AHOLCUS EUPROCTISCIDIS MANI (SCELIONIDÆ: HYMENOPTERA), AN EGG PARASITE OF *EUPROCTIS LUNATA* WALKER

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The family Scelionidæ comprises a large number of genera of small size insects which have a unique character of parasitising eggs only, particularly those of Lepidoptera, Hemiptera, Orthoptera, Diptera and Arachnida. However, there are instances where they parasitise the eggs of coleopterous and neuropterous insects as well. Representatives of this family have been successfully employed in the biological control of insect pests in Hawaii, New South Wales and other regions. It is rather surprising that the biology and morphology of the immature stages of this group are not clearly known, though some information is available here and there. In this country the biology of the Scelionidæ has not been worked out before. This family exhibits some peculiarities in the morphology and in the development of the tracheal system in the immature stages. These aspects have been studied in detail in this investigation of the biology and morphology of the Scelionid.

Habits of the Adult Parasite

Aholcus euproctiscidis Mani is an important egg parasite of *Euproctis lunata* Walker that is a serious pest of castor throughout India. The damage caused by the voraciously feeding caterpillars is sometimes colossal and instances are not rare when the whole crop has been destroyed. The adult parasites are seen visiting the castor leaves in search of their host eggs during August, September and October when the host population is at its height.

Pre-oviposition Period

The parasites mate soon after emergence and the pre-ovipositional period varies from 12 to 24 hours.

Oviposition

The female parasite when it comes in the vicinity of the host egg mass examines it by gentle tapping of its antennæ and makes its way to the eggs through the fluffy fibrous material covering them. It then inserts the

ovipositor through the egg shell. Laboratory studies and field observations have indicated that the time taken to lay an egg varies from 5 to 10 minutes or more at times.

As a rule only one egg is deposited in a host egg. However, observations have shown that sometimes two eggs are laid in a single host egg. However, in every such case only one individual successfully completed its development and emerged as an adult, even though more than one egg was laid in the host egg.

Immature Stages

The Egg (Fig. 1, 1).—The egg is stalked, the body being spindle-shaped and measures 0·095 mm. in length. The pedicel measures 0·056 mm. in length while the spindle-shaped body is 0·044 mm. wide. The egg is translucent and is seen floating in the yolk of the host egg.

First Instar Larva (Fig. 1, 2).—The first instar larva of Scelionidæ is called the "teleaform" larva. It hatches out after an incubation period of 1 to 2 days. Its body is unsegmented, but is divided by a sharp constriction into two regions, namely, a cephalothorax and an abdomen, both being curved dorsally. At the cephalic end of the body there are two curved and pointed mandibles. On the ventral side of the thoracic region there is a small process that disappears in the second instar larva. The mandibles are long and fleshy and unsclerotised. There is a band of setæ separating the cephalothorax and the abdomen. The abdomen is globular and ends in two equally developed caudo-ventral horns that are unsclerotised and directed forwards.

As the first instar larva develops its size increases. A sac-like yellow alimentary tract appears within the abdomen and one of the caudo-ventral horns becomes reduced in length. When the larva is 2 days old, two more bands of setæ appear below the first band, one towards the ventral side and the other towards the dorsal side (Fig. 1, 3). As further development takes place the sac-like alimentary tract becomes larger.

The maximum length of this stage was 0·37 mm. and width 0·27 mm.

Second Instar Larva (Fig. 1, 4).—After 2 to 3 days of feeding and development, the larva moults. The second instar larva is irregularly ovoid. The mandibles are still well developed, but the setæ become irregular in arrangement. The caudo-ventral horns become reduced; one becomes much shorter than the other. The larva also becomes reduced in size. There is no trace of body segmentation or tracheal system or spiracles. The duration of the second stage is very short and lasts for about a day.

The maximum length of the second instar larva was 0·34 mm. and width 0·25 mm.

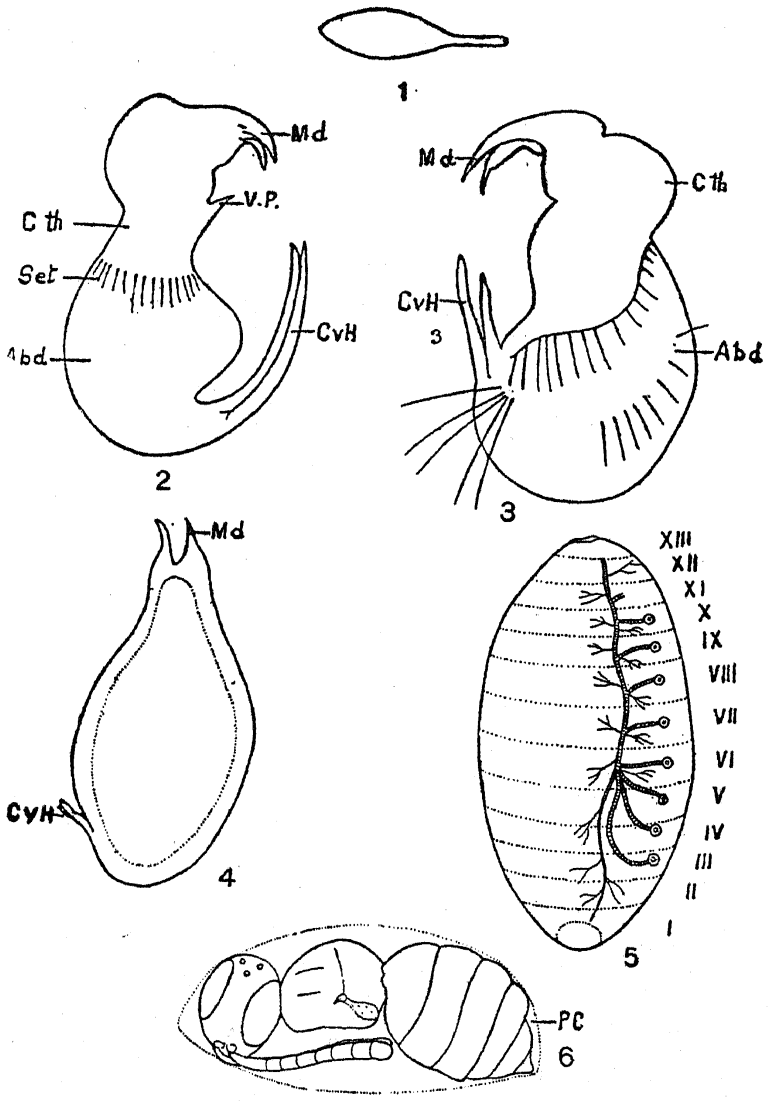

FIG. 1.—1. Egg. 2. Early first instar. 3. Late first instar. 4. Second instar larva 5. Arrangement of tracheal system in the third instar larva. 6. Pupa.—*Abd*-Abdomen; *Cth*-Cephalothorax; *CvH*-Caudoventral horn; *Md*-Mandible; *Set*-Setæ; *V.P.*-Ventral Process.

Third Instar Larva (Fig. 1, 5).—In the third instar larva the appendages are absent. But the body becomes clearly segmented and the tracheal system makes its appearance. The mandibles become short, but well sclerotised. The larva has thirteen segments. The tracheal system consists of two lateral longitudinal trunks united anteriorily, but not posteriorly. There are 8 pairs of spiracles and these are present on segments 3 to 10. The spiracles are connected to the lateral longitudinal trunks by means of long

spiracular stalks. On the 11th segment only the spiracular stalk is present. It is interesting to note that the spiracular stalks of segments 3, 4 and 5 and the tracheæ that supply the head region take their origin from the lateral longitudinal trunk in segment 6. Only in segments 5 to 12 are the dorsal and ventral branches present.

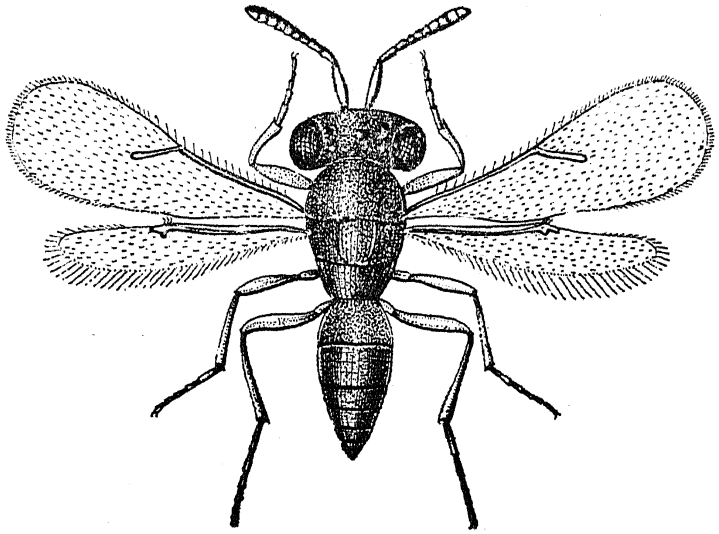

FIG. 2. *Aholcus euproctiscidis* Mani. Adult female.

The larva, now developing rapidly, devours all the egg contents. The alimentary sac becomes more prominent. It is a closed one. Now the larva secretes a thin cocoon-like protective structure around its body and prepares to pupate. The labial and the ileac glands perhaps secrete a thin viscid fluid which hardens to form the protective covering. Just before pupating the larva ejects the excrement. The duration of this stage is about 2 days.

The maximum length of the third instar was 0·66 mm. and width 0·48 mm.

Pupal Stage.—The pupa is black and imparts a black colour to the host egg. The adult parasite cuts a round hole on the egg shell and emerges.

Length of Life-Cycle.—The length of the life-cycle varied from 12 days in September (Maximum temperature 88° F., Minimum temperature 77·5° F. and Relative Humidity 75%) to 15 to 16 days in November (Maximum temperature 78° F., Minimum temperature 71° F. and Relative Humidity 60%).

Stage	*No. of days*
Incubation period of egg	1–2
First instar larva	2–3
Second instar larva	1
Third instar larva	2
Pupal stage	6–8

DISCUSSION

There is very little published record on the biology and morphology of the immature stages of this economically important group of parasitic insects. The present investigations have given some indication of their oviposition habits, larval development and the arrangement of tracheæ in the larvæ.

Oviposition.—Some members of the family Scelionidæ, including *Aholcus euproctiscidis* show preference for freshly laid host eggs for oviposition. Van Vuuren (1935) observes that in *Phanurus beneficiens* (Zehntner), an egg parasite of *Schœnobius bipunctifer* Walker, oviposition takes place only soon after egg deposition by the host female. Parman (1928) states that *P. emersoni* Girault does not oviposit in *Tabanus hyalinipennis* Hine eggs which are more than six hours old. The " teleaform " larva, which is very tiny and delicate, in all probability will not be able to pierce with its soft mandibles the body-wall of the embryo, once the body-wall becomes hardened and hence the adults prefer freshly laid host eggs for oviposition. But according to Costa Lima (1928) *Telenomus fariai* Costa Lima develops successfully in eggs of *Triatoma* whose embryos are well advanced at the time of oviposition by the parasite. Pemberton (1933) mentions that *Scelio pembertoni* Timberlake parasitises *Oxya chinensis* Thunberg eggs in all stages of development. Thus it is observed that while some members of the family Scelionidæ show a marked preference for freshly laid host eggs, others do not show such preference.

Superparasitism.—A considerable degree of selectivity is exhibited by many species of Scelionidæ. It has been observed by Morrill (1907) that the females of *Telenomus ashmeadi* Morrill are able to discriminate the parasitised host eggs from the healthy eggs by the scrapings made on the former by the ovipositing females. The same observation was made by Costa Lima in the case of *T. fariai.* Usually one egg is laid in a host egg by *Aholcus euproctiscidis.* However, in the case of *Eumicrosoma benefica* Gahan, McCulloch and Yuasa (1915) state that the females lay in eggs of *Blissus leucopterus* Say containing various stages of their own species. Noble (1935)

says that even though more than one egg of *Scelio fulgidus* Crawford in *Calataria terminifera* Walker was observed, only one reached maturity. This phenomenon was noticed in the case of *Aholcus euproctiscidis* also.

Immature Stages.—The first instar larva of *Aholcus euproctiscidis* differs from those of other species of Scelionidæ in having no antennal processes above the base of the mandibles and in having two caudo-ventral horns. The antennal processes were observed, among others, by Pemberton (1933) in *Scelio pembertoni* and Noble (1935) in *Scelio fulgidus*. In all Scelionids whose life-history has been worked out, only one caudo-ventral horn is mentioned. In some species one or two supplementary lobes are also observed. But in the case of *A. euproctiscidis* two equally developed caudo-ventral horns are present.

Only in very few cases has the second instar larva been described. This stage in *A. euproctiscidis* has no tracheal system or spiracles, but the segmentation is not discernible, as observed by Jones (1937) in the case of *Telenomus ulyetti* Nixon. McCulloch and Yuasa (1915) state that the second instar larva of *Eumicrosoma beneficia* has faint segmentation of the body and possesses 4 or 5 pairs of spiracles. But the present authors are inclined to believe that this stage described by McCulloch and Yuasa is really the third instar and not the second. Many other workers have apparently observed only two instars, *e.g.*, Bakkendorf (1933) in *Phanurus angustatus* Thomson and Noble (1935) in *Scelio fulgidus*. An interesting feature of this stage is the reduction in size as compared to the first stage, which is perhaps peculiar to this group of insects alone. However, the larva attains the maximum growth in the third and the last instar.

The third instar larva is distinguished by the presence of a well developed tracheal system, the spiracles and the well defined body segments. The mandibles become short, but well sclerotised. *A. euproctiscidis* has 8 pairs of spiracles. Nine pairs of spiracles have been reported in *Telenomus ulyetti* Nixon by Jones (1937). Kamal (1938) states that in *Microphanurus basalis* Wollaston though a full complement of 9 pairs of spiracles are present, only the two pairs of thoracic spiracles are functional and the rest are minute and closed. In *A. euproctiscidis* all the 8 pairs of spiracles are well developed and functional. There are only stalks and no spiracles in the second segment. It is observed that the larva before pupating secretes a thin membranous protective covering. In the case of Encyrtids the function of ileac and labial glands in secreting a thin protective covering before the larva prepares to pupate is well known. However, the protective cover-

ing in the case of Scelionids has not been mentioned by any workers so far. Bakkendorf (1933), while studying the biology of *Phanurus angustatus*, has observed this covering and he has shown it in his figures. But he has neither described it nor named it.

SUMMARY

1. *Aholcus euproctiscidis* Mani is an important egg parasite of *Euproctis lunata* Walker, which is a serious pest of castor.

2. Freshly laid host eggs are preferred by the parasites for oviposition.

3. Usually only one egg is laid in a host egg by the parasite. In any case only one individual completes development and emerges successfully.

4. The first instar larva differs from those of other Scelionidæ, whose life-cycle has been worked out, in not possessing antennal processes and in having two caudo-ventral horns. Only one caudo-ventral horn was observed in others.

5. A definite second instar larva is present.

6. The third instar larva has a well segmented body, a well developed tracheal system and 8 pairs of functional spiracles.

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* Not seen in original.