50; Fig 11—female Gonatopus bicolor, x 10. Fig. 12—male Labeo longitarsis, x 10. Fig. 13—nymph of Liburnia lutulenta with parasitic larva in sack on its abdomen, x 10. Fig. 14—fore-tarsus of female Gonatopus bicolor, x 40.