

Studies on the Biology and Rearing of an Indigenous Parasitoid *Eriborus argenteopilosus* Cam. (Hym., Ichneumonidae)

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ABSTRACT

Eriborus argenteopilosus Cam., is an indigenous solitary larval endoparasitoid of a polyphagous pest *Heliothis armigera* (Hubn.) in India. Developmental periods of egg, different stages of larva and pupa are described. A detailed description is given on the technique developed for the laboratory mass breeding of *E. argenteopilosus* on an alternative host, *Spodoptera litura* (F.).

Key words : *Eriborus argenteopilosus*, development, mass rearing technique, *Heliothis armigera*, *Spodoptera litura*.

Eriborus argenteopilosus Cam. (Hymenoptera, Ichneumonidae) is commonly found parasitizing larvae of *Heliothis armigera* (Hubn.) on tomato in and around Bangalore. Rao (1968) reported *E. pilosellus* Cam., on *H. armigera* while Bhatnagar *et al.* (1982) found *E. trochanteratus* Morley attacking the same pest. An unidentified species of *Eriborus* was also collected from *H. armigera* (Divakar and Pawar, 1983). However, Achan *et al.* (1968), Bilapate (1981) and Pawar *et al.* (1985) have reported *E. argenteopilosus* as widely attacking *H. armigera* in tomato, cotton, pigeonpea and safflower ecosystems.

E. argenteopilosus was also known to attack other host insects like *Spodoptera litura* (F.), *S. exigua* (F.) (Beeson, 1938; Patel *et al.*, 1972) and *Prospalta capensis* (Gr.) (Paliwal and Jakhmola, 1981). Except these records and reports, not much information is available on *E. argenteopilosus*. Therefore a study on the biology and rearing method of *E. argenteopilosus* was conducted.

MATERIALS AND METHODS

Larvae of *H. armigera*, collected from tomato fields, were reared on artificial diet developed by Nagarkatti and Satyaprakash (1974) for observing the emergence of *E. argenteopilosus*. Adults of *E. argenteopilosus* emerged from parasitized larvae were released in a well ventilated plastic jar (11.5 x 7.5 cm) for mating and were provided with 40% honey solution in swabs. Mated females were segregated and held in individual jars (11.5 x 7.5 cm) with food. These females were offered daily with 2-4 day-old *S. litura* larvae for parasitization

until death. Parasitized larvae were reared initially on castor leaves and later individually on artificial diet in vials. A set of 20 parasitized larvae were dissected out at an interval of 6, 24, 30 and 48h to record the incubation period of the egg of the parasitoid. To record number of instars of the grub, dissections were made at 24 h interval after hatching. Cocoon period, sex ratio and adult longevity were recorded. Twenty replications were maintained for each stage. Observation was also made on the number of progeny produced by each female. Measurements of eggs, different instars of grub and cocoons of *E. argenteopilosus* were taken. Mass rearing of the parasitoid was done using larvae of *S. litura* and the method is described elsewhere in this paper. All these studies were carried out at 26±2°C and 60-70% RH in the laboratory.

RESULTS AND DISCUSSION

Freshly deposited egg is hymenopteriform, whitish, elongate, broadly rounded at both ends and slightly curved in the middle. The incubation period is 38 to 48h (Table 1). Perera (1977) reported an incubation period of 1 to 1½ days for *E. trochanteratus*. The size of the egg laid by *E. argenteopilosus* is presented in Table 2. It is observed that the egg size was bigger than that of egg of *Campoletis chloridae* Uchida, which also attacks *H. armigera* in the field (Gangrade, 1964).

On hatching from the egg, the caudate type of grub was found floating in the haemolymph along with empty egg case. During this period, the grub was found to destroy the supernumerary eggs (if any) laid by the parasitoid. This period lasted for 48h (Table 1).

Table 1. Developmental period of immature stages of *E. argenteopilosus* on *S. litura*

Stage	Developmental Period* (h)		
	Min.	Max.	Mean
Egg	38	48	42
Grub I instar	46	50	48
II instar	46	50	48
III instar	48	72	66
IV instar	48	72	62
Cocoon	7.5 days	9.0 days	8.6 days
Total	16.9 days	21.2 days	19.7 days

* Mean of 20 replicates

The second instar was characterized by a reduction in the length of tail, which, though persisted prominently. The tail was shorter and thicker than in the first instar. The gut contents were yellowish in appearance; the grub was elongate and yellowish white. There were 13 body segments, the tail being the last one. Fully grown second instar had a greatly reduced tail and lasted for 48h (Table 1). At the end of the second instar, the grub became oriented within the host; its head was positioned towards the anal end of the host. Similar observation was also made by Gangrade (1977) in *C. chloridae*.

Third instar was creamy white, elongate and conspicuously flattened. The head was narrow and retracted within the thorax. The body segments were approximately equal in size, except the last one. The intersegmental lines were deeply infolded. This stadium lasted for 48 to 72 h. (Table 1).

Table 2. Measurements of immature stages of *E. argenteopilosus*

Stage	\bar{x} length * (mm)	\bar{x} width * (mm)
Egg		
Freshly laid	0.29	0.10
Full grown	0.49	0.14
Grub I instar		
Freshly hatched	0.55	0.15
Full grown	1.61	0.24
II instar	1.86	0.29
III instar	7.74	1.64
IV instar	11.47	2.84
Cocoon		
Male	7.92	3.01
Female	8.53	3.33

* Mean of 20 replicates

In, fourth instar, the whole body had a pebbled appearance as observed in the case of *C. chloridae* by Gangrade (1977). The hymenopteriform grub could be seen moving within the host body and gave the host a whitish or reddish white appearance. The host at this stage was nearly dead with its thoracic legs and prolegs straight and wide apart. The parasitoid grub before making final exit, consumed the entire contents of the host body. When the grub was nearly half way out, the parasitoid was seen to bend itself towards the anterior end of the host remnant and started construction of its cocoon. This stadium also lasted for 48 to 72 h (Table 1).

Perera (1977) reported that the developmental period of grub was 7 to 8 days in the case of *E. trochanteratus* which is shorter than *E. argenteopilosus*. The increase in size of second instar from fully grown first instar was not much. But enormous increase in size was found in third and fourth instars (Table 2). The full grown grub of *E. argenteopilosus* appeared to be much longer than that of *E. trochanteratus* (4-6 mm in length and 2-3 mm in width) (Perera, 1977) and *C. chloridae* (6.4 - 7.8 mm in length and 1.6 - 1.9 mm wide) (Gangrade, 1964).

The external case of the cocoon was loosely spun while the internal case reinforced and tough. When the grub was separated from its cocoon, it failed to construct cocoon further. Cocoons were cylindrical and those of males were pale whitish, while that of females were dark buff coloured. The size of the cocoon is furnished in Table 2. Prepupal period actually began when the parasitoid stopped feeding. The prepupa cut its way out of the host and started spinning its cocoon. The pupa was of the exarate type. The total period from cocoon formation to adult emergence ranged from 7.5 to 9.0 days (Table 1). The adult emerged by cutting a circular opening at the cephalic end of the capsule. Adults were ready for mating immediately after their emergence. The male displayed excitement, vibrating his antennae and fluttering wings internally upon location of female and effected copulation by bending the abdomen under her body. During mating, both remained quiet for 3 to 7 min. Females mated more than once.

A pre-ovipositional period of 48h was observed. The antennae vibrated rapidly, touching the host body in an apparent effort to locate the spot for a strike. Soon the abdomen was bent and the ovipositor thrust into the body; 2-5 seconds

later, the ovipositor was withdrawn. Super parasitism was common. Total number of eggs laid per female varied from 120 to 310, but fertile eggs were not laid in the last few days of its life as observed by Perera (1977) with *E. trochanteratus*; the latter species laid 68-164 eggs. Ultimate successful progeny resulting from each female varied from 90 to 207. In the presence of 40% honey solution as food, the male and female survived for 7.17 and 13.22 days respectively. Perera (1977) observed that the female *E. trochanteratus* survived for 6-13 days (mean 11 days). The sex ratio of *E. argenteopilosus* was 1 : 0.61 (male:female) under laboratory conditions.

S. litura larvae were used instead of *H. armigera* to breed *E. argenteopilosus* for the reason that the parasitized *S. litura* larvae were relatively hardier than the parasitized larvae of *H. armigera* which invariably succumbed to outbreak of viral and bacterial diseases in the laboratory. Two to 4 day-old *S. litura* larvae were found ideal for parasitization. Continuous exposure of older larvae (beyond 5 days old), weakened the female quickly.

The parasitoids mated readily soon after emergence when held together at 1:1 ratio in well ventilated plastic jars (11.5 x 7.5 cm). When a number of parasitoids were in one jar, a mating pair was invariably disturbed by other males which tried to copulate with the same female. The females in such instances were either unduly exhausted or internally damaged, and died soon after copulation. By way of careful isolation of mating pairs into individual vials this was avoided. Food was provided by way of 40% honey solution in cotton swab. Mated females were used for parasitization after completion of preovipositional period of 2 days. Active oviposition was normally observed in the morning hours.

The larvae of *S. litura* was taken on the tip of a camel hair brush and introduced into the jar where mated females were held. The female quickly responded and parasitized. Parasitized larvae were held together initially on castor leaves for 5-6 days and later segregated and released individually on artificial diet in vials. The larva bored into the diet and constructed a cell after 8th or 9th day of parasitization. This behaviour of constructing a pre-pupal cell was probably induced by the parasitoid's presence inside the host. The host was killed by the parasitoid on 10th or 11th day of

parasitization and the parasitoid grub came out of the host and spun a cocoon inside the cell itself. The cocoons were collected from such cells after 6-7 days of formation without damage and held together in a clean plastic jar for adult emergence. From 9th day onwards, the adult started emerging from the cocoons.

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