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LARVAL CHAETOTAXY OF THREE SPECIES OF GENUS *HARMONIA* MULSANT (COLEOPTERA: COCCINELLIDAE) AND PHYLOGENETIC RELATIONSHIP AMONGST ITS SPECIES

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ABSTRACT

Larval chaetotaxy of three species of genus *Harmonia* MULSANT (Coleoptera: Coccinellidae) and phylogenetic relationship amongst its species.

Comparative studies on mature fourth larval instar chaetotaxy of three species of genus *Harmonia* i.e. *H. sedecimnotata* (FABRICIUS), *H. eucharis* (MULSANT) and *H. dimidiata* (FABRICIUS), have been presented. The phylogenetic relationship amongst its known species is also discussed. Characterization of the genus and keys at spp. level based on larval chaetotaxy are also provided.

Key words: Coleoptera, Coccinellidae, *Harmonia*, scolus, phylogenetic, monophyletic, Oriental region.

INTRODUCTION

Due to the economic impact of Coccinellidae, its biology and taxonomy has been of great concern. Most of the adults exist in colour aberrant forms, thus, their identification requires the consideration of larval characters too. Pioneering attempts in this direction have been made by BOVING (1917), GAGE (1920) and STROUHAL (1926). The works of VAN EMDEN (1949), KAPUR (1950), and SAVOISKAYA & KLAUSNITZER (1973) including keys based on larval characters are much informative. The present work deals with larval chaetotaxy of three Indian coccinellids of genus *Harmonia* i.e. *H. dimidiata* (FABRICIUS), *H. sedecimnotata* (FABRICIUS) and *H. eucharis* (MULSANT). So far this genus is known for its larval characters by *H. octomaculata* FABRICIUS, *H. yedoensis* TAKIZAWA and *H. dimidiata* (FABRICIUS) (SASAJI, 1977), *H. quadripunctata* PONTOPPIDAN (STROUHAL, 1926; KLAUSNITZER, 1973), and *H. axyridis* PALLAS (SAVOISKAYA, 1964; SAVOISKAYA & KLAUSNITZER, 1973; SASAJI, 1977).

MATERIAL AND METHODS

The larval material for *H. eucharis, H. dimidiata* and *H. sedecimnotata* was obtained after rearing the field collected adult beetles in laboratory cages on their normal diet. The fully grown larvae of each instar were killed according to the method given by ROY & BASU (1977) and preserved in 70 percent alcohol for further details. The larvae were dissected and cleared in 10 per cent KOH solution

and permanent mounts were prepared. The diagrams have been drawn with camera-lucida and SAVOISKAYA & KLAUSNITZER (1973) have been followed for the nomenclature of setae. To provide clarity and to avoid undue descriptions, thoracic and abdominal setal maps also highlighting the colour pattern of larvae have been presented. Until and unless specified, the discussion pertains to the mature fourth instar larvae.

RESULTS AND DISCUSSION

Setae of cranium, head appendages and mouth parts are of no taxonomic use at any level. As for the setae of thorax, the prothorax in all the three species bears two sclerotised dorsal plates each possessing different number of setae/chalazae/scoli and senti (Figs. 1-3). Meso and metathoraces have similar setose projections, each bearing well defined 'd', 'dl', and 'l' groups dorsally. In all the three species, 'd' meso consists of a two branched scolus and 'l' of sentus, the latter is well developed in *H. dimidiata* and least in *H. sedecimnotata.* In *H. sedecimnotata* and *H. dimidiata,* 'dl' meso is formed by a long sentus and a 3-4 branched scolus, while in *H. eucharis,* it consists of two senti and a three branched scolus (Figs. 1, 2, 3). All the setose projections at 'dl' meso position appear to arise from a common base and probably due to this reason, SASAJI (1977) preferred to mention the total number of projections only and in the generic diagnosis she describes "Mesothoracic plates bearing five projections at outer margin and two at inner margin as a rule". But, the present observations show that though in all the three species 'd' meso conforms to the description presented by SASAJI (1977), 'dl' meso do not. The number of setose projections at this place have been found to vary in a species viz. *H. dimidiata* and *H. sedecimnotata* has 4-5 projections, while *H. eucharis* 5-6. Meso and metathoracic projections of first instar larvae suggest a close resemblance amongst these three species (Figs. 4-6), which indicate that these are closely related phylogenetically. However, in the older instars, there is a tendency towards attainment of species

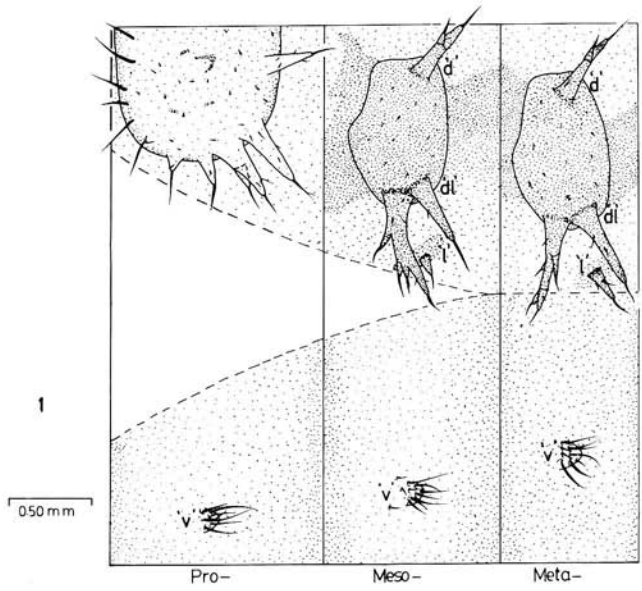


Fig. 1: Thoracic setal map of fourth instar larva of *H. sedecimnotata* (FABRICIUS).

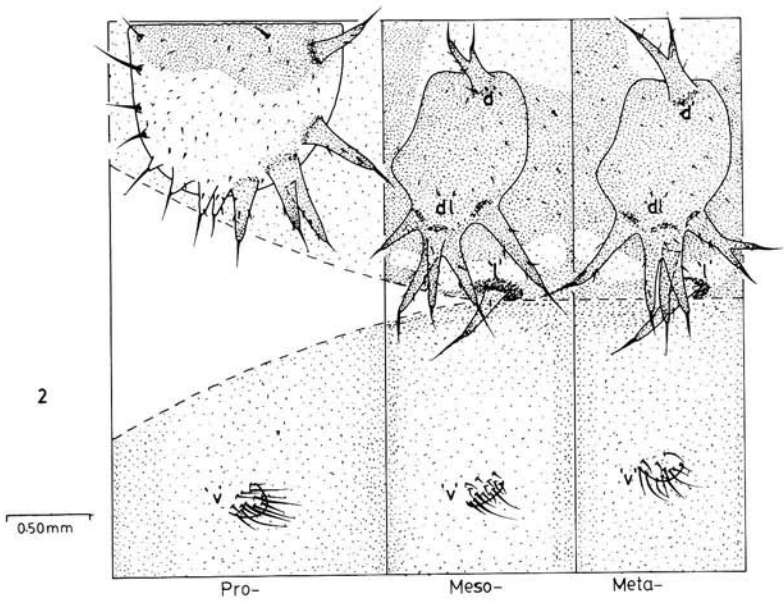


Fig. 2: Thoracic setal map of fourth instar larva of *H. eucharis* (MULSANT).

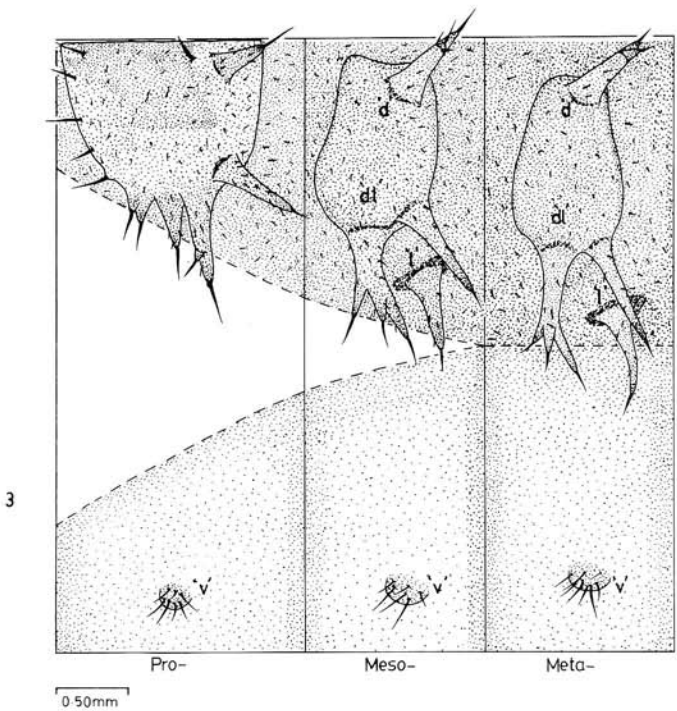
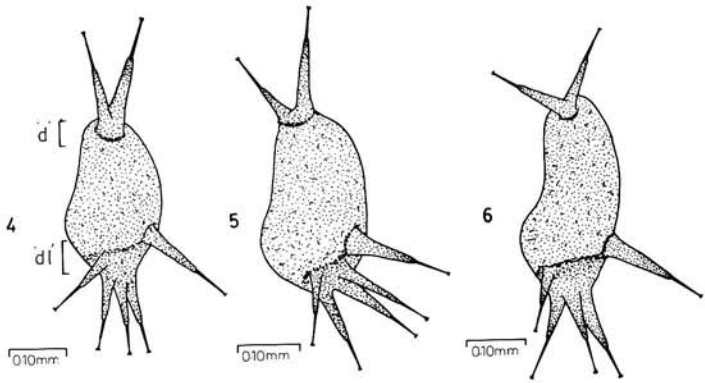


Fig. 3: Thoracic setal map of fourth instar larva of *H. dimidiata* (FABRICIUS).



Figs. 4-6: Dorsal thoracic plates of first instar larvae of *H. sedecimnotata* (FABRICIUS) (4); *H. eucharis* (MULSANT) (5); *H. dimidiata* (FABRICIUS) (6).

diagnostic characters as far as 'd' and 'dl' meso are concerned and these structures in mature instars suggest a more close relationship amongst *H. sedecimnotata* and *H. dimidiata* than *H. eucharis* (Figs. 1-3).

In all the three species, 'd', 'dl' and 'l' groups of abdominal setose projections are three branched, two branched and unbranched respectively and clearly recognisable on first eight segments (Figs. 7-9). This character is shared by all the three species of *Harmonia* described so far except in *H. quadripunctata*, where 'dl' I-VIII are three branched projections instead of usual two branched in the remaining species. Thus, SASAJI (1977) has correctly listed these among the generic characters of *Harmonia* as "dorsal projections of abdomen always trilobed, dorso-lateral ones bilobed or trilobed and lateral ones conical". The ventral abdominal groups 'v', 'vl' and 'pl' being represented by variable number of setae, and also the ninth and tenth segments do not present any taxonomic character.

The above discussion clearly bring out the fact that the larval characters are helpful taxonomically and that the three species presently studied well belong to *Harmonia*. The species *sedecimnotata* and *dimidiata* have long been treated under *Coccinella* which were later transferred to *Harmonia*. Similarly, species *eucharis* was treated under *Ballia* which has quiet recently been shifted to *Harmonia* by IABLOKOFF-KHNZORIAN (1979) and is well supported with the present larval studies. Moreso, the adults of *H. eucharis* are quite variable as far as their colour pattern is concerned and thus variable colour aberrant forms have been considered different species until IABLOKOFF-KHNZORIAN (1979) synonymised all those species based on other adult characters. This specific case shows the utility of larval studies in sorting out such confusions, as the larval setal characters and colour pattern are quiet consistent.

Based upon above discussion it seems quiet probable that at least in case of *Harmonia*, the larval chaetotaxy is helpful at the generic as well as at the specific level and it is quiet pertinent to present the generic diagnosis and key to the species based on chaetotaxy.

Larva of genus **HARMONIA** MULSANT

DIAGNOSIS

'd' meso and 'd' meta setose projections two-branched, 'd' I-VIII projections three branched, 'dl' I-VIII two or three branched and 'l' I-VIII unbranched.

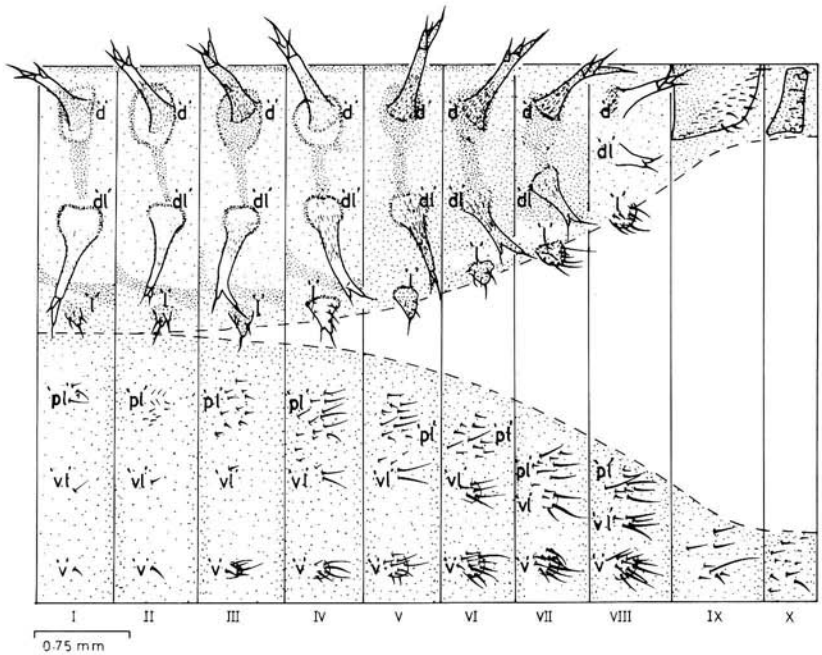


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Fig. 7: Abdominal setal map of fourth instar larva of *H. sedecimnotata* (FABRICIUS).

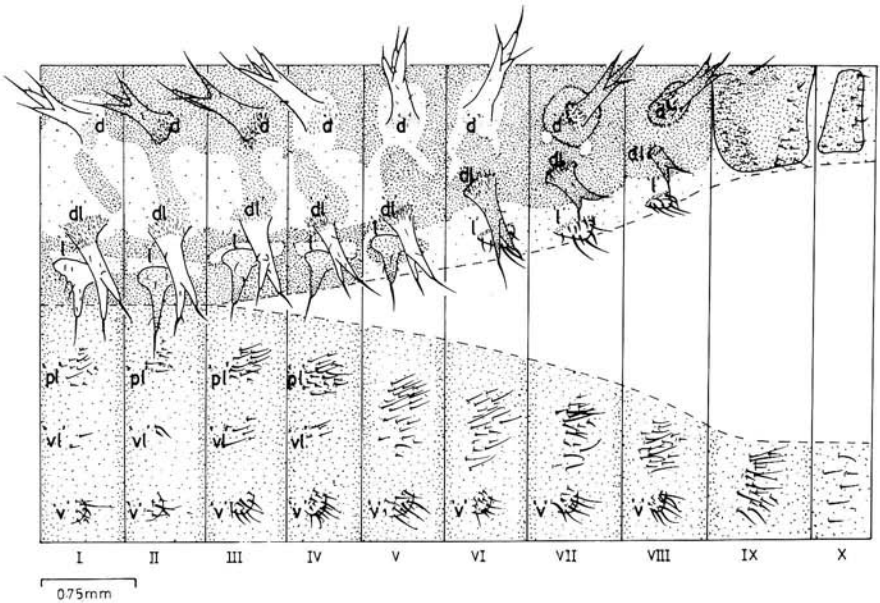

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Fig. 8: Abdominal setal map of fourth instar larva of *H. eucharis* (MULSANT).

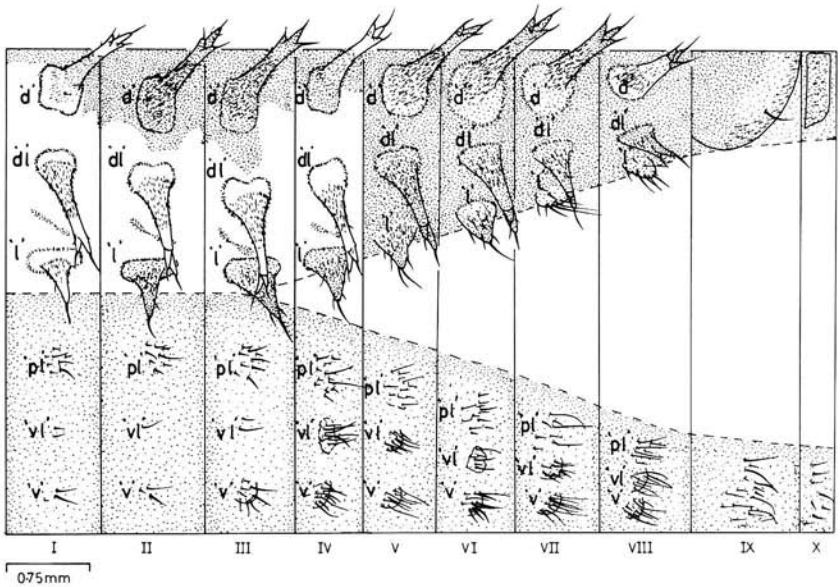
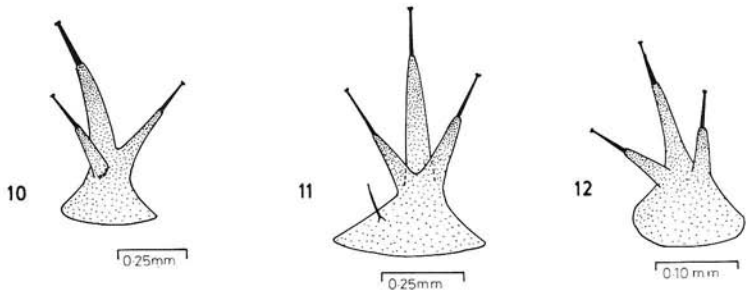


Fig. 9: Abdominal setal map of fourth instar larva of *H. dimidiata* (FABRICIUS).

Key to the larve of species of genus HARMONIA

1. – 'l' I setose projection well-developed forming a sentus 2
   – 'l' I setose projection never form sentus (Fig. 7) . . *H. sedecimnotata* (FABRICIUS)
2. – 'd' I and 'dl' I bearing fine pubescence only at their bases (Fig. 8) . . . . . *H. eucharis* (MULSANT)
   – 'd' I and 'dl' I bearing fine pubescence upto middle of their lengths (Fig. 9) . . . . . *H. dimidiata* (FABRICIUS)

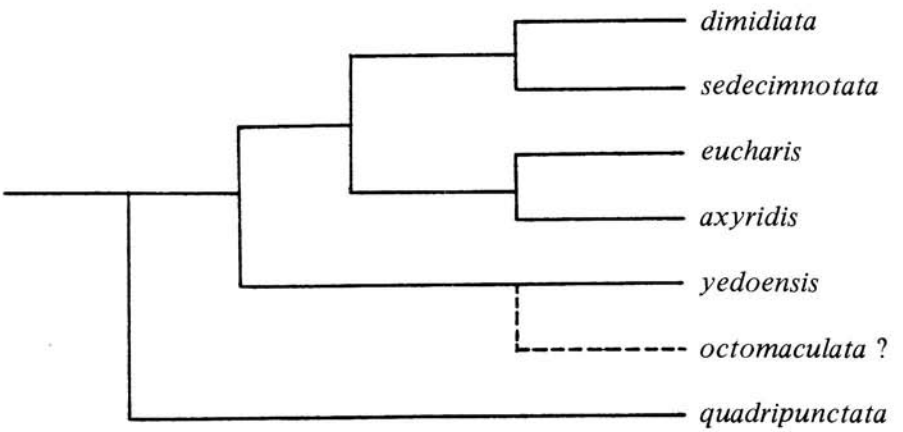
The setose projections of first instar larvae of the three species extremely resemble and the larvae are hardly separable in their first instars (Figs. 10-12). Moreover, consultations of figures of first instar larvae of *H. axyridis* and *H. yedoensis* as given by SASAJI (1977) also suggest a close resemblance to the presently studied species indicating monophyletic origin of *Harmonia*. Also, as suggested by



Figs. 10-12: 'd' I of first instar larva of: *H. sedecimnotata* (FABRICIUS) (10); *H. eucharis* (MULSANT) (11); *H. dimidiata* (FABRICIUS) (12).

SASAJI (1977), the larval characters of species of *Harmonia* do not proximate any other genus known from its larval characters.

The comparison of first and fourth instar larvae of *H. sedecimnotata, H. eucharis* and *H. dimidiata* (under present study) and *H. axyridis* and *H. yedoensis* shows that the first instar larvae of all these species bear well developed abdominal as well as thoracic setose projections which extremely resemble in all the species and there are different lines of development and retraction of this character (setose projections) in the species of *Harmonia* so that in *H. dimidiata, H. sedecimnotata, H. eucharis* and *H. axyridis,* the setose projections develop more strongly though to varying degree in different species and in *H. yedoensis,* there is retraction of this character i.e. its fourth instar larva bears weakly developed setose projections (SASAJI, 1977). The first instar larval descriptions of *H. octomaculata* are not available for comparison, however, diagrams of its fourth instar larva (SASAJI, 1977) brings it close to *H. yedoensis.* On comparison of setose projections of fourth instar, *H. dimidiata* seems to be closely related to *H. sedecimnotata* and *H. eucharis* to *H. axyridis* (diagrams of SASAJI, 1977). As pointed by SASAJI (1977), on account of three branched dorsal projections of abdomen, *H. quadripunctata* appears to bear some differentiation from the rest. So based on the setal studies, the probable phylogenetic relationship amongst the known species of *Harmonia* larvae can be represented as below:



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