THE ANATOMY OF A CHIRONOMID LARVA OF THE GENUS *POLYPEDILUM.*

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(Plate XXIII).

There has been an unfortunate confusion as to the generic name of the larva here described. The adult fly reared from a similar larva was originally named by Kieffer *Chironomus fasciatipennis* (4), and is referred to under this name by Annandale (2), and also by Gravely (3). Kieffer in a later paper (5) assigned the species to the genus *Polypedilum* Keiff., and it must therefore be known as *Polypedilum fasciatipennis* (Kieff.). It is impossible to be certain with our present knowledge of the Chironomid larvæ whether the form that I am about to discuss is specifically identical with the one from Calcutta, but no difference has been discovered either in structure or in habits, and there is no doubt of the generic identity.

The specimens on which I have based my observations were taken in the Inlé Lake, Southern Shan States, by Dr. N. Annandale and Dr. F. H. Gravely in February 1917. They were living among dense masses of weed (*Ceratophyllum*) in clear water. The habits of the Calcutta form as described by Annandale (1, 2) are as follows :—" In the early stages of its larval life this insect wanders free among communities of protozoa (*Vorticella, Epistylis*, etc.) and rotifers on which it feeds, but as maturity approaches begins to build for itself a temporary shelter of one of two kinds, either a delicate silken tunnel the bottom of which is formed by some smooth natural surface, or a regular tube
The tubuler shelters occasionally found are very much stouter structures than the tunnels, but are apparently made fundamentally of the same materials ; and structures intermediate between them and the tunnels are sometimes produced. The larva as a rule fastens to them branches detached from living colonies of Vorticellid protozoa such as *Epistylis*." In the Inlé form the tube[1] is made of a silky material and is closed at both ends, the larva however can come out of it at any point as the whole structure forms a loose net work. The tube is covered by a thick growth of a protozoan which has been identified as *Epistylis flavicans* by Dr. Ekendranath Ghosh.

The larvæ in their cases on being taken from the lake were put into a bowl of water, and it was observed that they began to devour the *Epistylis*. The protozoa on this broke off from their stalks and swam away. A small caddis-fly, of which vast swarms arose from the lake every evening at the period at which the larvæ were collected, dropped its eggs into the bowl in which the larvæ were living. These eggs were

[1] An enlarged photograph of the tube with its covering of protozoa is reproduced by Dr. Annandale on pl. XXI of this volume.

enclosed in a globule of jelly about the size of a small shot. The globule adhered to the case of a larvæ, which tried to eat them, but was prevented by the jelly from doing so.

The larva preserved in spirit is of a creamy colour when taken out of its tube ; when alive it was semi-transparent without any tinge of red. It is 6·5 mm. in length, and like the ordinary Chironomid larvæ is worm-like in appearance. It differs from the common blood-worms in having no ventral blood-gills on the eleventh segment, and in that the blood lacks red pigment. In one specimen, which was ready for pupation when preserved, the nymphal characters are well developed and can be easily seen in a Canada balsam preparation. It shows that in the nymph, instead of the two groups of respiratory filaments on the pro-thorax, two nymphal trumpets are developed for respiration. The larva is thus of Meinert's *Motitor* group of Chironomus larvæ (6), but differs from other described larvæ of this group in having a small head, and in that the brain lies in the pro thorax instead of the head.

In the body of a young larva the head and the twelve segments of the thorax and abdomen can be easily distinguished (fig. 1). In advanced larvæ, however, fusion takes place in the thoracic region and the segments are not easy to distinguish.

Head.—The head is a very small structure with a chitinous covering much thicker than that of the rest of the body. It is of a yellowish colour. In front of the antennæ it is much narrower than behind. The dorsal surface is very convex, descending rapidly to the nearly straight posterior surface, gradually at the outwardly bulging sides, and with a very steep forward slope on the anterior surface (fig. 3). The ventral surface is nearly flat. The dorso-lateral sides of the head are formed by three chitinous pieces, *viz.*, a median process (the clypeus), and two lateral plates. The lateral plates are designated the epicranial plates by Miall and Hammond (7). This, however, is an inappropriate name when applied to the head of this larva, because in it the brain does not lie in the head, and so this part of the head is not the cranium in a strict sense. The lateral plates besides forming the sides also form a little of the dorsal surface, and are continued ventrally to meet each other in the middle line, where a faint suture can be distinguished (fig. 4). From the anterior margin of the pre-antennal portion of the head a shelf-like fold hangs forwards. Its dorsal surface is convex and highly chitinized. The ventral surface slopes sharply inwards and slightly upwards towards the entrance to the buccal cavity. The ventral surface of this pre-antennal shelf is termed the *labrum* (*la*) by Miall and Hammond. It overhangs the mouth-parts, is mobile and can be bent backwards and inwards. On the dorsal surface the shelf bears two setæ, one on either side, while on the ventral surface (*i.e.*, the labrum) there are two simple setæ in the middle line, and two groups of thick setæ ; besides these the chitin on this surface is thickened along two crescentic lines on the sides and a central triangular area. The margins of this triangular area are raised into tooth-like processes.

Ventrally the pre-antennal portion of the head is marked off from the post-antennal by a narrow linear band of thickened chitin arising from

the sides of the labium. Immediately in front of the labium lies the opening of the buccal cavity. Ventrally in the post-antennal region the chitin is thickened to form the *labium* (*lb*) or the lower lip in the middle and two striated flaps (*f*) on its two sides. The flaps bear a large number of setæ, and are brush-like structures which help in closing the mouth opening on the sides.

On the lateral sides of the head two pairs of pigment spots or simple eyes (*e*) are present. The antennæ (*an*) lie in front of the eyes. Each antenna consists of a large basal joint arising out of a cup-shaped depression on the head. No sensory spot can be distinguished on the basal joint of the antennæ. To this basal joint two ramii are attached, the outer one is five-jointed and the inner is a long unjointed hair-like structure.

The mouth-parts consist of a pair of large *mandibles* (*md.*) and two pairs of *maxillae*. The mandibles (fig. 5) are large heavily chitinized structures without any setæ. They are attached by a broad base and have a curved pointed tip ; their inner cutting margin bears a number of teeth. The first pair of maxillæ (*mx.* fig. 6) are two-jointed structures, one on each side of the buccal opening and arising near the base of the mandibles (fig. 4) ; the upper joint is small and setose. The second pair of maxillæ are fused to form the *labium* (*lb.* fig. 4) which forms the lower margin of the funnel shaped buccal cavity. The labium has a toothed anterior margin with the teeth pointing forwards. Above it lies another thin plate. Miall and Hammond call the upper the *mentum* and the lower the *submentum*.

Thorax.—In a young larva the first three segments following the head are the pro-, meso-, and metathoracic (*t* 1, *t* 2, *t* 3, fig. 1). These three segments are quite distinct, but in a fully grown adult larva the line separating the mesothoracic from the metathoracic segment is not seen, the two forming a single structure. The notch separating the prothoracic from the mesothoracic segment, however, persists (fig. 2).

The prothoracic segment has a pair of club-shaped feet (*t. f.*) armed with two types of hooks. Both types of hooks are simple without serrations or teeth. One type (fig. 7) is curved like a scythe, whilst the other (fig. 7*a.*) is nearly straight. The curved hooks are arranged on the margins of the knob at the end of the foot, and the straight ones are in the centre. Both types of hooks, especially the curved ones, are of use to the animal in collecting and planting the colonies of *Epistylis* on its tube. The other two thoracic segments do not have any appendages.

Abdomen.—The abdomen is formed of nine segments (1-9, fig. 1), all of which are alike except the last one, which bears appendages and other outgrowths. It has a pair of large anal feet (*a.f.* fig. 1) ; these like the thoracic feet bear hooks. The hooks are arranged in concentric circles. The outermost ones have a very broad base and a much bent upper surface (fig. 8*c*), in the inner ones the curve is not so marked (figs. 8*a*, *b*), whilst the centre ones have a much less curved upper portion (fig. 8). Besides the anal feet described above, this segment bears two bunches of five setæ each (fig. 1), arising from conical papillæ on the dorsal

side ; these anchor the larva to the tube. Near the anus two pairs of blood-gills are also present (*b.g.*, fig. 1) ; from the base of each of the upper pair of gills a stout seta is also seen to arise.

Internal Anatomy.—No attempt is made to describe the internal anatomy in detail, which would be impossible with the very limited material available ; a few differences, from the form described in detail by Miall and Hammond are, however, noted.

The supra-oesophageal and the sub-oesophageal nerve ganglia lie in the prothoracic segment and not in the head, which as noted above is very small. The rest of the nervous system is essentially the same.

In the alimentary canal the cardiac portion of the stomach (*ca.* fig. 9) and the dilated chamber at the beginning of the small intestine (*ch.*) are poorly developed. The salivary glands (*s. g.*) also lie much more anteriorly, the ducts being relatively small.

The tracheal system has two well developed longitudinal tracheæ one on either side.

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