

XXXIII DESCRIPTIONS OF NEW INDIAN ODONATE LARVAE AND EXUVIAE

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(With Plates XXXII—XXXVII).

The following descriptions of Odonate larvae have been made from specimens sent to me through the kindness of Dr. N. Annandale and from others collected by myself. The former were mostly collected by Messrs. S. Kemp and F. H. Gravely. The latter were collected around Poona and the types or paratypes have now been sent to the Indian Museum.

Only two specimens of *Epophthalmia* were collected and one of these has since been partly destroyed, the perfect specimen going to the Museum.

Very little has been written on individual Odonate larvae and not more than 10 per cent of the Indian forms have hitherto been described. Still less is known of their habits. As more descriptions become available, they may be expected to throw considerable light on the phylogeny of the race, and if only for this reason, are valuable. That this is so, is aptly illustrated by the descriptions of the three species of *Cyclogomphus* and by noting the close similarity of two of them,—*C. verticalis* and *heterostylus*,—to *Macrogomphus annulatus*. This similarity is much greater than that between the two species and a third,—*C. minusculus*, and raises doubts as to whether they are placed correctly. The curving and cupping of the antlered lobes of *Epophthalmia* foretells the evolution of the cupped mask of the Libellulines. One has only to web in the spaces between the elongated teeth to obtain such a mask. This bears out the theory that the Libellulinae are an offshoot of a Corduline stem. Other suggestive structures are the triquetral caudal gills of *Chloroneura quadrimaculata* and the cleft middle lobe of *Protosticta graveleyi*.

SYSTEMATIC.

Suborder ANISOPTERA.

Subfamily CORDULIINAE.

1. *Epophthalmia frontalis*, Selys.

(Pl. xxxii, fig. 1; pl. xxxiv, fig. 2.)

Poona, 7. 4. 19, 1512/H2.

Length 33 mm. Length of hind femora 16 mm. Length of abdomen 24 mm. Mask deeply cupped and curved to cover the

face as in Libellulinae. The cup formed by the interlocking of the long, spinous jaws of the lateral lobes, in a way similar to the interlocked fingers of two hands. Base of mask extending as far back as the mid pair of coxae. Lateral lobes long and curved, antler-like, furnished with 6-7 long, spinous teeth, the proximal 3 or 4 of which are half the length of the distal and the most distad furnished with a small, moveable hook on its inner side (pl. xxxiv, fig. 2).

Antennae long and filiform, 7 segments. Eyes stalked, crab-like in appearance but not retractile, moderately small in comparison to the size of the head. Synthorax saddle-shaped and bulky. Abdomen tumid, strongly carinated dorsally, the carina consisting of a row of backwardly imbricated spines, one on each of segments 5 to 9; spinous prolongations to the sides of segments 8 and 9. Legs very long and spidery, naked.

Hab.—Running streams amidst curtains or masses of water-weed.

Subfamily *LIBELLULINAE*.

2. *Tholymis tillarga*, Hagen.

(Pl. xxxii, fig. 2; pl. xxxiv, fig. 1.)

Poona, 9. 5. 18, 1513/H2.

Length 26 mm. Length of hind femora 13 mm., of the hind leg 22 mm. Length of abdomen 15 mm.

Mask typically Libelluline, the lateral lobes meeting flush, by the close interlocking of bordering rows of small saw-like teeth to the number of 11. Mask deeply cupped (pl. xxxiv, fig. 1).

Antennae long and filiform. Eyes bluntly conical, the functioning part comparatively large. Posterior to the eyes, the head bears some coarse hairs.

Synthorax stout, abdomen tumid, not carinated on the dorsum, the sides of the segments finely spined and ending posteriorly in stout spines, these being very long and robust on the last three segments. Internally the terminal spines are finely fringed with longish hairs. Apical border of all segments finely fringed with short, even hairs.

Anterior and middle pairs of coxae clothed with long, coarse hairs. Femora with 3 rows of minute, widely-spaced spines.

Hab.—Conceals itself amongst masses of coarse water-weed. Usually breeding in small tanks, disused granite quarries which have filled with water being favourite spots.

3. *Tramea limbata*, Kirby.

(Pl. xxxii, fig. 3; pl. xxxiv, fig. 3.)

Poona, 4. 5. 18, 1514/H2.

Length of body 26 mm. Length of hind femora 13 mm., of hind leg 32 mm. Length of abdomen 17 to 18 mm.

Similar to the last in most respects but of heavier build.

Mask typically Libelluline, very deeply cupped, lateral lobes with interlocking teeth to the number of 16. These teeth pigmented at the tips and turned sharply in so that the apposition of the lobes is not so flush as in *tillarga*. Mid lobe moderately straight, slightly crenate along the border and fringed with coarse hairs (pl. xxxiv, fig. 3).

Antennae long and filiform, 7 segments.

Eyes small and shaped as horn-like processes which project markedly out from the sides of the head. Two or three coarse hairs posterior to the eyes and a largish, horn-like process at the posterior, outer angle of the head.

Trunk stout, abdomen tumid, markedly carinated, the carination made up of a row of stout, backwardly directed spines, one on each segment, to the number of 6 and each overlapping the ensuing segment. The last four segments with stout spines on the postero-lateral corners and segments 7, 8 and 9 with smaller, but robust spines situated mesially on the borders.

Legs very long and spidery, naked.

Hab.—Similar situations to the last.

Subfamily GOMPHINAE.

4. *Macrogomphus annulatus*, Selys.

(Pl. xxxiii, fig. 3; pl. xxxiv, figs. 4, 4a.)

Poona, 1. 8. 19, 1515/H2.

Length 49 mm. Length of hind femora 7.5 mm. Length of abdomen 39 mm. Mask typically Gomphine, very flat, oblong, the basal half constricted, mentum square, lateral lobes kukri-shaped, jaws armed with five robust teeth on the inner border and a long, moveable hook on the outer. No setae. Mid lobe straight, not projecting, minutely crenate along its border (pl. xxxiv, figs. 4 and 4a).

Eyes globular, comparatively large. Head small. Antennae short, club-shaped, 4 segments, coated with coarse, short hairs.

Synthorax narrow, wing-cases very narrow, triquetral, abdomen tapering towards the anal end, cylindrical, not carinated, greatly elongated, especially the last two segments, the 9th being furnished with a robust, backwardly directed spine on the mid-dorsum.

Legs very short and robust, adapted for digging, the femora and tibiae strongly curved and the former furnished with a long fringe of hairs on the extensor surface.

Hab.—Burrows in mud, in running streams. The fringe of hairs on the femora serve to collect flocculent debris which further conceals the insect.

The syphon-like end of the abdomen projects from the mud and thus permits the easy inspiration of clear water for purposes of respiration.

They emerge from the water about the 2nd week in August, often in great numbers and then fly inland for long distances. Finally the imago comes to rest in low growing trees, on the terminals of branches on the leeward side of the trees. Babul trees seem to be their special selection in the Deccan and about the end of August very few of these trees can be found that have not one or two occupants.

5. *Cyclogomphus heterostylus*, Selys.

(Pl. xxxiii, fig. 1 ; pl. xxxiv, figs. 5, 5a.)

Poona, 10.9.17, 1516/H2.

Length 21 mm. Length of hind femora 4.5 mm. Length of abdomen 15 mm.

Mask very broad, almost square, the base constricted, very flat, the outer surface coated sparsely with short hairs. Mid lobe straight, not projecting, fringed with longish, fine bristles, the lateral lobes somewhat similar to those of *annulatus* but without a marked, kukri-like bend at the tip, the inner border furnished with blunt, molar-like teeth, the outer with a long, robust, moveable hook (pl. xxxiv, fig. 5 and 5a).

Antennae clubbed, four segments, the last minute. Head comparatively larger than in *annulatus*.

Abdomen tapering slightly, more torpedo-shaped and the end segments not prolonged as in *annulatus*. The 8th and 9th segments with a robust, mid-dorsal spine projecting back from the apical border, the 10th segment very short, unspined, the 7th to 9th segments with short spines laterally.

Legs moderately short (rather shorter than shown in pl. xxxiii), the femora bearing the same fringe of hairs as seen in *annulatus*.

Hab.—Found in running streams crawling on the surface of muddy bottoms or rocks.

6. *Cyclogomphus verticalis*, Selys.

Poona, 17.8.19, 1517/H2.

Length 21 mm. Length of hind femora 4.5 mm. Length of abdomen 15 mm.

Almost exactly similar to the last. Differs by having blunt, mid-dorsal spines on all abdominal segments except the 9th and 10th, the latter segment is more than twice the length of the same segment in *heterostylus*. This segment also hollowed on the upper surface. Mask scarcely differing from that of *heterostylus*.

7. *Cyclogomphus minusculus*, Selys.

(Pl. xxxiii, fig. 2 ; pl. xxxiv, figs. 6, 6a.)

Poona, 9.8.19, 1518/H2.

Length of body 15 mm. Length of hind femora 5 mm. Length of abdomen 10 mm.

Mask very flat, the mentum slightly rounded, the base furnished laterally with a projecting, robust spine and 4 spinous hairs posteriorly, its sides bearing 7 short spines and the anterolateral corner bearing a single, stout spine, lateral lobes without any armature whatever save for a short, moveable hook. The inner border finely crenulate, the outer bearing two small spines at its base, the mid lobe projecting somewhat like that of an Agrionid, its border finely crenulate and fringed with short, stiff hairs. The outer surface of the mask coated sparsely with short hairs (pl. xxxiv, figs. 6 and 6a).

Head triangular, the fore part projecting well in front of the eyes which are rounded and somewhat large.

Synthorax small, wing-cases short, flat and broad. Abdomen very broad and greatly depressed as in fact is the whole body of the larva. Dorsal spines on all segments except the last. The three last segments spined laterally.

Legs robust, femora short, tibiae comparatively long, naked except for a few scattered hairs.

Hab.—Lies buried in the mud near the borders of running streams. Emerges in considerable numbers about the end of August.

8. *Onychogomphus lineatus*, Selys.

Poona, 9. 3. 18.

Length of body 25 mm. Length of hind femora 5 mm. Length of abdomen 17 mm.

Almost exactly similar to *verticalis*. Differs only in its larger size, the short 10th abdominal segment, which is not hollowed out above and is similar in size to that of *heterostylus*. Differs from the latter in having mid-dorsal spines on the same segments as in *verticalis*.

Hab.—As for *C. verticalis* and *C. heterostylus*.

Suborder ZYGOPTERA.

Subfamily CALOPTERYGINAE.

9. *Matrona basilaris*, Selys.

(Pl. xxxv, fig. 1; pl. xxxvii, fig. 1.)

Shillong, 4,500-5,000 ft., in streams, Khasi Hills, Assam, 16-20.4.18, N. Annandale, 1320/H2, 1321/H2.

Length 36 mm. Length of mask 6 mm. Length of caudal appendages 11 mm.

Head small, eyes globular, antennae typically Calopterygine, the 2nd segment greatly elongated and pigmented on the outer side. This band of brownish pigment is continued across the head and synthorax on to the wing sheaths. Ocelli visible in the last stage.

Synthorax long and narrow. Wing-cases flat, leaf-like, venation well marked. Abdomen very long and narrow, tapering very

slightly. Caudal appendages triquetral, very long, the middle one considerably shorter than the lateral and lying in a vertical plane.

Legs long and slim, spidery, no armature.

Mask typically Calopterygine; middle lobe very deeply cleft, the terminal halves minutely crenate on the outer borders, where they engage with the outer lobes, the ends with a small spine at the tip and the extreme edge curling over, the edge of the curled part furnished with minute teeth, 2 setae on the inner surface; lateral lobes with a long moveable hook, 2 setae situated just below it and 3 long robust spines of which the middle is the smallest; inner border minutely crenate where it engages the border of the middle lobe. Mask extends back as far as the hind coxae (pl. xxxvii, fig. 1).

Hab.—Generally concealed amongst debris, dead twigs, etc., or lying under cover of rocks. Movements sluggish. The insect is apt to be mistaken for a *Ranatra* to which it bears a close resemblance.

Subfamily *LESTINAE*.

10. *Lestes* sp.

(Pl. xxxv, fig. 2; pl. xxxvii, fig. 2, 2a.)

Jor Pokhri, Darjiling Dist., E. Himalayas, 6.8.18, S. Kemp, 1316/H2, 3 larvae.

Mask typically Lestine, very much elongated, very narrow, mid lobe projecting very slightly, 6 setae on either side of the middle line of the inner surface, lateral lobes foliate and branched, a moveable hook supported on one of the branches, from which spring 3 setae (pl. xxxvii, figs. 2 and 2a).

Head relatively large, eyes globular, antennae filiform, wing-case long and narrow, flattened, abdomen elongated, cylindrical, each segment bearing a lateral spine.

Caudal appendages 9 mm. long, spatulate, oar-shaped, of even width, flattened, crossed by broad bands of pigment. Tracheal vessels branching at right angles to the main vessel.

Legs long, armature 4 rows of fine spines on the femora.

Hab.—Running streams. Found on water-weeds or clinging to roots.

Subfamily *PLATYCNEMINAE*.

11. *Copera marginipes*, Ramb.

(Pl. xxxv, fig. 3; pl. xxxvii, fig. 6.)

Poona, 6.4.18, F. C. Fraser, 1519/H2.

Length 14 mm. Length of caudal appendages 5.5 mm. Length of abdomen 7 mm.

Mask pyriform, tapering sharply to the mentum, sides spined to the number of 11 or 12; mid lobe projecting sharply, armed with 4 setae, whose bases are in line at right angles to the middle line of the mask, the biting edge minutely dentate; lateral lobes finely spined on the outer border, minutely dentate on the inner,

5 long setae on the inner surface, a robust, moveable hook and a shorter, robust, terminal spine (pl. xxxvii, fig. 6).

Head large, eyes globular, projecting laterally, prothorax small, thorax angular, its shoulders projecting, its dorsum triangular, wing sheaths flat and elongated.

Abdomen short, each segment spined laterally.

Caudal appendages highly differentiated, 3 in number, all lying in the vertical plane, petiolated and nodate, the petioles spined laterally, terminal part expanding like a leaf, its edges deeply dentate. Peppered with brownish pigment.

Legs long and slim, barred with pigment, minutely spined.

Hab.—Found in shallow brooks, in dense, darkened jungle, clinging to pieces of dead twig or tree roots. When not disturbed, they stand well out from the resting place, with the abdomen curled well over the back and the large, caudal appendages waving freely in the current. When disturbed they swiftly crouch flush with the root or twig on which they happen to be. The abdomen and caudal appendages are lowered and if the insect be approached, it will continually manoeuvre so as to place the root or twig between itself and the point of danger.

12. *Calicnemis miniata*, Selys.

(Pl. xxxvi, fig. 4; pl. xxxvii, fig. 5.)

Jor Pokhri, Darjiling District, E. Himalayas, 6. 8. 18, S. Kemp, 3 larvae, 1316/H2.

Length 17 mm.

Mask typically Agrionine in shape, somewhat similar to the last but the base not tapering so markedly and there are only 9 spines on the outer border. On the inner surface, a row of setae, 4 in number, placed rather far back on each side of the middle line; mid lobe similar to the last; lateral lobe with 7 setae, no spines on the outer surface, moveable hook robust. Biting edges of lobes finely crenulate (pl. xxxvii, fig. 5).

Legs long and slim, bearing 4 rows of fine spines.

Abdomen cylindrical, strongly spined laterally.

Caudal appendages 3 in number, broadly sagittate, subnodate, the position of node only indicated by extent of a row of spines bordering the outer side of the petiole, tracheae branching, root-like from the main stem.

Appendages banded with 4 rows of pigment.

Hab.—Running streams.

Subfamily *PROTONEURINAE*.

13. *Protosticta gravelyi*, Laidlaw.

(Pl. xxxv, fig. 4; pl. xxxvii, fig. 7.)

Between Nierolay and Mettupalaiyam, Bhavani River, base of Nilgiris, ca. 1,500 ft., 2 exuviae, 24. 8. 18, N. Annandale, 1360/H2.

Mask very flat, ovate, resembling in some measure that of a Gomphine, the inner surface finely striated with rows of minute, transverse grooves; mid lobe with a well-marked cleft, the mouth of which is contracted so that the edges approximate and enclose a small fenestrum. The free biting edge of this lobe armed with a row of slightly irregular, fine teeth. Lateral lobes massive and short, ending in a blunt, molar-like tooth and furnished with a robust, moveable hook. No setae on the mask (pl. xxxvii, fig. 7).

Head moderately large, eyes globular, synthorax small. Abdomen not spined laterally. Caudal appendages in a very poor, shrivelled condition. They appear to be lanceolate and triquetral in shape and without node or spines. Legs long and slim.

Hab.—Found "breeding in a small, rocky stream," N. Annandale.

[Adults flitting about in mottled shadow and light in rather deep jungle at edge of rocky stream. Rendered extremely inconspicuous by the broken colouration of the body. Exuviae on rocks in stream.—N A.]

14. *Chloroneura quadrimaculata*, Ramb.

(Pl. xxxvi, fig. 3; pl. xxxvii, fig. 4.)

Bagra, Hooshangabad Dist., C.P., 3. 19, F. H. Gravely, 1 exuvia, 1333/H2.

Mask broadly pyriform in shape, its borders bearing about 18 spines, the foremost of which are the most robust; on the inner surface and immediately behind the middle lobe and on either side of the middle line is an oblique row of 4 setae; the mid lobe narrow and projecting sharply, entire, its edge finely crenulate; lateral lobes placed well away from the lateral border of the mask, reduplicated, the inner part ending in a blunt spine and furnished with 6 setae and a moveable hook, the outer part ending in a long and a short spine (pl. xxxvii, fig. 4).

Head moderately large, pentagonal, 4 small spines on the posterior border immediately posterior to the eyes. The eyes globular. Wing-cases long, flat and narrow.

Abdomen of moderate length, the last 3 segments with 2 or 3 spines laterally and the 10th with a row of dorsal spines on the apical border.

Caudal appendages 3 in number, triquetral, the broadest, flattened surface of the lateral ones, looking downwards, whilst the broadest surface of the middle appendage is uppermost, so that this appendage fits neatly between the lateral ones. Long, narrow and spined along their borders.

Legs longish, banded with pigment.

Hab.—Running streams.

Subfamily *AGRIONINAE*.15. *Pseudagrion microcephalum*, Ramb.

(Pl. xxxvi, fig. 2.)

Hooshangabad, C.P., 12. 3. 19, F. H. Gravely, 1458/H2., and 16. 3. 19, 1456/H2. Pachmarhi, Satpuri Hills, C.P., 3,500 ft., F. H. Gravely, 1457/H2, 1461/H2, 1464/H2.

There are a large number of these larvae, which have been previously described by Dr. Laidlaw in the *Memoirs of the Indian Museum*, Vol. V, 1915, p. 179.

In regard to the caudal appendages, autotomy is a noticeable feature and what is of even greater interest, the power of replacing the lost appendages is aptly illustrated in several specimens. The replacement occurs at ecdysis, but even at the final instar the new appendage is never nearly as large as the originals.

The specimens differ considerably in the amount of pigmentation, this probably depending largely on environment.

The mask, which has been figured by Dr. Laidlaw (*loc. cit.*), has some inconspicuous teeth on the accessory lobe of the lateral lobe.

16. *Pseudagrion hypermelas*, Selys.

(Pl. xxxvi, fig. 1; pl. xxxvii, fig. 3.)

Hooshangabad, C.P., 3. 19, F. H. Gravely, 1438/H2, and at Burhanpur, C.P., 4. 3. 19, F. H. Gravely, 1466/H2.

Length 18 to 20 mm. Caudal appendages 4 mm.

Body usually darkly pigmented, rather stout and short.

Mask scarcely differing from that of *microcephalum*, but the accessory lobe of the lateral lobe absent and the setae numbering 5 (pl. xxxvii, fig. 3).

Abdomen much shorter than the former, the sides spined.

Caudal appendages pyriform in shape, blunt at the ends, subnodate, the proximal part spined laterally. Tracheae branching, root-like. A row of black, pigmented spots round the borders and some mottling elsewhere.

Legs long and slender, barred with pigment.

Hab.—Quiet running streams or large tanks, amongst weed.

