

A Mecopterous Larva from Tasmania and Notes on the Morphology of the Insect Head

By

J. W. EVANS

(Read 13th October, 1941)

PLATE IV

In some spirit material which was sorted during the winter of 1941, two larval Mecoptera were discovered. They had been collected in moss on Mt. Wellington during the previous January, at an elevation of between two and three thousand feet.

Four species of Mecoptera are known to occur on Mt. Wellington. These are *Harpobittacus australis* Klug. (Bittacidae); *Apteropanorpa tasmanica* Carp. (Panorpidae); *Nannochorista dipteroides* Tillyard and *N. maculipennis* Tillyard (Nannochoristidae). The larva of *Harpobittacus* has been described (Currie, 1932), and in no way resembles those found. It is probable that these are the larvae of a *Nannochorista* and not of *A. tasmanica*, because the moss was from an environment frequented by *N. dipteroides*. *A. tasmanica* and *N. maculipennis* have so far only been taken in open country, at an elevation of about four thousand feet.

Tillyard (1917) believed *Nannochorista* larvae to be aquatic, because the adult insects are almost always taken close to water. However, as they can be found in equal abundance both close to stagnant alpine pools and to fast-flowing streams, damp moss might even more be expected to provide their natural environment. The suggestion that the larvae are those of *Nannochorista* is supported by their structure. Adult *Nannochorista* spp. retain more archaic characters than any other representatives of the Eumecoptera; hence their larvae might well be expected to have primitive features. The larvae described in this paper are less specialized than any described Mecopterous larvae, and have, as well, certain unusual primitive features associated with the structure of the head.

Applegarth (1939) has stated that very little is known concerning larval Mecoptera, yet they are of the very greatest interest, because it is accepted that the Mecoptera are directly ancestral to all Holometabolous orders of insects, with the exception of the Coleoptera. Further, as the nymphs of all the Hemimetabola hatch from the egg in a post-oligopod phase, which is a later ontogenetic stage than that retained by the larvae of Holometabolous insects, in a polypod Mecopteron larva may be expected to occur more primitive structural characteristics than in any other pterygote insect.

DESCRIPTION

The two larvae are five and six millimetres long respectively. They are brown in colour and probably in their second instar.

The Head

The head is illustrated in Plate IV, figures 1-3. Figure 1 represents the head in facial aspect. Posteriorly a median oval area, the occiput, is separated from the rest of the head by inwardly-curved lateral sutures. Anterior to the occipital sutures are a pair of lateral folds, the postfrontal folds. The coronal suture is the median suture that extends from the hind margin of the occiput to the apex of the frons. The frons is delimited posteriorly by a V-shaped suture, the epicranial suture; laterally by a pair of more or less parallel frontal sutures and anteriorly by the epistomal suture. The epistomal suture is more pronounced than the other sutures and consists of a thickened sunken fold. The median portion of the frons is separated from the rest by a V-shaped ridge and bears a raised tubercle antero-medially.

Lying on each side of the frons, between it and the eyes, are the genae. These are bounded posteriorly by the postgenal sutures, which extend from the eyes on each side as far as the junction of the epicranial and the frontal sutures. The sub-ocular sutures extend from the margin of the eyes on each side as far as the frontal sutures. The clypeus is rectangular, sclerotized anteriorly, and the labrum is wide. The eyes comprise sixteen ommatidia, which lie close together in a compact group. The antennae have three segments. The first is reduced to a narrow band, the second is bulbous and bears several large sensory pits, arranged more or less in two rows, and the apical segment is spine-like. The anterior tentorial pits lie against the frontal sutures between the sub-ocular and the epistomal sutures.

Figure 2 represents the head in ventral aspect. The post-occiput, which consists of a pair of narrow sclerites separated from the rest of the head by the post-occipital suture, borders the foramen magnum on each side, and the cervical sclerites articulate with the occipital condyles, which lie in the centres of the two sides of the post-occiput. The labium consists only of a longitudinally divided sub-mentum and a pair of palps, and the posterior tentorial pits are invaginated between the sub-mentum and the post-occiput.

The Thorax

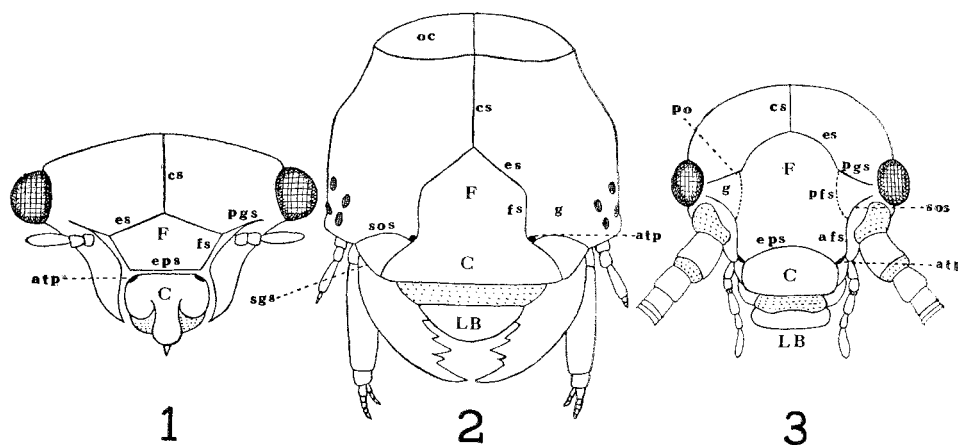
The first and second thoracic segments are illustrated in Plate IV, figures 3 and 5. The metathorax resembles the mesothorax in all essential features. Between the head and the thorax is a distinct neck region, which is supported by a bow-shaped cervical sclerite. Both the meso- and meta-thorax have several raised bosses armed with delicate spines; the position of these is indicated in the figures. The legs have each three segments and their apices are hook-shaped.

The Abdomen

An abdominal segment typical of segments 1-7 is illustrated in Plate IV, figures 4 and 6. The terminal segments are illustrated in figure 7. There are ten abdominal segments, the first eight of which bear a pair of appendages and the first nine a pair of spiracles. The appendages, which are simple processes, are slightly curved in a forward direction. In addition to spines (fig. 8c), each of the abdominal segments 1-9 bears a pair of small dorsal processes (fig. 8a), whilst segment 10 has a somewhat larger median dorsal process (fig. 8b). There is a sensory pit close to the base of each dorsal paired process.

DISCUSSION

In certain groups of insects, such as the Dermaptera, a triangular area may occur in the frontal region of the head which is bordered by faint lines or ridges, but not true sutures, and in addition a pair of widely divergent sutures extend outwards from the anterior apex of the coronal suture. Snodgrass (1935) is of the opinion that these widely divergent sutures are not homologous with true frontal sutures, and following Crampton (1932) terms them postfrontal sutures. This is because not only do these sutures extend as far as the eyes on each side but they may also lie posterior to the paired ocelli.



1. Head of a nymph of *Hemiodoecus fidelis*.
2. Head of a larva of *Archichauliodes dubittatus*.
3. Head of a nymph of *Tasmanoperla* sp.

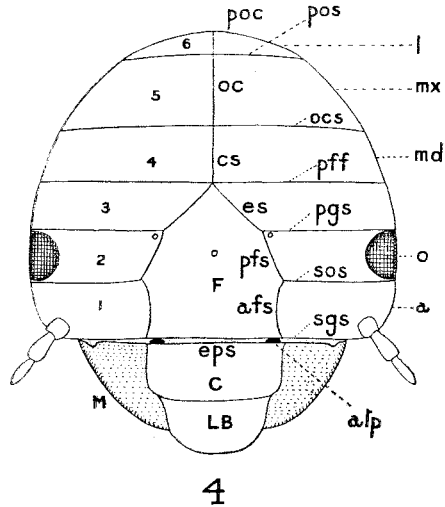
afs., anterior frontal suture; atp., anterior tentorial pit; C., clypeus; cs., coronal suture; es., epicranial suture; eps., epistomal suture; F., frons; fs., frontal suture; g., gena; LB., labrum; oc., occiput; pfs., posterior frontal suture; pgs., postgenal suture; po., position of ocellus; sgs., subgenal suture; sos., subocular suture.

In certain insects the frons, instead of being triangular in shape, as is usual, is either five- or seven-sided. Examples of such a frons occur in the nymph of *Hemiodoecus fidelis* Evans (Homoptera, Peloridiidae), the larva of *Archichauliodes dubittatus* Walk. (Neuroptera Corydalidae), the nymph of *Tasmanoperla* sp. (Perlaria, Austroperlidae), and the larva of *Perga* spp. (Hymenoptera, Tenthredinidae). The heads of the three first-named are illustrated in Text-figures 1-3.

The frons of the larva of *Nannochorista* (?) has seven sides, and it is suggested that such a condition is ancestral to a triangular frons.

Following the use of terms already employed in describing the heads of Homoptera (Evans, 1938), the posterior sutures of the frons are referred to as the epicranial sutures and the lateral sutures as the frontal sutures. Each frontal suture consists of an anterior and a posterior frontal suture. The sutures that arise from the anterior apices of the epicranial sutures on each side of the head, and which extend as far as the eyes, have been named, earlier in this paper, the postgenal sutures. It is believed that the postfrontal sutures of Snodgrass and Crampton are the combined epicranial and postgenal sutures. Further, the lateral sutures of a triangular frons are made up of combined epicranial and frontal sutures. In *H. fidelis* epicranial, postgenal, frontal, and epistomal sutures are

present. In *A. dubittatus* epicranial and frontal sutures are developed, but not postgenal and epistomal sutures. In *Tasmanoperla* epicranial, postgenal, anterior frontal, posterior frontal, and epistomal sutures are all present, as they are likewise in *Nannochorista* (?). Paired ocelli, when present, lie in the angles between the postgenal and frontal sutures; their position is indicated in Text-Figure 3 (po.).



4. Hypothetical insect head to illustrate the basic segmentation.

a., antennal segment; l., labial segment; m., mandible; md., mandibular segment; mx., maxillary segment; o., ocular segment; ocs., occipital suture; pff., postfrontal fold; pos., post-occipital suture. Other lettering as in previous figures.

Thus the head is seen to have several distinct transverse sutures, of which the three posterior continue across the head and the three anterior are interrupted by the frons. Text-figure 4 is a diagrammatic representation of an insect head based on the head of the larva of *Nannochorista* (?) and on the heads illustrated in Text-figures 1-3. The subocular suture is not homologous with the subocular suture of Snodgrass (fig. 58a), which is the anterior frontal suture, as is also his subantennal suture (fig. 59a). It is possible that the sclerite numbered 1 in Text-figure 4 may be homologous with the sclerite lying anterior to the eyes in *Chauliognathus pennsylvanicus* de Geer (Coleoptera, Cantharidae) figured by Campau (1940), with the anterior lateral sclerites of *A. dubittatus* and with the antennal sclerite of *Tasmanoperla*. Whether this sclerite is also homologous with the pleurostoma of certain Orthoptera is uncertain. In *Corydalus*, Comstock (1920), who termed these sclerites the ante-coxal pieces of the mandibles, believed them to be of clypeal origin. Somite 3, to which no appendage has been assigned, may be identified either with the first postoral somite, as illustrated in Snodgrass (fig. 54a), or with the mandibular somite. If the latter, then somite 4 will be the superlingual segment.

The significance of the median triangular area of the frons is uncertain (Plate IV, fig. 1); it may be associated with the tentorium, as the sides of the triangle lie immediately above the anterior arms of the tentorium. Although

homologous with a similar area to be found in some Dermaptera, it is not homologous with that of Lepidopterous larvae, where it consists of the clypeus. The raised tubercle figured may precede the median ocellus.

The head of the first instar larva of *Panorpa klugi* MacLachlan, figured by Miyake (1912), resembles that of the larva of *Nannochorista* (?) in general features. The frons of the latter is narrower and more elongate, postgenal and occipital sutures are not developed, and the eyes have twenty-eight ommatidia. In addition the labial palps are shorter in relation to the maxillae, and the antennae have more numerous sensory pits.

Crampton has illustrated a head of a *Panorpa* sp. which resembles the head of the Tasmanian insect in the retention of a distinct occipital region, and in the possession of a five-sided frons. It differs in having a pair of transverse sutures that extend widely from the junction of the coronal and epicranial sutures as far as the antennae on each side, and in lacking postgenal sutures. Such an unusual development is difficult to comprehend, unless it is supposed that Crampton's paired transverse and anteriorly directed sutures are actually combined epicranial and postgenal sutures, and his frons identical with the area in Plate IV, fig. 1 which is bordered by dotted lines. This median frontal area is also differentiated in *Apterobittacus apterus* MacLachlan, figured by Applegarth.

With regard to the ventral surface of the head, the labium in *Nannochorista* (?) is better developed than in *A. apterus* and *Harpobittacus tillyardi* E. P., whilst in *Apterobittacus* no trace remains of the distinct divided sub-mentum of *Nannochorista*.

The single thoracic spiracle is in an identical position in *Nannochorista* (?) and *P. klugi*, but in *Apterobittacus* it lies directly below the pronotum, and the arrangement of the thoracic setae of *Nannochorista* (?) is similar to, though not identical with, that of *P. klugi*.

The abdomen of the larvae of *Nannochorista* (?) differs from that of other known Mecopterous larvae in lacking dorsal annulated setae, such as are well developed in every segment of first-instar specimens of *P. klugi*, and retained though reduced, excepting on the eighth and ninth segments, in later instars. The simple nature of the setae of *Nannochorista* (?) can best be explained on the grounds that they are primitive rather than reduced structures.

REFERENCES

- APPLEGARTH, A. G., 1939.—The Larva of *Apterobittacus apterus*. *Microentomology* IV (4); 109.
 CAMPAU, E. J., 1940.—The Morphology of *Chauliognathus pennsylvanicus*. *Microentomology* V (3); 57.
 COMSTOCK, J. H., 1920.—An Introduction to Entomology. Comstock Publishing Co., Ithaca, N.Y.
 CRAMPTON, G. C., 1932.—A Phylogenetic Study of the Head Capsule in certain Orthopteroid, Psocoid, Hemipteroid, and Holometabolous Insects. *Bull. Brooklyn Ent. Soc.* XXVII (1); 19.
 CURRIE, G. A., 1932.—Some Notes on the Biology and Morphology of the immature stages of *Harpobittacus tillyardi*. *Proc. Linn. Soc. N.S.W.* LVII (3-4); 16.
 EVANS, J. W., 1938.—The Morphology of the Head of Homoptera. *Pap. R. Soc. Tas.*; 1.
 MIYAKE, T., 1912.—The Life-History of *Panorpa klugi*. *Jour. Agric. Imp. Univ. Tokyo* IV; 117.
 SNODGRASS, R. E., 1935.—Principles of Insect Morphology. McGraw-Hill Book Co. Inc., N.Y.
 TILLYARD, R. J., 1917.—Studies in Australian Mecoptera, No. 1. *Proc. Linn. Soc. N.S.W.* XLII (2); 284.

PLATE IV

- FIG. 1.—Head of larva of *Nannochorista* sp. (?) in facial aspect. atp., anterior tentorial pit; cs., coronal suture; eps., epistomal suture; es., epicranial suture; fs., frontal suture; g., gena; oc., occiput; ocs., occipital suture; pff., postfrontal fold; pgs., postgenal suture; sos., subocular suture.
- FIG. 2.—Head of larva of *Nannochorista* sp. (?) in ventral aspect. csl., cervical sclerite; occ., occipital condyle; poc., post-occiput; pos., post-occipital suture; ptp., posterior tentorial pit; smt., sub-mentum.
- FIG. 3.—Head and two anterior thoracic segments of the larva of *Nannochorista* sp. (?) in lateral aspect. sp., spiracle; csl., cervical sclerite.
- FIG. 4.—Second abdominal segment of the larva of *Nannochorista* sp. (?) in lateral aspect.
- FIG. 5.—Two anterior thoracic segments of the larva of *Nannochorista* sp. (?) in dorsal aspect.
- FIG. 6.—Second abdominal segment of the larva of *Nannochorista* sp. (?) in dorsal aspect.
- FIG. 7.—Apical abdominal segments of the larva of *Nannochorista* sp. (?) in dorsal aspect.
- FIG. 8.—(a) dorsal abdominal process; (b) median terminal dorsal abdominal process; (c) thoracic and abdominal seta.

