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# CHAETOTAXY OF LAST INSTAR CATERPILLAR OF *CHALCIOPE HYPPASIA* (CRAM.) A BEAN DEFOLIATOR (NOCTUIDAE)

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The relative length of coronal stem and frons, position of $AF_2$, $P_2$, puncture Fa, ocellar and sub-ocellar groups on the head capsule; punctures on prothoracic-shield and setae of SD and L groups on the prothorax and $SD_1$ and SV groups of abdomen are enumerated and elaborated as characters of taxonomic significance in the chaetotaxy of *C. hyppasia* (Cram.).

## INTRODUCTION

*Chalciope hyppasia* (Cram.) amongst noctuids from subfamily Catocalinae is one of the important pest whose immature stages cause an appreciable amount of damage to bean crop in western Uttar Pradesh. Inview of the life history already studied by Singh & Goel (1986), it becomes rather essential to describe the immature caterpillars for purposes of identification. Larval chaetotaxy has proved to be an important taxa for such identification and remains constant even under different environmental conditions. Number of earlier workers on immature stages of Noctuidae have described chaetotaxy of classificatory significance (Forbes, 1910 & 1916; Fracker, 1915; Heinrich, 1916; Gerasimov, 1935; Issac and Rao, (1941). Hinton (1946) though evolved a system of chaetotaxy but Crumb (1934) happended to be earlier to utilize the same in the classification of subfamily Hypeninae. Ripley (1923), Gardner (1946, 1947 & 1948), Mukerjee & Singh (1951), Neunzing (1964), Bhattacharjee & Gupta (1971), Thakar & Srivastava (1983) are others to describe more noctuid caterpillars. The

present study on *C. hyppasia* (Cram.) evolves more chaetotaxic details and furnishes more distinguishing features of taxonomic use.

## MATERIAL AND METHODS

The caterpillars of *C. hyppasia* (Cram.) were collected from the field and reared in the laboratory on the bean leaves. The mature final instar caterpillars were preserved in KAAD for chaetotaxic studies. The head capsule was removed under a Stereoscopic Binocular Microscope, KOH treated caterpillars were then dissected laterally. The material cleared in acetic acid, dehydrated, and stained with acid fuschin for preparing the balsam mounts. Sketching was done with the help of camera lucida following Hinton's (1946) system of nomenclature with minor modifications.

## OBSERVATION ON CHAETOTAXY OF CATERPILLAR

### The head claetotaxy (Figs. 1a, b & 2)

The head capsule of *C. hyppasia* (Cram.) with hypognathous type of orientation is spherical and light brown in colour. An inverted Y-shaped epicranial suture separates the two epicranial plates, running anterodorsally. The coronal stalk (CS) anteriorly bifurcates in two diverging frontoclypeal sutures encircling frontoclypeus (FC). An incomplete sclerotized ridge divides the triangular frontoclypeus into two unequal halves, an anterior clypeus (CL) and frons (F) behind. The frontoclypeus has three setae and a puncture namely, two setae $C_1$ and $C_2$ in the clypeal region, seta $F_1$ and puncture Fa in the frontal region. Laterad on the clypeus, seta $C_1$ longer than $C_2$ lies slightly anterad to $C_2$. Seta $F_1$ lies at the level of $A_2$ and $OC_4$ and anterior of midfrons whereas puncture Fa anterodorsal to $F_1$ and adjacent to middorsal line of frontoclypeus. The seta $F_1$ is as long as $C_2$. By the laterodorsal sides of frontoclypeus and adjacent to parietals the narrow adfrontals (AD) are characterised by equalized $AF_1$ and $AF_2$ with a puncture AFa. $AF_1$ is slightly anterad to the level of $OC_3$ whereas $AF_2$ at the level of La, posterior to the coronal bifurcation and along the adfrontal suture. The puncture AFa lies closer to $AF_2$ than $AF_1$ and situated anterad to coronal bifurcation. However, the distance between $AF_1$ and $F_1$ is lesser to the distance of $AF_1$ and $AF_2$. The frontoclypeus and adfrontals proximally support to a cuticular anteclypeal region providing an articular surface for the labrum.

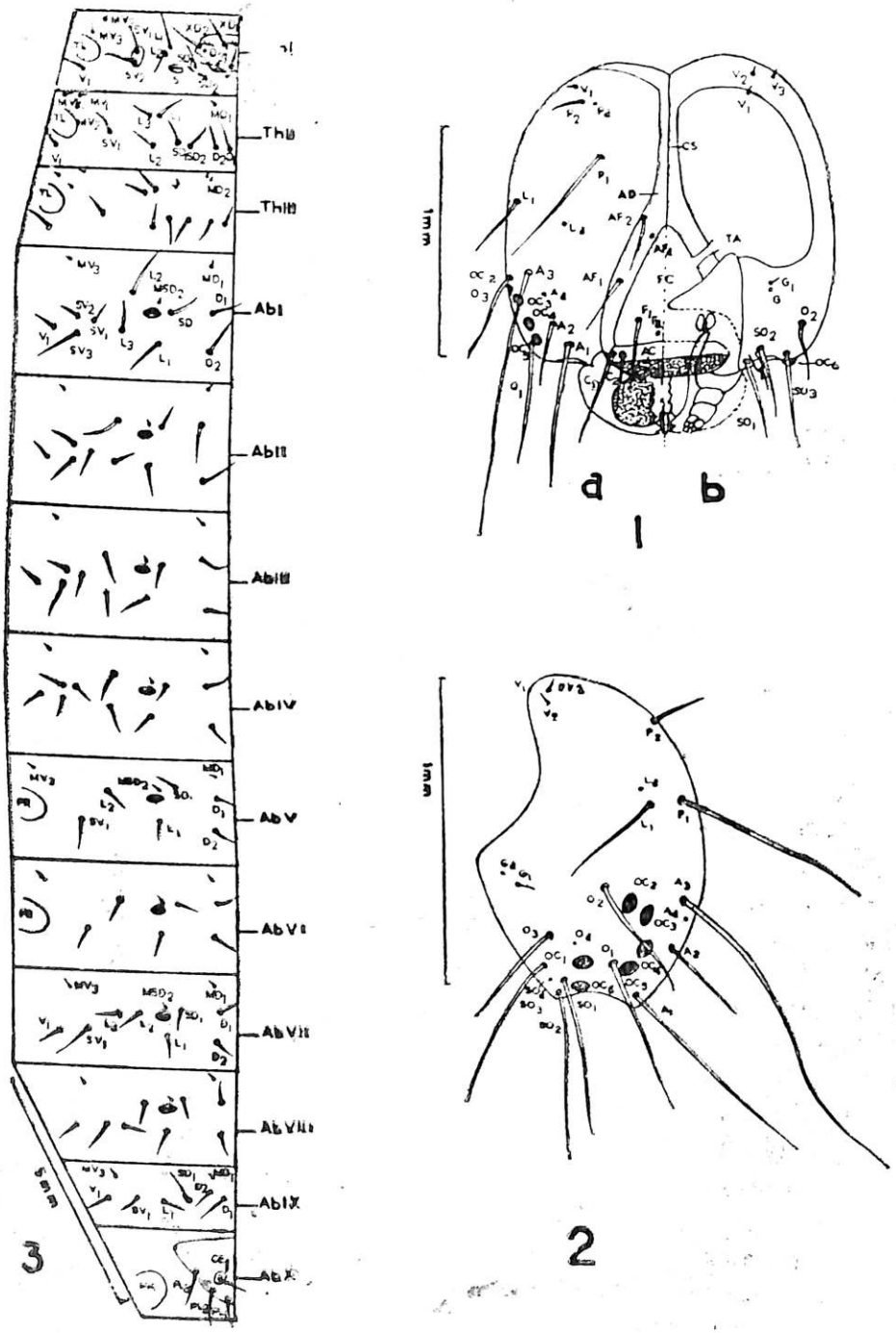
Each epicranial plate is demarcated in different areas and characterised by 12 long, 4 minute setae and 6 punctures. The setae of anterodorsal group $A_1$,

$A_2$ and $A_3$ with a puncture Aa lie inbetween ocellar and adfrontal groups. Seta $A_1$ posterad to antennal socket, is slightly anterior to the level of $OC_5$. $A_2$ is laterad to $A_1$ and at the level of $F_1$ and $OC_4$ and $A_3$ being posterolateral to $A_2$ and posterodorsal to $O_3$. Seta $A_2$ is closer to $A_1$ than to $A_3$. $A_3 > A_1 > A_2$ lengthwise. $A_3$ is the largest seta on head capsule. Puncture Aa is situated equidistant to $A_2$ and $A_3$ and at the level of $OC_3$. The lateral group is characterised by a single seta $L_1$ having a dorsal puncture La at the level of $AF_2$. $P_1$ and $P_2$ setae with a puncture Pa represent the posterodorsal group Seta $P_1$ lies posteriorly between $AF_2$ and $L_1$. Distance between $P_1$ and $L_1$ is more than to the distance of $P_1$ and $AF_1$, $P_2$ is posterolateral to $P_1$ and is posterior most smaller tactile seta of the head capsule. Puncture Pa lies dorsally close to $P_2$. The vertical group has three minute setae $V_1$, $V_2$ and $V_3$ having a puncture Va. $V_1$ lies posterolateral to $P_2$, $V_2$ posterolateral to $V_1$ and $V_3$ still posterior most seta of the epicranium. Puncture Va is situated in between $V_2$ and $V_3$.

The ocellar group bearing six ocelli ($OC_1 - OC_6$), three setae ($O_1 - O_3$) and a puncture Oa are situated behind antennal socket. The five ocelli ($OC_1 - OC_5$) are arranged in a semicircle whereas $OC_6$ anterior to $OC_1$, at the margin of antennal socket. Seta $O_1$ lies ventrally close to $OC_5$, $O_2$ posteroventral to $OC_2$ and $O_3$ posteroventral to $OC_1$. $O_1 > O_2 > O_3$ lengthwise. puncture Oa lies between $O_3$ and $OC_1$ but closer to $OC_1$ than $O_3$ The subocellar group lies posterior and ventral to the antennal socket and characterised by three setae $SO_1$, $SO_2$ and $SO_3$ with a puncture SOa. $SO_1$ is situated anteroventral to $OC_6$, $SO_2$ near and posteroventral to $OC_6$ and $SO_3$ posteroventral to $SO_2$. Distance of $SO_2$ and $SO_3$ is more than the distance of $SO_2$ and $SO_1$. $SO_1 > SO_2 = SO_3$ lengthwise. Puncture SOa lies equidistant between $SO_1$ and $SO_3$. $G_1$ is the only ventral seta of the genal group having a puncture Ga.

**The body chaetotaxy (Fig. 3)**

Prothorax (Th I) : The squarish prothoracic shield is dark brown in colour, having extended into an outgrowth laterally. It is characterised by four tactile setae and three punctures. $XD_1$ and $XD_2$, both lie in anterior half of the shield but $XD_2$ on an outgrowth of the shield. $D_1$ and $D_2$ lie situated posterodorsally to $XD_1$ and $XD_2$ respectively in the posterior half of the shield. $XD_1$ is shorter than $XD_2$ but both longer than $D_1$ and $D_2$. The puncture XDa lies caudad to $XD_1$, and XDb posterolateral to XDa and XDc dorsal to $XD_2$. The two setae $SD_1$ and $SD_2$ near the posterolateral angle of the shield and dorsal to spiracle characterized the subdorsal group. The thin and delicate seta with pigmented socket $SD_1$ is anterolateral to $SD_2$. The lateral group possessed two setae $L_1$ and $L_2$ lying anterior to lateral margin of the spiracle. $L_1$ and $L_2$ close to each other are identical to $SD_2$ and $SD_1$ respectively. $SV_1$ and $SV_2$ setae of subventral group




Figs. 1–3. 1. Head capsule of last instar caterpillar of *C. hyppasia* (Cram.). (a) Dorsal view (b) Ventzal view 2. Lateral view. 3. Setal map of body segments of the same.

are ventrad to the lateral group. $SV_1$ is shorter and anterior to $SV_2$. $V_1$ of ventral group lies postcoxal in position.

The microscopic setae lie in two groups *viz.* $MXD_1$ and MV, $MXD_1$ is very close to the caudal margin of the shield in between $D_1$ and $D_2$. $MV_2$ and $MV_3$ are precoxal in their position.

Meso-and Metathorax (Th II–Th III) : The mesothorax is characterised by nine tactile and six microscopic setae. Setae $D_1$, $D_2$, $SD_1$ and $SD_2$ of dorsal and subdorsal groups are situated in a vertical line. $D_1$ and $D_2$ are approximately equal in size. Thin, delicate with pigmented socket, the seta $SD_1$ is equal in length to $SD_2$. The lateral group is trisetosed having $L_1$ anterolateral to $SD_1$. $L_2$ posterolateral to $L_1$ and $L_3$ ventral to $L_1$. $L_1$, $L_2$ and $L_3$ are at right angle to each other with $L_2 > L_1 > L_3$ lengthwise. Single seta $SV_1$ characterizes the subventral group and is dorsal in position to the coxa of the segment. $V_1$ of ventral group is identical to the preceding segment. The microscopic setae composed of three groups namely $MD_1$ lies at the anterior margin infront of $D_2$. $MSD_1$ and $MSD_2$ are anterior to $SD_1$ and $MV_1$, $MV_2$ and $MV_3$ are precoxal in their position. The most anterior seta is $MV_1$, $MV_2$ is posteroventral whereas $MV_3$ anteroventral to $MV_2$.

The metathorax is identical to the preceding segment in its setal map except variation in the number of microscopic setae of the dorsal group. The additional seta $MD_2$ is posterodorsal to $MD_1$.

First abdominal to fourth abdominal segments (Ab I — Ab IV) : These segments are characterized by ten tactile and three microscopic setae, each having an identical setal map. Equal sized setae $D_1$ and $D_2$ of dorsal group lie near the middorsal line of the segment where $D_1$ lies infront of $D_2$ and at the level of spiracle. $SD_1$ of subdorsal group is supraspiracular in position. The lateral group has three setae, $L_1$ is postspiracular, $L_2$ infraspiracular and $L_3$ posterolateral to $L_2$. Thus the three making a triangle with $L_2 > L_1 > L_3$ lengthwise. The trisetosed subventral group also forms a triangular configuration like the lateral group. $SV_1$ is anteroventral to $L_3$, $SV_2$ ventral to $SV_1$ and $SV_3$ posterior to $SV_2$. $SV_1 = SV_2 > SV_3$ lengthwise. Seta $V_1$ lies below $SV_3$ and near the ventral margin of the segment. The microscopic seta $MD_1$ lies near the anterior margin of the segment and makes a longitudinal line with $D_1$ and $D_2$. $MSD_2$ is prespiracular in position and $MV_3$ is anteroventral to $SV_2$.

Fifth and sixth abdominal segments (Ab V — Ab VI) : Setae of the dorsal, subdorsal and lateral groups of leg bearing segments are identical to the preceding segments (Ab I to Ab IV). The lateral group becomes bisetosed, $L_3$ being absent.

Subventral group is unisetosed with seta $SV_1$ lying dorsal to the coxa of the segment. The microscopic seta $MD_1$ lies anterior to $D_1$ whereas $MSD_2$ is prespiracular and $MV_3$ precoxal in position.

Seventh and eighth abdominal segments (Ab VII — Ab VIII) : Setae of the dorsal and subdorsal groups are identical to the preceding segments (Ab V and Ab VI). The three setae of the lateral group *i e.* $L_1$ being postspiracular, $L_2$ infraspiracular and $L_3$ posterolateral to $L_2$. Ventral group is unisetosed having $V_1$ ventral to $SV_1$. The microscopic setae $MD_1$ and $MSD_2$ are identical to the preceding segments and $MV_3$ lies anteroventral to $SV_1$.

Ninth abdominal segment (Ab IX) : Ab IX is devoid of spiracle and characterized by six tactile and two microscopic setae. $D_1$ is near the middorsal line of the segment and $D_2$ anterolateral to $D_1$ $SD_1$ of Ab IX is identical to $SD_1$ of the thoracic segments and situated postero atral to $D_2$. The lateral, subventral and ventral groups are unisetosed with setae $L_1$, $SV_1$ and $V_1$ respectively lie ventral to $SD_1$, all in a straight line. The microscopic seta $MD_1$ migrates towards the lateral margin and lies infront of $D_2$. $MV_3$ situated anteroventral to $SV_1$ near the anterior margin of the segment.

Tenth abdominal segment (Ab X) : Ab X is characterized by a pair of anal legs and a middorsal anal shield The anal shield has four tactile setae. $CE_1$ is situated in the centre and $PL_1$, $PL_2$ and $PL_3$ are situated at the posterolateral margin of the shield. $CE^1$ lies longitudinally with $PL_2$ and transversly with $PL_3$.

## DISCUSSION

The frons is characterized smaller than coronal stem whereas puncture Fa anterior to $F_1$ lies situated near the mid dorsal line are distinguishing features for the present noctuid *C. hyppasia*. Similar findirgs have also been described by Gardner (1945) in different noctuids and Singh (1951, 1956) in geometrids. Gardner (1947) and Bhattacharjee and Gupta (1971) further overweighed the location of Fa in classification of different noctuid species. Hence the presence of Fa in frontoclypeus appeared a generalized character and its position further may be takenup a subfamily feature in Noctuidae. Crumb (1934) while classifying Hypeninae, taken the relative length of $P_1$ more than $P_2$ and its position in relation to $L_1$ into classification. An identical condition is endorsed in *C. hyppasia* belonging to Catocalinae. The presence of three setae and a puncture Oa in the ocellar group, Oa being near and anterad to $OC_1$ in *C. hyppasia* has also been observed by Gerasimov (1935), Hinton (1946), Bhattacharjee and Gupta (1971) and Thakar and Srivastava (1983) in their respective noctuids. Further more,

the three setae and a puncture present in subocellar group being a general feature of Noctuidae, in *C. hyppasia* their position is more akin to the condition described by Gerasimov (1935) in the same family. The presence of a single genal seta and a puncture recognized by Heinrich (1916), Ripley (1923), Gerasimov (1935), Bhattacharjee and Gupta (1971) and Thakar & Srivastava (1983) has also been described in *C. hyppasia*. However, earlier workers like Dyar (1896) and Forbes (1910) have not recognized this group in their respective noctuid.

In present noctuid, the squarish prothoracic shield with extended latero-median margin, possessed two pairs of setae $XD_1$, $XD_2$ and $D_1$, $D_2$ with three punctures. Fracker (1915), Garman (1921), Gerasimov (1935) and Hinton (1946) also assessed the shape, number of setae and punctures on the prothoracic shield of taxonomic significance in Noctuidae. But presence of all the three punctures XDa, XDb and XDc with their respective position in *C. hyppasia* appears specific for Catocalinae. The two setae of subdorsal group in *C. hyppasia* though the same length differ structurally, $SD_1$ being thin, delicate and having a pigmented socket than $SD_2$. The same condition of $SD_1$ has also been repeated only in Ab IX. Hinton (1946), however, described the pigmented socket of $SD_1$ in the thorax of Agrotinae alone but the differentiation in the nature of $SD_1$ and $SD_2$ was not uncommon in Pyralidae. Nonetheless, the equal sized $SD_1$ and $SD_2$ were described by Thakar & Srivastava (1983) in another catocalid, *Achaea janata* (L.). In present study the bisetosed lateral group has $L_2$ identical to $SD_1$ in the prothorax of *C. hyppasia*. The bisetosed condition in lateral group emphasized as an important character of Noctuidae by Gardner (1948) was later utilized to plan out three species of *Plusia* by Mukerjee and Singh (1951). Peterson (1962) also used this as a common feature for Noctuidae (=Phalaenidae) while describing the immature stages of Lepidoptera. Thakar & Srivastava (1983), however, overlooked $L_2$ in *Achaea janata*. On uni, bi-and trisetosed condition of subventral group on Ab I and II, Gardner (1947) differentiated the subfamilies of Noctuidae. According to him, the trisetosed subventral group places *C. hyppasia* in Catocalinae. The presence of a single seta of SD group from Ab I–Ab VIII, Gardner (1946, 1947) described as the subfamily character but its supraspiracular position anterad to the level of spiracle in *C. hyppasia* is very much inaccordance to the position given in *Gramodes stolida* (Fabr.), another catocalid figured by him. $SD_1$ of Ab IX, though is identical to $SD_1$ of thoracic segments in *C. hyppasia*, Mukerjee and Singh (1951) described similar position for two species of *Plusia nigrisigna* and *P. chelcytes* but described $SD_1$ as a normal seta in *P. orichalcea*. Hinton (1946) described $SD_2$ on the spiracle bearing abdominal segments with its function being tactile. An identical seta since named as microscopic ($MSD_2$) appears justified to assign proprioceptor after Hinton (1946) as observed on Ab I to Ab VIII in *C. hyppasia*.

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