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NEW RECORDS OF INSECT PARASITOIDS OF LEAF-ROLLER AND FLUSHWORM OF TEA

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THE larvae of the moths, *Caloptilia theivora* (Wals.) (Lepidoptera: Gracillaridae) and *Cydia leucostoma* (Meyr.) (Lepidoptera: Olethreutidae) are commonly called 'leaf-rollers' and 'flushworms' respectively. They are found to attack young tea leaves especially those just coming from pruning, resulting in heavy economic loss. A review of literature shows the occurrence of a wide variety of insect parasitoids, parasitizing these pest larvae in the tea-growing regions of N.E. India, South India and other parts of Asia[1-7].

The present author collected the 'leaf-roller' and 'flushworm' infested leaves in and around Kil-Kotagiri, Nilgiris, Tamil Nadu (4800' to 5500' above MSL) throughout the years from 1982 to 1986. The flushworm infested shoot could be easily differentiated from the leaf-roller infested leaf in its appearance. The pest larvae were segregated and reared separately in transparent plastic containers to observe the primary and hyperparasites.

The larvae of the above moths could be easily identified from their external characters. While the head of the flushworm is yellowish or brownish and is characterized by the presence of a black 'cheek-spot' behind the simple eyes on either side of the head, the head of the leaf-roller is black, the rest of the body being pale-yellow with the 'cheek spot' absent.

The present author observed the emergence of *Genotropis* sp., an ichneumon parasite from the puparia of leaf-roller. Braconid parasites, *Apanteles* sp. (*octonarius* group) and *Bracon hebetor* (Say.), an ichneumon, *Diadegma* sp., eulophids, *Pediobius* sp. and *Tetrastichus* sp. (miser-group) and an eurytomid, *Eurytoma* sp. emerged from flushworms as primary parasites. The above parasites on flushworms and leaf-rollers have been recorded for the first time. Investigations on the biology of these parasites are in progress.

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SEXUAL DIMORPHISM IN THE LARVA AND PUPA OF COCONUT RHINOCEROS BEETLE *ORYCTES RHINOCEROS* (COLEOPTERA: SCARABAEIDAE)

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IT is well known that adult *Oryctes rhinoceros* exhibits sexual dimorphism[1,2], the males, in general, having a longer horn and almost bare pygidium with a blunt tip. The females have bushy pygidium with densely packed hairs and conical tip.

Studies in our laboratory necessitated a reliable method for sexing the insect during the larval and pupal stages. The horn size[2] and body size are not conclusive criteria for sexing the pupa. Hence a large number of larvae and pupae raised in the laboratory or collected from the field were screened under a binocular dissecting microscope. It was found that the ventral surface of the abdominal extremity in the female pupa behind the 8th segment is made up of a fused segment (IX and X) and is divided anteriorly into the right and left rounded slightly convex lobes bearing in between and behind

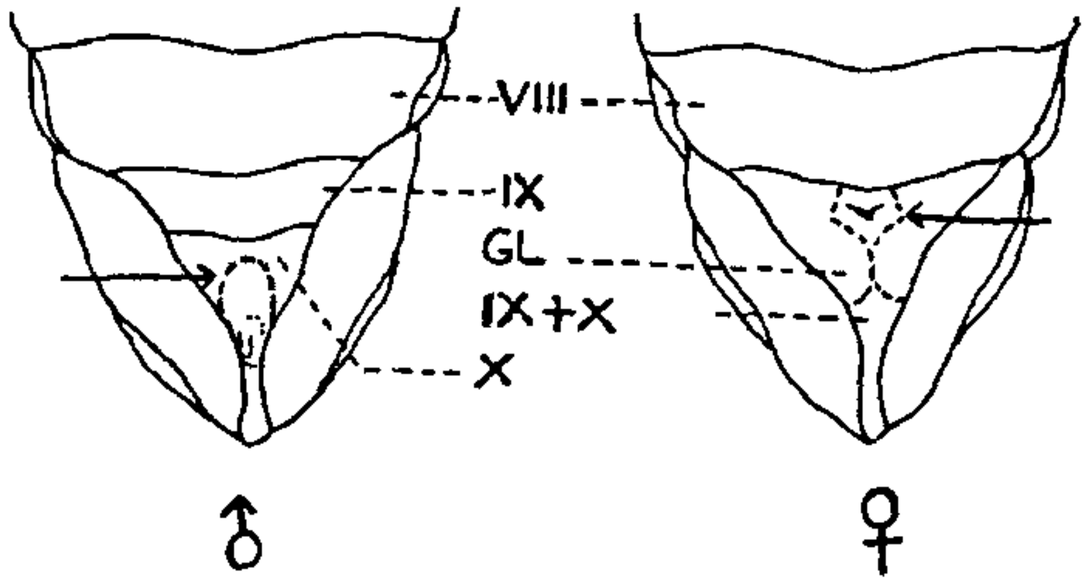

Figure 1. Ventral view of the abdominal tip of *O. rhinoceros* pupa. VIII–X abdominal segments; GL, genital lobe. Arrow indicates elevated area with indentation in the male and shining area with depression in the female.

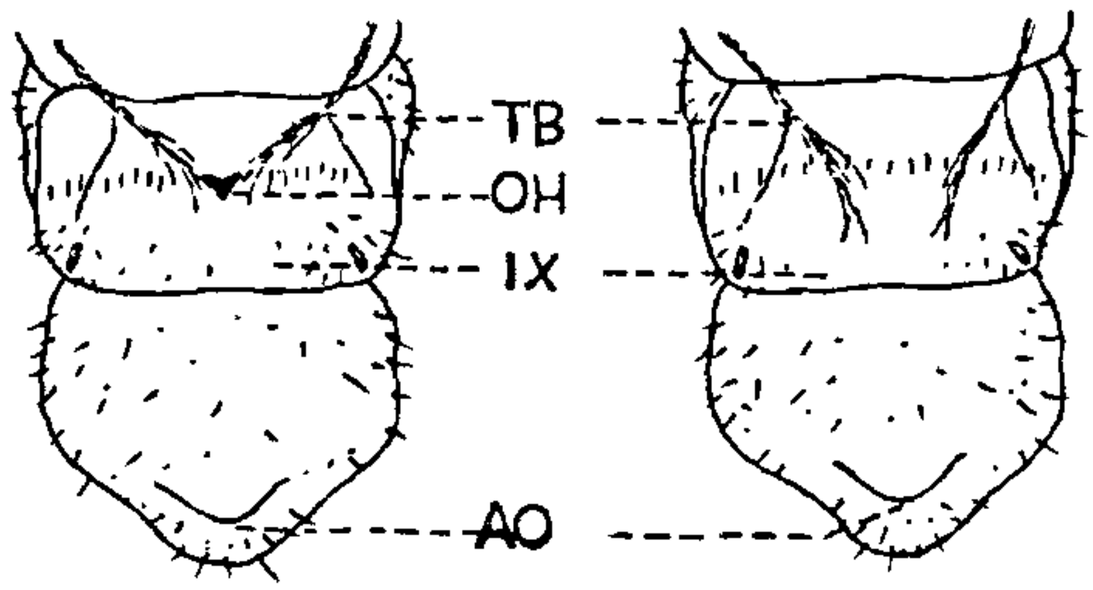

Figure 2. Ventral view of the abdominal tip of *O. rhinoceros* larva (early third instar). TB, tracheal branch; OH, organ of Herold; IX, ninth abdominal segment; AO, anal opening.

the anterior margin of this segment, an easily distinguishable shining area with a minute depression at its middle. This area corresponds to a tuft of long hairs in the middle of the segment just anterior to the genital opening in the adult.

In the male pupa, segments IX and X are separate, the lobes occurring in the female being absent. The X segment bears towards its posterior end a median elevated area. It carries an indentation at its hind end corresponding to the point of attachment of the aedeagus protruding through the genital aperture of the adult developing within.

The pupal sex can be determined at any stage, with unaided eye, by the above method even using the discarded pupal exuvia.

Bedford[3] referred to the organ of Herold, indicative of male sex, on the venter of the IX abdominal segment in some of the third instar larvae of *O. rhinoceros*. However, no details regarding this characteristic are available. In the mature larva of *O. rhinoceros*, the organ of Herold consists of a small brown, more or less hammer-shaped chitinous plate contained within transparent jelly, the chitin being clearly visible to the unaided eye through the transparent cuticle at about the middle of the venter of the IX abdominal segment. This organ is identifiable from the first instar though, at this stage, it is represented as a minute scar visible only under high magnification and optimum illumination conditions.

Apart from the presence of the organ of Herold, the early stages of the larva, especially the early third instar, can be distinguished easily on the basis of the characteristic pattern formed by the convergence of some of the tracheal branches adhering the ventral wall of the 9th segment towards the organ of Herold, presenting a conspicuous blunt 'V' in the male. This pattern is not seen in the female. Owing to the deposition of fat body, this character is less apparent during the larval growth.

The organ of Herold is also visible in the prepupal stage, though less conspicuously, due to the shrinkage of cuticle. During moulting, the chitinous plate of the organ of Herold is discarded along with the prepupal exuvia. Hence an examination of the exuvia can reveal the sex of the individual as well.

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