BIOLOGY AND MORPHOLOGY OF IMMATURE STAGES OF *BRACON BREVICORNIS* (HYMENOPTERA : BRACONIDAE) AN IMPORTANT BIOLOGICAL CONTROL AGENT OF THE BLACK-HEADED CATERPILLAR PEST OF COCONUT[1]

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(With fifteen text-figures)

Bracon brevicornis (Braconidae : Hymenoptera) is one of the important biological control agents of *Nephantis serinopa*, the black headed caterpillar pest of coconut. An account of the biology and morphology of the immature stages of this parasitic wasp is given. There are five larval instars and the duration of development from egg to adult takes about 7-8 5 days.

INTRODUCTION

Bracon brevicornis (Hymenoptera : Braconidae) is one of the important biological control agents of *Nephantis serinopa*, the black-headed caterpillar pest of coconut in S. India. Though information on the biology of this parasitic wasp is available (Cheriyan 1928 ; Ramachandra Rao *et al.* 1948 ; Nirula 1955) no detailed studies have been made on the biology and morphology of its immature stages, hence the present study has been undertaken.

MATERIALS AND METHODS

In the laboratory *Corcyra cephalonica* S. was used as the host for rearing the parasite. Observations on the immature stages were done under Leitz Wetzlar Ortholux and Bausch & Lomb Stereozoom microscopes. Measurements of immature stages were taken using ocular micrometer. For the study of mouth parts, larvae were mounted in gum chloral. The diagrams were drawn by using camera lucida. The larval instars are determined by measuring the size of the mandibles as well as the diameter of the first thoracic spiracle which varies from instar to instar.

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OBSERVATIONS AND RESULTS

DESCRIPTION OF LIFE STAGES :

Egg (Fig. 1)

Freshly laid egg is typically hymenopteriform and measures 0.40 to 0.55 mm in length and 0.13 to 0.15 mm in width. It is translucent and milky whitish in colour. Chorion is smooth, shiny and devoid of any sculpturing. It contains little yolk when laid and it occupies the entire area within the chorion leaving only a little space.

Hatching

The incubation period varies from 24-28 hours. When the egg is approximately twenty hours old, developing larva is visible through the transparent chorion. A wriggling movement of the larva is noted 4-5 hours prior to eclosion. Segmentation of the larva is quite distinct at this stage. Later 4-5 hours after the start of the wriggling movement a rupture forms on the chorion at the cephalic end of the

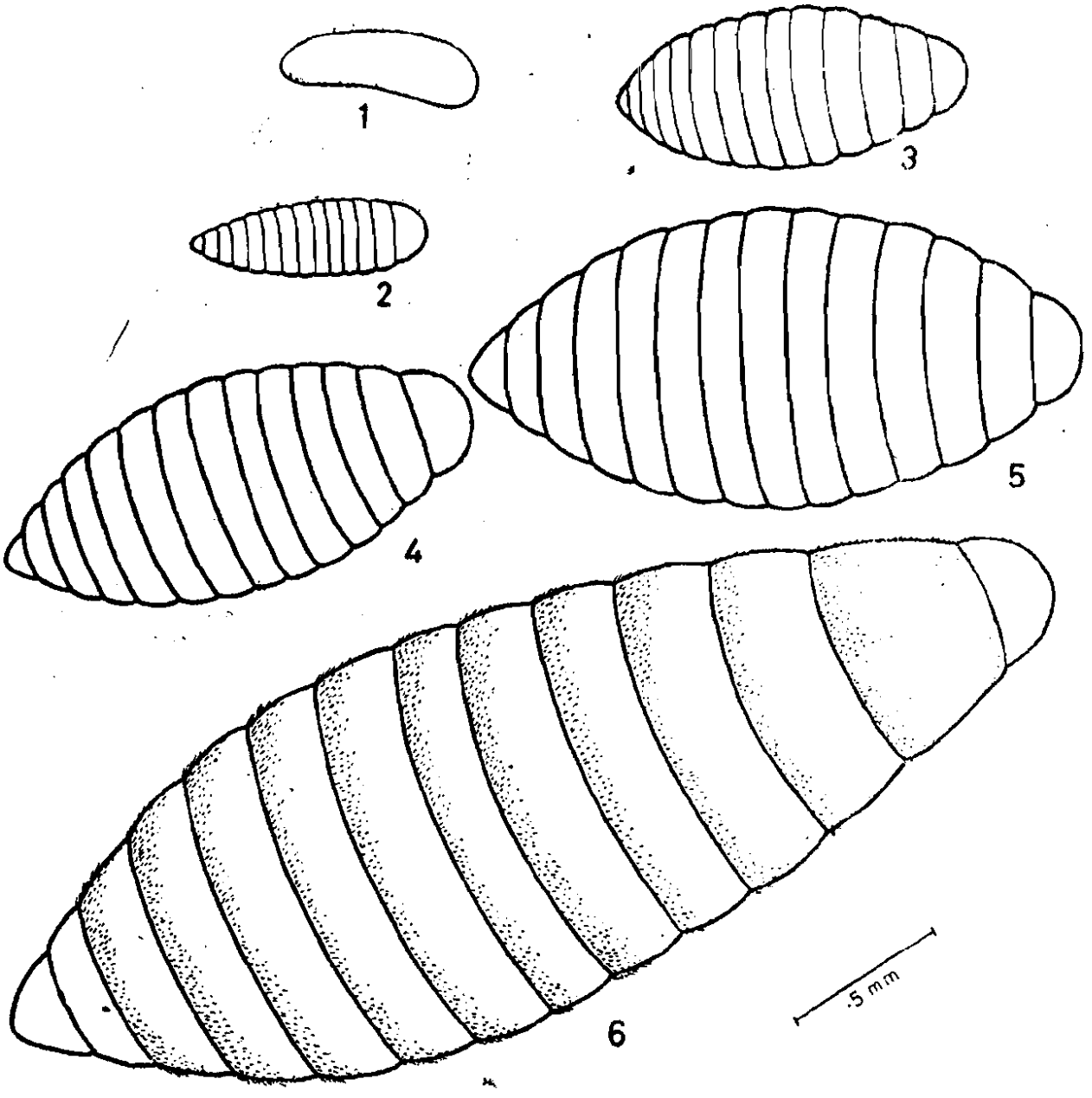

Fig. 1. Egg.

Figs. 2-6. Larval instars (first to fifth).

egg due to the action of the mandibles and possibly from the increased pressure from within the egg. Through this rupture, the larval head first protrudes out. The wiggling movement of the larva finally enables itself to escape completely from the chorion. It takes about 15-20 minutes for the larva to become completely free from the chorion.

Larva

Soon after hatching the first instar larva makes a puncture on rhc body of tho host with the mandibles and starts feeding by continuously ingesting the host haemolymph by pharyngeal pumping. Once the parasite begins its regular feeding movements, development is rapid.

Lnrvnl instars

There arc five larval instars. The measurements of mandibles and prothoracic spiracle of various instars arc tabulated (Table I). Because of the circular nature of the spiracles an accurate measurement can be taken from any angle, as long as the maximum diameter of the apparent elliptical out-lie is considerod.

TABLE 1

MEASUREMENT IN MY. OF THE SIZE OF THE PROTHORACIC SPIRACLE AND MANDIBLE OF DIFFERENT LARVAL INSTARS (MEAN ± SE)

Instar	Diameter of Prothoracic Spiracle	Length of Mandible
I	0.002 ± .0001	0.030 ± .002
2	0.009 ± .0003	0.035 ± .002
3	0.015 ± .002	0.047 ± .004
4	0.024 ± .003	0.057 ± .003
5	0.033 ± .002	0.068 ± .001

First instar larva (Fig. 2)

First instar larva is typically hymenopteriform with well defined head and thirteen body segments. It is glassy whitish in colour. The skin is smooth without any cuticular structures. The larva measures about 0.45-0.85 mm in length and 0.16 to 0.36 mm in width.

The head is thimble shaped and possesses a pair of stumpy antennae. Head capsule measures an average of 0.15 mm in width. Mouth opening is situatod at the front end of tho head at the apex. In describing the mouth parts (Fig. 7) the terminology of Vance and Smith (1933) has been employed. Epistoma, pleurostoma and hypostoina are clearly demarcated. Mandibles are triangular in outline and little chitinised. Each mandible is articulated anteriorly with the superior pleurostomal ramus and posteriorly with tho inferior pleurostomal ramus. Mandibles consist of a main tooth followed by small bristle-like teeth in a comb-like arrangement along the inner edge (Fig. 8). Tracheal system is composed of two well developed lateral trunks united transversely in the first thoracic segment and posteriorly in tho ninth abdominal segment. There aro nine pairs of spiracles, a pair in the first thoracic segment and one each in the first eight abdominal segments.

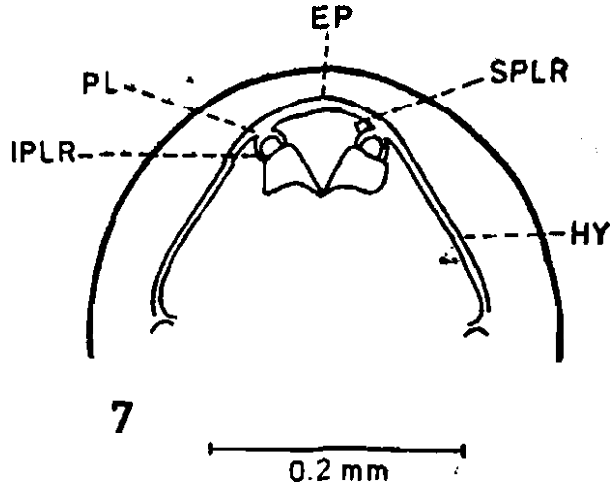

Fig. 7. Head of first instar larva—front view. EP—Epistoma, PL—Pleurostoma, SPLR—Superior pleurostomal ramus, IPLR—Inferior pleurostomal ramus, Hy-Hypostoma.

Second instar larva (Fig. 3)

Second instar larva measures.0.85-1.4 mm. in length and 0.36-0.50 mm. in width. The duration bf second instar varies from 7 to 7.5 hours. It is translucent and pale yellowish white in colour. It can be readily distinguished from the previous stage by the sizes of the head capsule, mandibles (Fig. 9) and the spiracle. The head capsule measures an average of 1.9-2 mm. in width.

Third instar larva (Fig. 4)

The duration of third instar larva varies from 5 to 6.5 hours. It measures 1.2 to 1.9 mm in length and 0.52 to 0.72 mm. in width. Head capsule measures an average of 0.28 mm. in width. Mouth parts resemble that of second instar with increase in the size of the mandibles (Fig. 10).

Figs. 8-12. Mandibles of first to fifth instar larval stages.

Fourth instar larva (Fig. 5)

Fourth instar larva shows only minor differences from th third instar. Duration of the fourth instar v ries from 6 to 6.5 hours. The larva measures 1.9 to 2.5 mm. in length and 0.72 to 0.85 mm. in width. Head capsule measures 0.35 mm. in width on the average. Mandibles show remarkable change in the shape (Fig. 11).

Fifth instar larva (Fig. 6)

Fifth instar stage is reached 26-29 hours after eclosion and its duration varies between 12 and 13 hours. The body is yellowish white in colour and it tapers towards both ends. It can be easily di inguished from the previous stage by the pres ce of cuticular spines in all segments, except in the ninth and tenth abdominal ones. The cuticular spines arc arranged as transverse bands on each segment and is absent on the ventral side. Fifth instnr larva measures about 2.27-3.18 mm in length and 0.85-1.2 mm in width.

The head (Fig. 13) shows distinct features. The various parts are ; the vortex, the temporal region, the antennal region, frontal region and the genal region. The mouth parts are quite distinct. The mandibles (Fig. 12) are well sclerotised and brownish at the tip. Main tooth is followed by eight brisdc-like teeth arranged in a comb-like fashion. Labrum is enclosed above by epistoma. Maxilla is bounded above by hypostoms and below by maxillary sclerome. Cardo and stipes arc demarcated by a stout vertical thickening of chitin, the stipital sclerome. Middle region of the labium is thickened into an oral area bounded

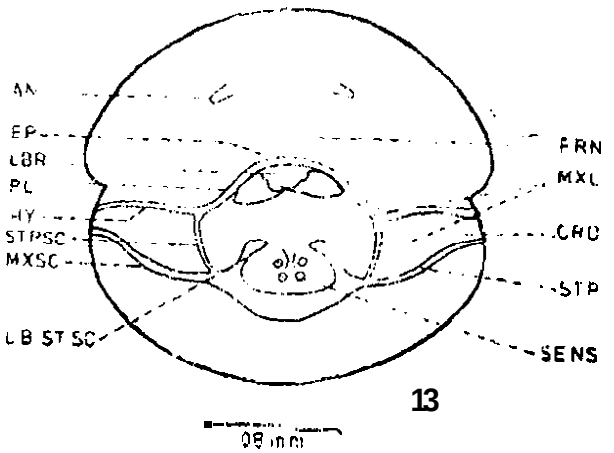

Fig. 13. Head of final instar larva—front view.

AN—Antennal bud, MXL—Maxilla, EP—Epistoma, CRD—Cardo, FRN—Frontal region, STP—Stipes, SENS—Sensilla, L — LBSTSC—Labiostipital sclerome, MXSC—Maxillary sderome, STPSC—Stipital sclerome, HY—Hypostoma, PL—Pleurostoma.

by labiostipital sclerome. Labium preserves its division into postmentum and prementum. Tracheal system is well developed. The number of spiracles is same as in the first instar larva.

Prepupa and cocoon

The end of larval duration is when the larva stops feeding. Total duration of the larval stages of *B. brevicornis* varies from 39 to 43.5 hours. The full fed larva first detaches from the hosts' body and starts spinning a cocoon with white silken fibres. Usually, the larvae which detach from the same host body construct their cocoon very close to each other. The Cocoon is oval in outline with a convex dorsal surface and a flat base. Outer surface of cocoon is translucent whereas the base is transparent and the larva lying inside is visible. Cocoon measures about 3.63 mm. in length and 1.7 mm. in width on an average. Each larva usually takes about 8-10 hours to construct its cocoon. After construction of tho cocoon, within 14-20 hours the larva voids its meconium which is stored at the posterior end of the cocoon as a black semi-solid mass. Tho larva at this stage is called as prepupa. Prepupa (Fig. 14) is yellowish white in colour. Cuticular spines present on the body as in the case of fifth instar larva.

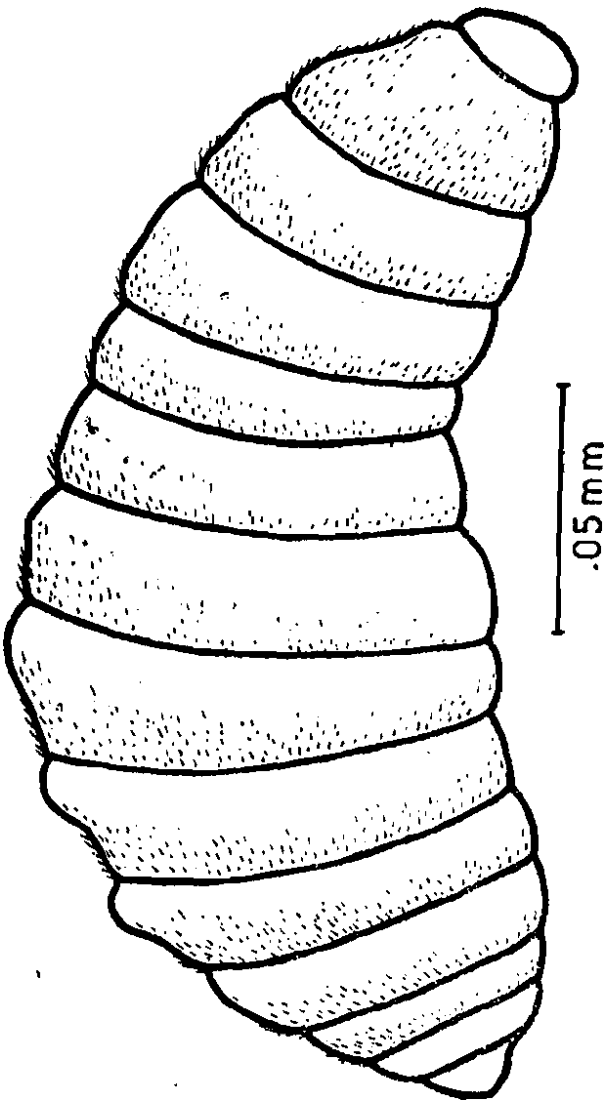

Fig. 14. Prepupa—Lateral view.

It is sluggish and is capable of feeble wriggling action.

Pupa (Fig. 15)

Prepupal stage lasts about 13 to 15 hours.

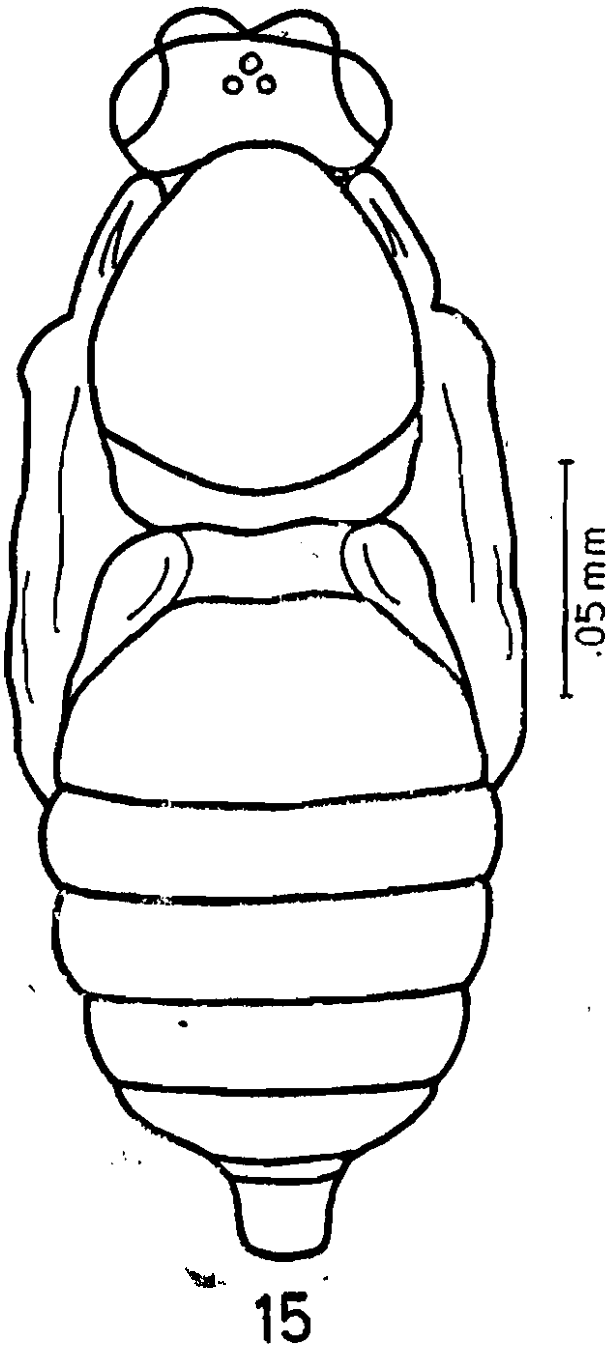

Fig. IS. **Pupa--dorsal view.**

Prior to pupation thoracic and abdominal regions become differentiated by a construction at the junction of fourth and fifth segments. The prepupa finally casts off its skin and the pupa emerges. Pupa is exarate and yellowish white in colour. About 24 to 32 hours after pupation the body colour changes into pale reddish brown. Tho eyes and the three ocelli which are red in colour later change to black. The head of the pupa is flexed downwards. Antennaeare directed backwards on the ventral surface. Developing wing pads are distinct. Segmentation of tho abdomen is distinct. The duration of pupal stage varies between 72 to 84 hours.

Emergence

Approximately ten hours before emergence. pupal moult takes place. At first, the pupa lies with its ventral side facing the base of the cocoon. After its primary emergence from the pupal exuvium, the adult turns round and lies upside down within the cocoon with its dorsal side facing the base of the cocoon. Prior to secondary emergence from the cocoon. the adult gnaws an irregular hole at the antero-dorsal side of the cocoon. Later it comes out through this hol

DISCUSSION

According to Clausen (1940) the eggs of *Microbracon lendicivorus* have a slender tapering stalk, slightly longer than the egg body. In *Bracon brevicornis* the egg is cylindrical. elongate and represents the general form of braconid egg. Munro (1917) observed that in *B. hylobii* Ratz. the early larval stages possessed no spiracles and they first appeared only in the fourth instar stage. *B. brevicornis* shows the presence of 9 pairs of spiracles throughout the larval stages. Ac ording to Clausen (1940) tho mandibles of B. *chardiae* are 4 dentate and it reveals an increasing number of small teeth on the inner margin of the mandibles,

in the intermediate instars; the four teeth of the first instar are succeeded by five in the second and third. In the case of *B. brevicornis* the main tooth is followed by eight small teeth in comb-like arrangement, from the first instar stage onwards.

ACKNOWLEDGEMENT

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