Uttar Pradesh J. Zool. 1 : 6–15, 1981

CEPHALIC DEMARCATIONS AND CHAETOTAXY OF LARVAL *DIACRISIA OBLIQUA* (WLK.) (ARCTIIDAE)

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The diversified position of the frons, adfrontals and clypeal sclerite on the head capsule of larval Lepidoptera an arctiid has been attempted to simplify the terminology for uniformity in usage. Several unnomenclated setae and punctures are named, and described new while discussing the chaetotaxy. A few characters of taxonomic interest have also been generalised.

INTRODUCTION

Number of workers on immature stages of several lepidopteran families have described the cephalic chaetotaxy of classificatory significance (Dyar, 1896 Frackers, 1915; Forbes, 1910 & 1916; Heinrich, 1916; Ripley, 1923; Gardner, 1946; Hinton 1946 & 1947; Mukerji & Singh, 1951; Mathur, 1954; Singh 1951 & 1956; Farooqui & Singh, 1973; and Downey & Allyn, 1979). Comparing the bulk of lepidopteran species available in Indian tropics very little has been attempted to describe the homology and setal arrangement of the head capsule. While describing the head capsule of *Diacrisia obliqua* (Wlk.), it is observed that it gets modified during ecdysis but with proportionate growth. According to Heinrich (1916) the basic plan of such characters persists even through most of the changes. Being another polyphagous lepidopteran pest, and India wide in distribution, *D. obliqua* has been described in the present study which feeds over the summer and monsoon crops of the sunflower, an unconventional oilseed crop raised in western Uttar Pradesh.

MATERIAL AND METHODS

The eggs of the *D. obliqua* collected from leaves of the sunflower crop (EC 68414) raised in the college campus, and were reared in laboratory. The exuvia obtained from each moulting instar was cleared in distilled water, dehydrated and stained with Acid fuschin for preparing the balsam mounts. The sketching of the head capsule of fourth instar caterpillar was directly done from such mounts with the help of Camera lucida. The position of setae and punctures

was also ascertained from a sequence of freshly narcotised instars. To maintain uniformity for the head sclerites and sutures Hinton's (1947) terminology was followed. The setae and punctures were named after Heinrich's (1916) setal areas, and elaborated after Hinton (1946).

OBSERVATIONS

The head capsule

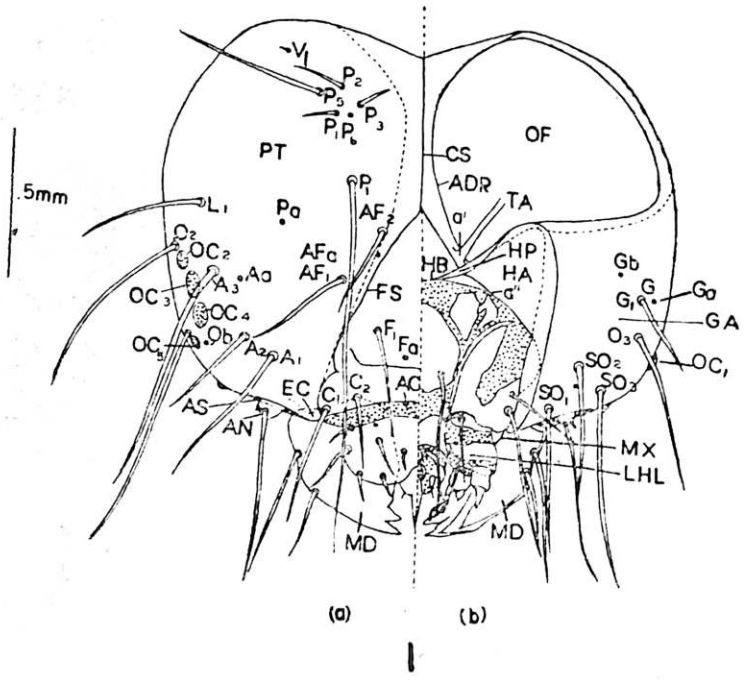
Compressed cephalo-caudally with hypognathous type of orientation, the head capsule of *D. obliqua* was dark brown in colour and elliptical in shape (Fig. 1). The cephalic sclerites got largely consolidated bearing several setae and punctures. An invented Y-shaped epicranial suture is present separating two large sclerites of the epicranium known as parietals (PT) running antero-dorsally. The common basal stalk of the epicranial suture is known as the coronal suture (CS) which gets bifurcated into two diverging arms, the fronto-clypeal sutures (FS). Each frontoclypeal suture is internally strengthened by the attachement of tentorial arms (TA) (a') (Fig. 3b). The triangular sclerite enclosed between the frontoclypeal sutures is the frontoclypeus (FC), with an incomplete transverse suturation (S) and ridged internally (R) (Figs. 3a & b). The frontoclypeus thus gets divided into two unequal halves. A thin cuticular, the anticlypeus (AC) lies infront (Fig. 3a). The frons, the adfrontals and the corresponding sutures of several authors are indistinct in *D. obliqua* The adfrontals appear to get inflected into the adfrontal ridge (ADR) (Fig. 3b) Behind the antennal sockets (AS) there are six ocelli (OC_1—OC_6). Ocellus OC_6 lies on the posterior whereas five (OC_1—OC_5) remained on lateral side of the epicranium arranged in a semi-circular style ventro-laterally (Fig. 2). The narrow marginal area of the sixth ocellus and the antennal sockets (antecava of Stickney, 1923) on either side contributes to a place of articulation for the gnathal appendages.

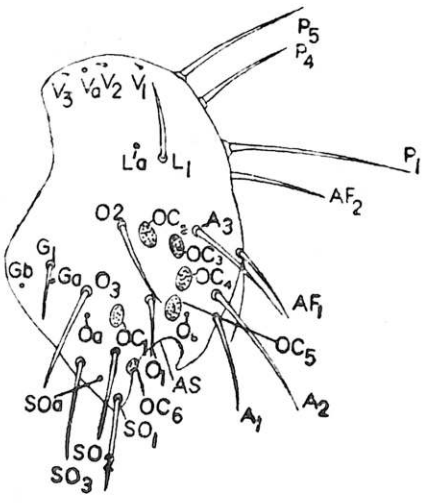
The epicranium of either side posteriorly forms a genal area (GA) which extends into the hypostomal area (HA) (Fig. 1b). From each hypostomal area there arises a short hypostomal process (HP) which medially gets connected by a similar process of either side to form a membranous hypostomal bridge (HB). The hypostomal area thus separates the maxillo-labial hypopharyngeal complex from the occipital foramen (OF). The dorso-posterior part of the epicranium has also contributed to the dorsal margin of the occipital foramen. The vertex of the caterpillar has no deep emargination (Fig. 1).

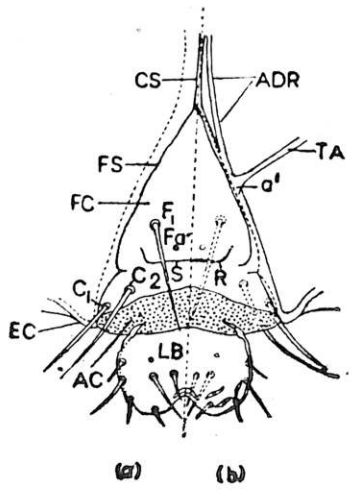
The setal arrngement

About 24 setae and 12 punctures have been observed on each half of the head capsule. The frontoclypeus anteriorly bears three pairs of setae C_1, C_2 and

F_1 and a single pair of punctures Fa (Fig. 1a). C_1 remains situated nearer the epicondyle of epicranium compared to C_2. The C_2 lies slightly mesad to and is longer than C_1. The F_1 and puncture Fa are situated on either side of the mid-dorsal part of the frontoclypeus. The puncture Fa lies mesad to F_1 and by the







Figs. 1-3. 1. The head capsule of 4th instar caterpillar of *D. obliqua* (a) anterior view (b) posterior view. 2. Lateral view of the parietal. 3. The frontoclypeal region (a) frontal view (b) inner view. (Abberiviation with the text)

side of incomplete suture of the frontoclypeus. The remainder 21 pairs of setae and 11 pairs of punctures remained associated to the epicranium. AF_1 and AF_2 with puncture AFa formed the adfrontal group of setae situated along the frontoclypeal suture with AF_2 almost near the point of bifurcation of the coronal suture. AF_2 is more dorsad and mesad than AF_1 whereas puncture AFa is again slightly mesad between AF_1 and AF_2 but more closer to the latter (Fig. 1a).

The antero-dorsal group of setae lying inbetween the ocellar and the adfrontal groups has three setae (A_1-A_3) and a puncture Aa with $A_3>A_1>A_2$ lengthwise. A_3 is closer to OC_3 in particular and dorsal to A_2 and A_1. The puncture Aa lies mesad to A_3 and in a linear position between A_3 and AF_1 (Fig. 1a).

The ocellar group dorsal to the antennal sockets bears six ocelli (OC_1-OC_6), five arranged in a semicircle (OC_1 to OC_5) whereas OC_6 remained situated at the margin of the antennal socket. This group is also characterized with three setae (O_1-O_3) and two punctures Oa and Ob. The seta O_1 is the longest and lies inbetween OC_1 and OC_5, and more closer to the later. O_2 is posterodorsal in position and nearer to OC_2. O_3 is posterodorsal and almost closer to OC_1. A puncture Oa lies in alinement of OC_1 and closer to O_3. The puncture Ob is anteriorly nearer to OC_5 (Fig. 2).

The subocellar group lies posterior to the antennal socket and has three equalized setae, SO_1, SO_2 and SO_3 and a puncture SOa. SO_1 is posteroventrad to SO_2 which is closer to OC_6, whereas SO_3 is posterior and slightly ventrad to SO_2. The distance between SO_3 and $SO_2<SO_2$ and SO_1. The puncture SOa lies in the line of SO_3 and almost at an equidistant from SO_3 and SO_1 (Figs. 1b & 2).

The genal group is situated laterad to hypostoma having a single small seta G_1 and two punctures Ga and Gb. Ga is laterad to G_1 whereas Gb is dorsomesad to G_1 (Figs. 1b & 2).

The lateral group is represented by a single seta L_1 and a puncture La. The L_1 lies dorso-mesad to OC_2 whereas the puncture remains posterodorsad and closer to L_1 (Fig. 2).

The posterodorsad group has five setae P_1 to P_5 and two punctures Pa and Pb. The seta P_1 is near and laterad in position to AF_2 and longest of all the seta present on the head, P_2, P_3, P_4 and P_5 forming a quadrate where distance between P_2 and $P_4<P_3$ and P_5. The puncture Pa lies in a line between P_1 and P_3. The puncture Pb also lies at a triangular position between P_3 and P_4 and also making a straight line with P_2 and P_1, where the latter lies closer to the puncture Pb (Fig. 1a). The setae of this area grouped into two, the primary setae

(P_1 & P_2) and secondary setae (P_3, P_4 & P_5). Due to the absence of P_5 in the left epicranium, an asymmetrical condition has been observed in *D. obliqua*.

The vertical group has three minute setae V_1, V_2 and V_3 and a puncture Va. The setae V_1 to V_3 form a row diverging along the occipital margin at right angle to the coronal suture. The puncture Va lies inbetween the V_2 and V_3 (Figs. 1a & 2).

DISCUSSION

Forbes (1910), Crampton (1921), Mukerjee & Singh (1951), Srivastava & Mathur (1964), and Azam & Ali (1965) have described in general to a triangular piece of sclerite situated in between the two frontal sutures (epistomal sutures of Snodgrass, 1935). According to them the frons is further bounded and delimited on either side by the adfrontals and the adfrontal sutures respectively. The clypeus lies infront of the frons as small sclerite. In *D. obliqua* it appears that the head epicranium along the epicranial suture (=line of weakness of DuPorte, 1946) gets deeply inflected into a corresponding inverted Y—shaped pronounced ridge. Such inflation of the so called frons along the Y—shaped suturation has been in agreement to Dampf (1910), Heinrich (1916), and Crampton (1921). Snodgrass (1935) and Hinton (1947) although described these sclerites based on the origin and insertion of different muscles but hold different opinions. Yet to the clypeus of Snodgrass (1935), Hinton (1947) described "a flexible more or less membranous anteclypeus and well sclerotized the postclypeus", and further that "the postclypeus usually has a transverse internal thickening (strengthening ridge) about half way between its anterior margin and the origin of the anterior tentorial arms". Hinton (1947), therefore, concluded in part to call the entire triangular sclerite as "the frontoclypeal apotome"* (antefrons of DuPorte, 1946). To simplify the position of the frons, Hinton's (1947) terminology is accepted in the present description.

The adfrontals of several workers of even to recent Franzmann & Garret (1978) are indistinct in *D. obliqua*. In all likelihood, the characterised inflected part of the margins of the epicranial suture overlooking through thin and transparant cuticle around the frontoclypeal area have been presumably the adfrontals. Besides, a triangular frons and anterior clypeus, Peterson (1912) and Srivastava & Pandey (1967) in confirmity to the present observations are the only workers who were unable to distinguish the adfrontals in their respective studies on *Protoparce carolina* and *Tarucus theophrastus* F. A flexible membra-

*Apotome : A short anterior subdivision of each abdominal sternum separated by a membranous fold from the rest of the plate (Snodgrass); Torre-Bueno, Glossary, 1962.

nous cuticle in between the labrum and the frontoclypeus is the anteclypeus (Hinton, 1947) in *D. obliqua*. The present frontoclypeus thus remains bounded by the frontoclypeal sutures on either side passing along the place of articulation of the tentorial arms internally. Each frontoclypeal suture thus extends forming the coronal stem of the epicranial suture. The two frontoclypeal sutures along the coronal stem lie parallel and closely approximated to each other forming a line of weakness (DuPorte, 1946) which usually splits open during ecdysis (Snodgrass, 1935; Hinton, 1947). Nonetheless, the presence of the hypostomal bridge (Snodgrass, 1935), an inverted Y—shaped epicranial suture, and relatively large occipital foramen have been characteristic for the lepidopteran caterpillars (Hinton, 1947).

In conformity to areas demarcated by Heinrich (1916), the anterodorsal, lateral, vertical, frontal, adfrontal and clypeal groups of setae hardly vary in their number and arrangement in *D. obliqua* and rather supported a more simplified system evolved by Hinton (1946) for these areas.

In an ocellar group of setae the caterpillar of *D. obliqua* has a puncture Ob close and mesad to OC_5. It was also described by Gerasimov (1935). Hinton (1946) though observed the presence of such a puncture between OC_3 and OC_4, but left unnamed. The subocellar group of setae in *D. obliqua* has three setae ($SO_1 - SO_3$) and a single puncture SOa. In the same region Gerasimov (1935) had described the same number of setae but with three punctures. The present observation although supported Gerasimov (1935) and Hinton (1946) but the latter did not name the punctures (Table 1).

Dyar (1895) and Forbes (1910) perhaps could not recognize the genal group of setae. Heinrich (1916), Repley (1923), Gerasimov (1935) and Downey & Allyn (1979) characterized the area by a single setae and a puncture G_1, Ga respectively. Hinton (1946) described the presence of the two setae and one puncture in the group. In *D. obliqua* the group is characterized by the presence of a single seta G_1 and two punctures Ga and Gb, the latter being described as a variation than earlier workers.

The posterodorsal groups of setae are characterized by two setae P_1 and P_2 and two punctures Pa and Pb in immature lepidopteran forms (Heinrich, 1916; Ripley, 1923; Gerasimov, 1935; Hinton, 1946; Azam & Ali, 1965). In fully grown caterpillar of *D. obliqua* the group is characterized by five setae P_1 to P_5 and two punctures Pa and Pb (Table 1). The first instar exeuviae had two setae P_1 and P_2 and two puncture Pa and Pb. The seta P_3 appears in the second instar exuvia mesad to P_2 whereas setae P_4 and P_5 appear in the third instar

Table 1. Nomenclature of the cranial setae according to various authors.

Dyar, 1896 Forbes, 1910	Heinrich, 1916		Ripley, 1923		Gerasimov, 1935		Hinton, 1946	*D. obliqua*
IX	Anterodorsal	Ad—1	Seta of vertex	V_9	Anteriores prima	A_1	A_1	A_1
VIII	,,	Ad—2	,,	V_8	,, secunda	A_2	A_2	A_2
IV	,,	Ad—3	,,	V_4	,, tertia	A_3	A_3	A_3
—	,,	Ad—2a	Sensorium of vertex	SV_3	Porus anteriores	Aa	Aa	Aa
VII	Ocellar	0—3	Seta of vertex	V_7	Ommatalis prima	O_1	O_1	O_1
V	,,	0—2	,,	V_5	,, secunda	O_2	O_2	O_2
—	,,	0—1	,,	V_6	,, tertia	O_3	O_3	O_3
—	,,	0—1a	—		Porus ommatalis	Oa	Oa	Oa
—	—		—		,, ,,	Ob	(not named)	Ob
XI	Subocellar	SO—1	Seta of vertex	V_{11}	Subommatalis prima	SO_1	SO_1	SO_1
VI	,,	SO—2	,,	V_{12}	,, secunda	SO_2	SO_2	SO_2
X	,,	SO—3	,,	V_{10}	,, tertia	SO_3	SO_3	SO_3
—	,,	SO—2a	—		Porus subommatalis	SOa	SOa	SOa
—	—		—		,, ,,	SOb	(not named)	—
—	—		—		,, ,,	SOc	(not named)	—
III	Lateral	L—1	Seta of vertex	V_3	Lateralis	L_1	L_1	L_1
—	,,	L—1	—		Porus lateralis	La	La	La
II	Posterodorsal	Pd—1	Seta of vertex	V_2	Posteriores prima	P_1	P_1	P_1
I	,,	Pd—2	,,	V_1	,, secunda	P_2	P2	P_2
—	—		—		—		—	P_3
—	—		—		—		—	P_4
—	—		—		—		—	P_5
—	Posterodorsal	Pd—1a	Sensorium vertex	SV_2	Porus Posteriores	Pa	Pa	Pa
—	,,	Pd—2a	,, ,,	SV_1	,, ,,	Pb	Pb	Pb

exuvia with a constant number of five setae in the successive moults thereafter. Following Forbes (1910), Hinton (1946) and Downey & Allyn (1979) it appears fully justified to describe P_1 and P_2 as the primary setae and P_3, P_4 and P_5 the secondary setae of the posterodorsal group of the epicranium, a characteristic suture of the arctiids (Forbes, 1910). Noteworthy has been the positions of the secondary setae at third exuviae where addition of P_5 leads to the left half of the epicranium asymmetrical with only four setae in the group. Heinrich (1916) also recorded such abnormalities on the two parietals (epicranial lobes) from the lepidopteran head.

Nonetheless, all the setae observed on the head cap ule of *D. obliqua* are smooth in their shape but vary in size. The long setae are more or less observed on those areas of the head which are not actually retracted into the prothorax, whereas the minute have been assigned to be the proprioceptors by Hinton (1946).

ACKNOWLEDGEMENTS

The Council of Science & Technology, Lucknow for sanction of a research scheme (CST-2387/DC-23 (67)/78) to one of the authors (SCG) is thankfully acknowledged. Thanks are also due to Dr. V. Misra, Principal (Sanatan Dharm College) for providing necessary facilities.

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