

STUDIES ON THE BRACONID, *AMYOSOMA ZEUZERÆ* ROHWER  
AN ECTOPARASITE OF THE COFFEE RED BORER, *ZEUZERA COFFEAÆ* NIETNER

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SEVERAL parasites are recorded on the Red borer, *Zeuzera coffea* Nietner (Lepidoptera—Cossidae), a potential pest of Arabica coffee, *Coffea arabica* L.<sup>1,2,4-7</sup> Two of these, the entomogenous fungus, *Beauveria bassiana* Bals., and the braconid external parasite, *Amyosoma zeuzerae* Rohwer,—at least subspecifically different from *A. zeuzerae* Rohw. reported from Java<sup>3</sup>—have been found widely distributed in various coffee zones in South India. Field surveys at the Coffee Research Station, Balehonnur, have shown that a high percentage of host larvae is parasitized by the two aforesaid enemies; the latter contributing to at least 30% in March to May; the peak period of infestation.

In view of the obvious efficiency manifested by *A. zeuzerae* and of the apparent lack of information in the literature on its habits and life-history, studies were undertaken on these aspects at the Coffee Research Station. Host and parasite materials were collected in the field, and in the laboratory, observations were carried out by confining them in glass jars and glass chimneys of suitable sizes. The adult parasites were fed on a mixture of diluted honey and sugar solution. Temperature and relative humidity were recorded with a thermohygrograph during the study.

#### HABITS

It was seen that all instars of the host larvae were parasitized, though the later instars sustained more parasites than the earlier ones. Parasitism was found confined on larvae in the primary and in the small branches of host plants than on those in the main stem. The locus of oviposition varied from the first thoracic to ninth abdominal segments of the host. Eggs were deposited mostly dorsad of the host, either singly or in groups of two to six. The maximum number of eggs found on a host larva was eight.

#### LIFE-HISTORY

Freshly laid egg was glistening white in colour, mildly curved dorsoventrally, with the cephalic region slightly broader and more rounded than the caudal end. It measured about 1.0 mm. long by 0.25 mm. broad. During the latter part of incubation period, which lasted for 24-36 hours, the movements of the emerging larva were clearly visible through the chorion.

Eclosion took place through the cephalic end of the egg.

There were four larval instars. Freshly emerged larva was pale white in colour and was about the same size as the egg. The head was triangular with the almost cylindrical antennae placed anterodorsally. The thoracic and the ten abdominal segments bore prominent setae dorsally and dorsolaterally. Spiracles were absent. After active roving on the host body for some time, the larva selected the intersegmental folds as the loci of attachment. Through the wound created by the sharp mandibles the body contents of the host were sucked in rhythmically. As feeding continued, the larva became more opalescent and, when full grown, it measured 0.7 mm. to 0.75 mm. in length. The instar averaged 30 hours in duration.

Body segmentation in the second instar larva was not as distinct as in the first and the prominent setae of the latter were found replaced by evenly distributed small setae. The head and the antennae were not as prominent as in the first instar and the former appeared retractile into the prothorax. In contrast to the first instar, spiracles were present in the prothoracic and first eight abdominal segments. They had a circular peritreme and a shallow, triangular non-reticulated atrium leading to an annulated stalk provided with a thick-walled closing apparatus. There were no apparent differences in the structure of spiracles on various segments. Feeding was almost continuous with interruptions for changing the site of attachment. The engorged food contents appeared as a coralline streak along the length of the body. The mesenteron was a blind sac and did not communicate to the exterior through the hind gut. The average length of the larva just before moult was 1.5 mm. The instar lasted for about 24 hours.

The third instar larva possessed a prominent tracheal system, well contrasted against the dark body contents. With continued feeding and consequent increase in size, white discoid bodies appeared in the body dorsally. When engorged, the larva averaged 2.5 mm. in length. The instar ranged from 36 to 48 hours in duration.

The fourth instar larva, in general, appeared similar to the third except for the body size and proportion of the head. The latter was protruded

and appeared not so retractile as in the earlier instars. Increase in size was noticeable especially on abdominal segments four to eight. The white discoid bodies were found in groups and coralline body contents were localized posteriorly in abdominal segments three to eight. When full grown it measured 2.9 mm. in length. As feeding stopped, the larva prepared for pupation and an average duration of 24 hours intervened between abandoning of the host body and commencement of spinning cocoon. The latter process, also lasting for 24 hours, consisted of three phases; the first in which the foundation strands were attached to the surface by extending them over the larva; and the second and third phases when further strands were laid to make a closely woven matrix. On completing 5 days in the fourth instar, the larva entered the prepupal stage, the latter averaging 48 hours in duration.

The cocoon was papyraceous, shining white in colour, measured 8.0 mm.  $\times$  2.0 mm. and often occurred in moist locations in groups of three to five enveloped in a common web. The maximum distance observed between these and the host remains was 12.75 cm. In the field, cocoons within the secondary and tertiary branches were located towards their proximal ends.

The mesenteron which was a blind sac till the last larval instar established connection with the hind gut during the prepupal stage and this was followed by the extrusion of meconium as brownish black droplets.

The exarate pupa, to begin with, appeared shining white in colour. Eyes and ocelli progressively became pigmented. At the end of five days, the head became completely black and nitidous. The prothorax was black dorsally, while the meso- and metathorax less so. A dusky linear pattern developed on the median dorsal region of first abdominal segment while the rest of the abdomen was yellow to light brown. By the seventh day, head, thorax and appendages were completely black and further pigmentation took place on the abdominal segments. Mild movements were discernible by the ninth day and emergence of the imago took place on the eleventh day through an irregular hole at the cephalic region of the cocoon. Emergence occurred only during daytime. It was also observed that all adults, irrespective of the size and number of cocoons in a group, emerged

within two hours while, those from cocoons kept singly, and isolated from each other, took longer periods for the process. Thus, it appeared that in a group of cocoons, the mechanical stimulus transmitted by one imago, in the process of emergence, induced the quick succession of other emergents.

The adults were highly phototropic and their longevity averaged five and six days for male and female respectively. Table I gives the duration of stages in relation to temperature and relative humidity.

Parasitized hosts appeared paralysed and became progressively pale and flaccid. Body wall bore yellow areas in patches suggesting the loci of attack of the parasite larvæ. Ultimately, only the flexible cuticle of the host body remained; the parasite larvæ having consumed the entire body contents.

TABLE I  
Life-history of *A. zeuzeræ*

Stage	No. of cases	Duration in hours/days	Average		
			Max. Temp. °C.	Min. Temp. °C.	R.H.
Egg	12	24-36 hrs.	27.8	24.4	46.87
I instar larva	12	30 hrs.	28.9	24.4	51.75
II	12	24 hrs.	27.8	25.6	60.75
III	12	36-48 hrs.	27.2	24.7	55.00
IV	12	5 days	27.5	24.7	57.84
Prepupa	22	48 hrs.	27.2	25.5	64.92
Pupa	22	11 days	26.6	24.2	69.20
Adult	♀ 15	8 days	27.3	25.3	68.58
	♂ 10	5 days	27.3	25.7	69.95

The author is grateful to Dr. P. S. Sekhar, Entomologist, for guidance and help in preparation of this paper and to Dr. N. G. Chokkanna, Director of Research, for evincing keen interest in the study. He is also indebted to the staff of the Division of Entomology for help in collection of host and parasite material.

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