NOTES ON THE LIFE HISTORY OF *CONCHYLOCTENIA NIGROVITTATA* (BOHEMAN) (COLEOPTERA: CHRYSOMELIDAE: CASSIDINAE)[1]

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(*With four text-figures*)

Key words: Chrysomelidae, Cassidinae, life cycle, *Conchyloctenia nigrovittata*, *Ipomoea eriocarpa*, tortoise beetle

The breeding of the rare tortoise beetle *Conchyloctenia nigrovittata* was observed under natural as well as laboratory conditions in Pune. The breeding period is July to October. The ootheca containing on an average 4 eggs, is deposited on the leaf of the host plant *Ipomoea eriocarpa*. The larvae are typically cassidine, with a flattened body and 16 pairs of lateral processes covered with spinules. The larvae undergo 4 moults and thus there are 5 larval instars. From the second instar onwards, they carry the moulted skin and faecal matter on the supra-anal processes. They pupate on the leaf surface. The pupa has a semicircular prothorax and 5 pairs of leaf-like lateral processes on the abdomen. It also carries the larval exuviae and a few threads of faecal matter. From the egg laying to the eclosion stage it takes around 30 days. The newly emerged imago is colourless, but develops its characteristic pattern of black patches within 3 hours, and its conspicuous red colour in 8-10 days. The imago requires about 6 to 10 days to reach sexual maturity.

INTRODUCTION

The genus *Conchyloctenia* Spaeth is distributed in India and Africa, except Madagascar (Maulik 1919, Borowiec 1994). In India, it is represented by one species, namely *C. nigrovittata* (Boheman), while there are 14 species in Africa (Borowiec 1994).

C. nigrovittata can be recognized because of its sub-oblong shape, bright red coloration and characteristic markings of black spots and patches. Another important character is that the claws are pectinate at the base on both sides. A detailed description is given by Maulik (1919) (Fig. 1).

Maulik (1919) recorded this insect from Surat (Gujarat), Nagpur (Maharashtra) and Calcutta (West Bengal). The only other record is from near Mysore (Borowiec 1990: based on a specimen collected in 1953). Thus, *C. nigrovittata* has apparently not been reported from any part of India during the past 45 years. No information is available on its life cycle either. Even for the African species of *Conchyloctenia*

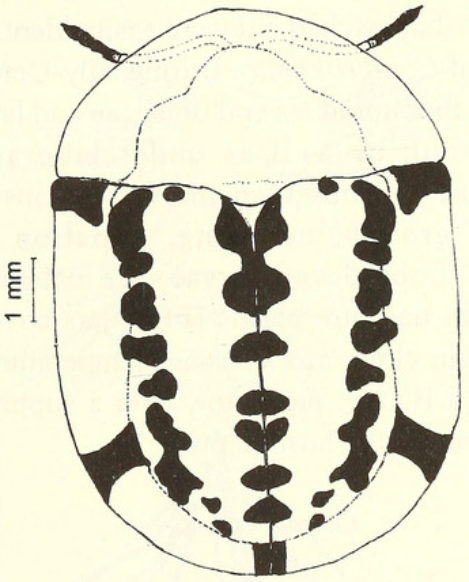

Fig.1: *Conchyloctenia nigrovittata* beetle with the general colour pattern.
(Punctation and costae not shown.)

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there is scanty information regarding bionomics of two species only (Borowiec 1994). We are, therefore, reporting this species from Pune (Maharashtra), along with notes on its life history, for the first time.

Conchyloctenia nigrovittata was first collected at the base of Parvati Hills in Pune, in July 1996. Later, in July 1997, we collected some tortoise beetle larvae near the Pashan lake. These larvae looked different from the ones we had seen and reared before. They had long thin threads of faecal matter attached to the supra-anal processes. We collected them with their food plant, which was identified as *Ipomoea eriocarpa*, and allowed them to grow, pupate and eclose under laboratory conditions. The beetle that emerged was *C. nigrovittata*. Within a month, we found a few different looking oothecae on *Ipomoea eriocarpa* in the same area. We reared 3 out of 4 oothecae in the laboratory, and the larvae that hatched out were easily identified as those of *C. nigrovittata*. During July-October 1999, we monitored several oothecae and larvae in the field, as well as under laboratory conditions, and observed the various instars, feeding, growth, moulting, pupation and eclosion. The beetles and larvae were maintained in ordinary one litre plastic [PET] jars covered with muslin cloth, at a constant temperature of 25 °C in a B.O.D. incubator, with a supply of fresh leaves of the host plant.

OBSERVATIONS

Ootheca: The ootheca is generally small (length 3.2 to 3.8 mm and breadth 2.2 to 2.5 mm), yellowish-brown (reddish-brown when fresh), somewhat elliptical, and is deposited on the upper or lower surface of the *Ipomoea* leaves. It is attached to the leaf with secretion from the accessory glands, as in other tortoise beetles. It is made up of three to four translucent membranes deposited over each other. The eggs are deposited between the two inner membranes. The outermost membrane is a flap-like lid, attached only to one end of the ootheca. It has a characteristic pattern of fine, transverse ridges and can be lifted with forceps (Fig. 2). Each egg is green or greenish-yellow and is enclosed in a separate membrane of its own. There are usually 3 or 5 eggs per ootheca and these are deposited in two tiers. The average length of the egg is about 1.2 mm and breadth about 0.4 mm. In the field, as well as under laboratory conditions, the larvae hatch in about 6 days.

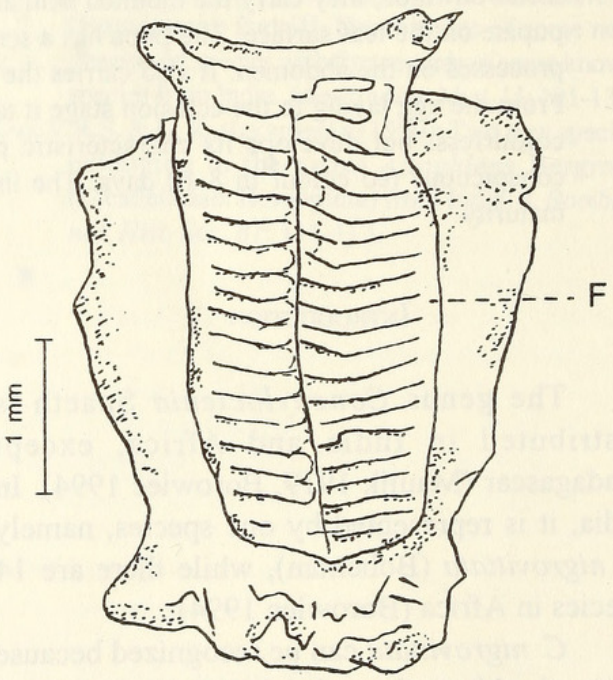

Fig. 2: Ootheca showing the characteristic fold pattern (F) and ridges as seen from above.

Larvae: The first instar larva is very small (about 1.3 mm) and a translucent pale green. During the next 3 days, it grows to about 2.2 mm before moulting. The second instar larva grows from about 2.2 to 2.7 mm before undergoing the next moult in 3 to 4 days time. This third instar grows to a length of about 4 mm in 3 days before moulting. The fourth and fifth instar larvae grow to about 5.3 and 8.4 mm respectively and the duration of each of these instars is about 4 days.

Up to the third instar, the larvae are pale green without any pigment pattern. In the fourth instar, however, the larvae develop a pattern of fine black spots. This pattern becomes bold and prominent in the fifth instar.

The larvae are more or less flattened overall, but with a somewhat convex dorsal surface. The larval head is oval and brown due to chitinisation and it is covered with many long and short setae. There are five lateral ocelli on each side of the head. The mandibles are prominent and possess five denticles, which are heavily chitinised. The larvae carry faecal matter, in the form of fine greenish-black threads, on their supra-anal processes. These faecal threads are very long and in the second instar the length of such threads is almost three times that of the body length. The larvae also carry the exuviae of previous instars. There are 16 pairs of lateral processes, each of which is provided with spinules, as shown for the fifth instar larva (Figs 3a & b). This figure also shows other structures such as the spiracles, faecal matter and colour pattern. The ventral aspect of the larva has no colour pattern or other notable features.

The larvae feed on the upper surface of the plant. The first and second instars only scrape the surface of the leaf, but the later instars cut holes and skeletonise the leaves. Feeding stops when the larva is about to pupate. The larva then becomes immobile and pupates on the leaf by attaching itself with the help of the three anterior abdominal segments (which become somewhat thicker at this stage).

Pupa: The pupa is translucent greenish-yellow, with a pattern of black spots, and is about 8 mm long. It retains all the larval skins in a folded form on the processes of the last abdominal segment. It also carries a few threads of faecal

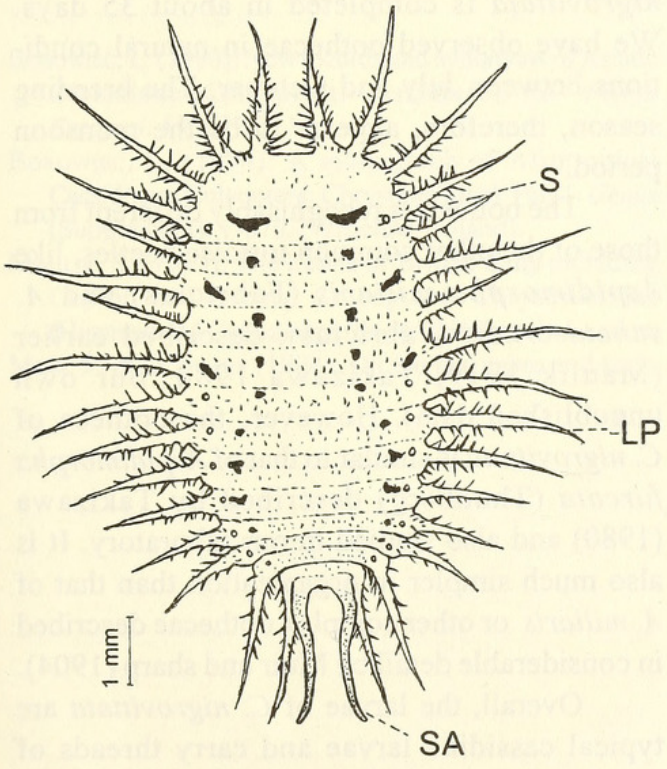

Fig. 3a: Fifth instar larva with typical lateral processes (LP) bearing spinules, spiracles (S) and supra-anal processes (SA).

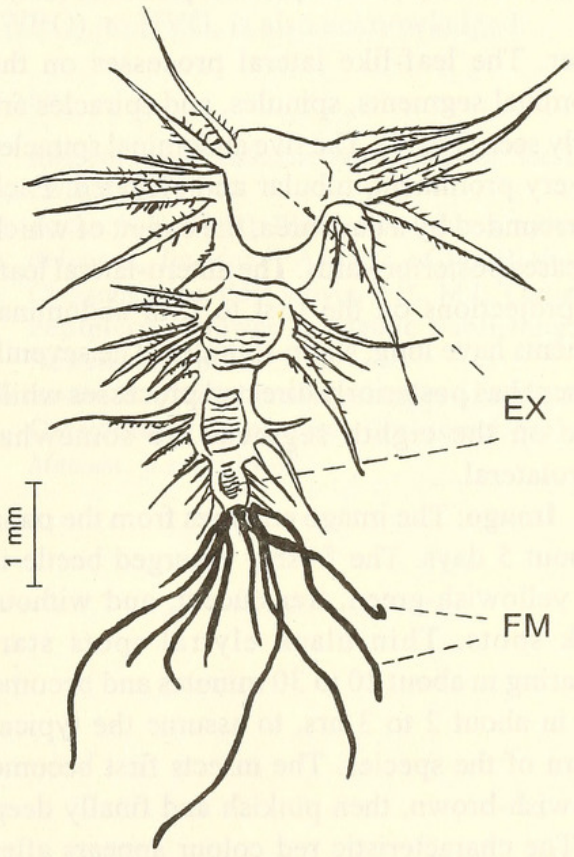

Fig. 3b: Complex exuviae (EX) and faecal matter (FM) carried by the fifth instar larva (detached and shown here).

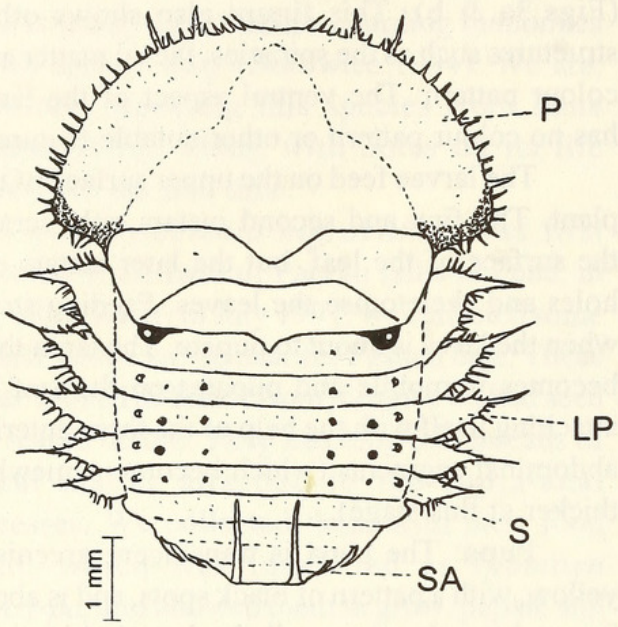

Fig. 4: Pupa showing pronotum (P), with a lining of spines anteriorly, and other thoracic segments. Abdominal segments with leaf-like lateral processes (LP), spiracles (S) and supra-anal processes (SA).

matter. The leaf-like lateral processes on the abdominal segments, spinules, and spiracles are clearly seen (Fig. 4). The five abdominal spiracles are very prominent, tubular and elevated. Each is surrounded by a dark area, the extent of which decreases posteriorwards. The antero-lateral leaf-like projections on the first to fifth abdominal segments have long, sharp spinules. The seventh segment has posteriorly directed processes while those on the eighth segment are somewhat ventrolateral.

Imago: The imago emerges from the pupa in about 5 days. The freshly emerged beetle is pale yellowish-green, translucent, and without black spots. Thin black elytral spots start appearing in about 20 to 30 minutes and become bold in about 2 to 3 hrs, to assume the typical pattern of the species. The insects first become yellowish-brown, then pinkish and finally deep red. The characteristic red colour appears after 8 to 10 days. The adult commences feeding within a few hours or may delay it up to 24 hrs. The species generally does not start feeding in the middle of the leaf as other tortoise beetles do, they restrict themselves to the leaf border. The average length of 26 beetles studied was 8.9 and breadth 6.1 mm.

The imago becomes sexually mature within 10 days and the female starts depositing oothecae within three to five days after mating. In the laboratory population in 1999, a single female usually deposited 3 or 4, sometimes 1 and rarely 5 oothecae per day, over a period of 10 days after mating. A total of 34 oothecae were deposited in 10 days. Hatching success was almost 95% under laboratory conditions, as there was no parasitisation by chalcid wasps, a phenomenon rather common in the oothecae of wild populations of tortoise beetles that we are studying (unpublished data).

Discussion

The life cycle of *Conchyloctenia nigrovittata* is completed in about 35 days. We have observed oothecae in natural conditions between July and October. The breeding season, therefore, appears to be the monsoon period.

The ootheca is recognisably different from those of the other common tortoise beetles, like *Aspidimorpha miliaris* (Fabricius) and *A. sanctaecrucis* (Fabricius), described earlier (Maulik 1919, Takizawa 1980, our own unpublished data). However, the ootheca of *C. nigrovittata* is similar to that of *Aspidimorpha furcata* (Thunberg) described by Takizawa (1980) and also studied in our laboratory. It is also much simpler in organization than that of *A. miliaris* or other complex oothecae described in considerable detail by Muir and sharp (1904).

Overall, the larvae of *C. nigrovittata* are typical cassidine larvae and carry threads of faecal matter like the larvae of *Aspidimorpha sanctaecrucis*. However, in *C. nigrovittata,* the threads are thinner and fewer in number. The

larva is also somewhat similar to that of *Aspidomorpha* (=*Aspidimorpha*) *tigrina*, as described in Muir Sharp (1904). [This African species is now transferred to the genus *Conchyloctenia*; see Borowiec, 1994.]

Carrying faecal matter is an interesting adaptation shown by the larvae and pupae of cassidine beetles. Takizawa (1980) even classified the various patterns of faecal matter carried by the larvae (filament type, shield type, spade type and mass type). Takizawa (1980) further attempted to find the relationship among the different tribes of the family Chrysomelidae, on the basis of oothecal structure, and larval and pupal characters.

It is said that the faecal shield protects the larvae from predators and, to a certain extent, from parasitoids. Use of waste matter by chrysomelid larvae has been the topic of interest for many workers. The reader is referred to an excellent discussion regarding these aspects by Olmstead (1994).

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